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GLOSSARY

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2 GLOSSARY AND ABBREVIATIONS

2.1 GLOSSARY OF TERMS

AAQC	Ambient Air Quality Criteria
AC	Alternating Current
ACG	Azeri, Chirag, Gunashli offshore oilfields, Caspian
Acheulian	A stratigraphic stage name based on an early Palaeolithic culture, for part of the European Lower Pleistocene
AEWA	Afro-Eurasian Water bird Agreement) of the Bonn Convention
AGI	Above Ground Installation (such as a block valve or pump station location)
AGT	Azerbaijan Georgia Turkey pipelines project - BTC and SCP combined
AIOC	Azerbaijan International Operating Company
AIDS	The disease Auto Immune Deficiency Syndrome
ALARP	As Low As Reasonably Practicable
Alluvium	Clay, mud, sand, silt, gravel, and other unconsolidated detrital matter that is carried along and deposited by flowing water
Alluvial plain	A flat or gently sloping tract of land alongside a periodically overflowing river that is produced by the deposition of alluvium. Also, wash plain, waste plain
Alternative pipeline route	A considered pipeline route that deviates from the preferred route
Ambient noise	Ambient noise is the "totally encompassing sound in a given situation in a given time. Usually composed of sound from many sources near and far" (ISO 1996-1)
AMSL	Above Mean Sea Level
Anti-scour devices	Impermeable barriers built around uphill and downhill pipeline sections to prevent erosion
APHS	American Public Health Service
API	American Petroleum Institute
ASCE	Azerbaijan State Committee for Ecology and Nature Resources Utilization. Recently restructured into the Ministry of Ecology and Natural Resources
ASME	American Society of Mechanical Engineers
ASNDT	American Society for Non Destructive Testing
Aspect	Aspect is "an element of an organization's activities, products or services that can interact with the environment" (ISO 14001). See also "Impact"
Assets	Property owned by a person or company, regarded as having value and available to meet debts, commitment, or legacies
Averaging time	The period of time over which measurements are averaged
A-weighting	This is a frequency weighting devised to attempt to take into account the fact that human response to sound is not equally sensitive to all frequencies. A-weighting most closely matches the sensitivity of the human ear to sound
Backfill crew	The crew that replaces subsoil and topsoil to the pipeline trench after the pipeline has been laid
Backhoes	Excavators
BACT	Best Available Control Technology
BaP	Benzo-a-Pyrene

Barg	Bar Gauge – a unit of pressure. Zero barg is equivalent to 1 atmosphere pressure
Baseline	Existing conditions. See also “Baseline studies”
Baseline studies	Studies conducted to establish the actual conditions at a specific period in time, to enable predictive and comparative studies to be conducted in the future in order to determine whether there is a predicted impact. The baseline studies in this report are primarily Environmental and Socio-Economic
BATNEEC	Best Available Techniques Not Entailing Excessive Cost
BCM	Billion Cubic Metres (10^9). Standard temperature (0 ºC) and pressure (1 atm)
Berm	An engineered (earth) bank forming secondary containment around tanks or a screen mound or stockpile
BG	British Gas
Biological diversity (biodiversity)	Variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part (Convention on Biological Diversity 1992)
Block valve	A valve for isolating the pipeline into distinct sections
Blowdown	1) Release of pressure from a vessel; or 2) Effluent resulting from purging of process vessels
Biochemical Oxygen Demand (BOD)	Measure of how much of the oxygen is used up by organisms in the water. BOD is the most important general indicator of pollution for most streams
BOD_5	BOD_5 is a most commonly used test where BOD is determined by measuring the dissolved oxygen (DO) level of a water sample after 5 days and comparing it to the original DO level. The test is generally used to identify the level of pollution in waters
Borrow pit	A pit created to provide fill material for another location usually involving construction activities
BOTAS	Boru Hatlari ile Petrol Tasima A.S. (Petroleum Pipeline Corporation established by the Turkish Petroleum Corporation)
BP	British Petroleum. International energy group currently leading work on the BTC and SCP projects
BPEO	Best Practicable Environmental Option
Breccias	Rock type consisting of angular fragments embedded in a concreted finer matrix
Bronze Age	Technological stage between the Stone and Iron Ages, beginning in the Middle East about 4,500 BC and lasting in Europe from 2,000-500 BC
BS	British Standard
BSI	British Standard Institute
BTC	Baku-Tbilisi-Ceyhan Oil Pipeline, alternatively known as the Main Export Pipeline (MEP)
BTC Co	BTC Pipeline Company (operating company to be formed in due course)
BTC Owners	The companies sponsors of the BTC project (listed in the PCDP)
BTEX	Benzene, Toluene, Ethyl benzene and Xylene
BU	Business Unit
Bunding	A form of secondary containment, around tanks
BVS	Block Valve Station

C2+/C4/C5+	Hydrocarbons with more than two/four/more than 5 carbon atoms
Caravanserai	An inn surrounding a courtyard where caravans rest at night
CARE	Cooperative for Relief and Assistance Everywhere – International Relief and Development Organisation
CAS	Centre of Archaeological Studies
CAS Number	Chemical Abstracts Service identification number, which is unique for each and every chemical
CCCR	Code of Conduct and Camp Rules
CCVT	Closed Cycle Vapour Turbogenerators
CCTV	Close Circuit Television
CE	Caucasian Endemic
CEMS	Continuous Emissions Monitoring System
Cenozoic	Geological time period: see Geological Time Scale at the end of glossary
CEP	Caspian Environment Programme
cfu	Colony-forming unit – used in the microbiological analysis of water and wastewater
CH_4	Methane
CIA	Central Intelligence Agency
CITES	Convention on International Trade in Endangered Species
CLO	Community Liaison Officer
CM	Caucasus Minor
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand is a test for assessing the quality of effluents and wastewaters prior to discharge. The COD test predicts the oxygen requirement of the effluent and is used for the monitoring and control of discharges, and for assessing treatment plant performance
Colluvial	Rock detritus and soil accumulated at foot of slope under the effect of gravity. See also “Alluvial” (a similar process involving water)
CONCAWE	Conservation of Clean Air and Water in Europe – the oil companies' European organization for environment, health and safety
CP	Cathodic Protection. The protection of a metallic material from corrosion, effected either by coupling such material with a less noble metal or by impressing a current
cP	Centipoise (a unit of dynamic viscosity)
CPC	Caspian Pipeline Consortium
Cretaceous	The final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), covering the span of time between 135 and 65 million years ago
CRM	Community Relations Manager
CRO	Community Relations Officer
CRTC	Caspian Regional Thematic Centre
CS	Compressor Station
CTD	Crude Topped Distillate. A process to remove the light ends from crude oil so it is suitable to use as a fuel source
Cumulative Impacts	“Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project” (EC, 1999)
CV	Calorific Value (joules/tonne or joules/m^3)
C&WI	Compression and Water Injection

Decibel (dB)	Sound can be defined as any pressure variation that the human ear can detect, such that the decibel is the unit of measurement of that pressure variation
dB(A)	A measurement on the decibel scale with A-weighting (see “Decibel”)
Deluvial	Material that is produced or related to, deposition during a flood or glacial outwash event
Delta	A nearly level, often triangular alluvial plain occurring between diverging branches of the mouth of a river (adj. *deltaic*)
Directional drilling	Drilling to deviate from the vertical in order to bypass obstacles
DIV	Dutch Intervention Values – in relation to soil and water contamination
DLN	Dry Low NOx emissions
DO	Dissolved Oxygen – represented either as a % or as mg/l
D&P	Drilling and Production
DPI	Dye Penetrant Inspection
DRO	Diesel Range Organics
Dual carriageway	A road of width sufficient for the passage of traffic in both directions at a time, but with a physical barrier between opposing directions; there are therefore two separate road surfaces (carriageways), one for each direction. The number of lanes can vary, but would rarely exceed four in any one direction, and can be as low as one
Dwt	Deadweight ton
ECA	Export Credit Agency
E&P	Exploration and Production
EAQG	European Air Quality Guidelines
EAP	Environmental Action Plan
EA-UK	Environment Agency - United Kingdom
EBRD	The European Bank of Reconstruction and Development
EC	European Community, now known as the European Union
EFA	Education for All, part of the World Education Forum
EHRA	Environmental Hazard and Risk Assessment
EIA	Environmental Impact Assessment - the process of collecting data, consulting with interested parties, assessing significant environmental impacts (positive and negative) and defining mitigation measures
EIP	Environmental Investment Plan
Eluvial	1) Composed of or relating to eluvium, fine soil material that has been deposited by the wind; or 2) A soil horizon that has lost material through eluviation
Eminent Domain	The ability to be able to compulsory purchase, if required, land from private landowners
EMP	Environmental Management Plan
EMS	Environmental Management System
EN	“Endangered” according to IUCN Red List categories
Eocene	An epoch of the early Tertiary period, after the Palaeocene and before the Oligocene corresponding to the period 53 to 37 million years ago
Eolian	Pertaining to wind deposited sediments
EOP	Early Oil Project
Epoch	A unit of geologic time, longer than an age and representing a subdivision of a period during which the rocks of a particular series were formed

EPCM Contractor	Engineering, Procurement, Construction and Management Contractor
Era	A unit of geologic time that includes two or more periods grouped together
ERA	Environmental Risk Assessment
ERM	The company Environmental Resources Management Ltd
ES	Environmental Statement
ESD	The Emergency Shutdown System
ESIA	Environmental and Social Impact Assessment
ET	Event Tree. In risk assessment, a sequence of events that lead to an incident
EU	European Union formerly known as the European Community
F	Female
Fault	A rock fracture along which movement or displacement in the plane of the fracture has taken place
FBE	Fusion Bonded Epoxy - a pipe coating system (internal or external) for corrosion protection
FCI-ROW	Facilities and Construction and Installation Right of Way refers to the corridor area over which pipeline construction and installation activities take place
FDP	Firewater Detention Pond
FEED	Front End Engineering and Design
FFD	Full Field Development
FID	Flame Ionisation Detector
Field walking	An archaeological survey technique comprising the systematic recovery of artefacts
Flagging	Demarcation of site/ services of particular interest or sensitivity
Flare	A process system for burning gas, either waste gas or vented for emergency relief
Flysch	A graded, thinly-bedded, poorly fossiliferous sequence of marls, sandy to calcareous shales interbedded with coarser sandstones, conglomerates and greywackes
Fold	A bend or buckle in bedded sedimentary rock or other planar structures, usually produced by deformation
Forb	A term for any herb plant that is not a grass
FSU	Former Soviet Union
Fugitives (emissions)	Discontinuous, diffuse, usually accidental, emissions to atmosphere
FWL	Fire Water Lagoon
Gabion	A stone / earth filled open wire mesh container used to strengthen river banks, steep slopes and foundations
Gale	A gale is labelled as a scale 8 wind on the Beaufort Scale and is defined by the World Meteorological Organization (WMO) as a wind travelling between 34-40 knots (17-20m/s)
Gamgebeli	Head of Local Authorities (Georgian)
Gauging pig	A device which can be passed through a pipe to assess its dimensions
GC	Gas Chromatography
GCM	General Circulation Models
GCR	Greater Caucasian Ridge
GCV	Gross Calorific Value is the heat evolved when all of the products of combustion are cooled to atmospheric temperature and pressure. Measured in MJ/volume (kg, l or m^3)
GGIC	Georgian Gas International Company

GDP	Gross Domestic Product
GDP Real Growth Rate	Growth in GDP measured at constant prices ie after price changes have been eliminated
GEL	Georgian Lari (Georgian national currency)
GGIC	Georgian Gas International Company
GHG	Greenhouse Gases
GIOC	Georgian International Oil Company
GIS	Geographical Information System - a digital process of mapping data in layers related to a geo-referenced base
GNP	Gross National Product
GPS	Global Positioning System
GRDB	Georgian Red Data Book – a list of rare, threatened and endangered species in Georgia
Ground surface temperature	The temperature of/at the ground surface (as opposed to the temperature beneath the surface)
GSJ	Grade Separated Junction
GT	Gas Turbine
GWP	Global Warming Potential
Hazard	An agent or activity that may cause an impact to people or the environment
HACH	A brand of equipment for water testing
HCFC	Hydro-chlorofluorocarbons
HDD	Horizontal Directional Drilling refer to “directional drilling”
HDR	Human Development Report (UNDP)
HFC	Hydro-fluorocarbon
HGA	Host Government Agreement
HIV	Human Immunodeficiency Virus. Responsible for the illness AIDS
HP	High Pressure
HSE	Health, Safety and Environment
HVAC	Heating, Ventilation and Air Conditioning
Hydrotest	A process of testing the pressure integrity of a pipeline using water at an elevated pressure for an extended period defined by the relevant API pipeline code
Hydrotest fluids	Fluids used in hydrostatic testing (eg water, possibly with biocides, oxygen scavengers, antifreeze, corrosion inhibitors and dyes)
ICP	Inductively Coupled Plasma
ICSS	Integrated Control and Safety System
IDP	Internally Displaced Person
IFC	International Finance Corporation, a member of the World Bank Group
IFI	International Finance Institution
IG	Information Gap
IGA	Inter-Government Agreement
IGE	The Institute of Gas Engineers
ILO	International Labour Organization
IMF	International Monetary Fund
Impact (environmental)	“Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization’s activities, products or services” (ISO 14001). Not always quantifiable (eg nuisance). See also “Aspect”

Impact (social)	"The consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs and generally cope as members or society. The term also includes cultural impacts involving changes to the norms, values, and beliefs that guide and rationalize their cognition of themselves and their society" (US Department of Commerce, May 1994)
Incident	A definite occurrence or event
Inspection crew	1) The crew who check the pipeline design and pipeline codes; or 2) The crew who radiographically or ultrasonically inspects the condition of the pipeline and welds prior to pipe wrapping
IP	The Institute of Petroleum
IPM	The Georgian company IPM Ltd
Iron Age	Technological time following the Bronze Age (cf Bronze Age)
ISO	International Standards Organization
ISO 14000	The International Standardization Organization's Set of Standards on Environmental Management
ISO 14001	ISO's 1996 Environmental Management System: Specification with Guidance for Use
ISO 1996-1	Description and measurement of environmental noise. Part 1. Guide to quantities and procedures
Issue	An element requiring consideration and assessment for which a policy or a specific mitigation strategy may need to be defined
ITT	Invitation To Tender
IUCN	International Union for the Conservation of Nature
kJ	Kilo-joule
Kg/m^3	Kilo-grams per cubic metre
KP	Kilometre Point
KPa	Kilopascal
KPIs	Key Performance Indicators
Kura	The Turkish/Azeri name for the Mtkvari River
kV	Kilovolt
kW	Kilowatt
$L_{Aeq, T}$ (dB)	A measure of "average" sound pressure level (over a specified time period, T). The constant level of noise that would have provided the same acoustic energy as the actual fluctuating sound during the same period
$L_{AN, T}$	The percentile level, ie the sound pressure level in dB_A which is exceeded for *N*% of the time interval *T*. eg L_{10} and L_{90}
Leachate test	A test to determine the potential for contaminants to dissociate from soils
LER	Local equipment room
LNAPL	Light Non-Aqueous Phase Liquid
LNG	Liquefied Natural Gas
LP	Low Pressure
L_P	Sound Pressure Level – the fluctuations in air pressure created by sound and described using the decibel scale rather than as pascals
L_W	Sound Power Level – the sound energy radiated per unit time by a sound source described using the decibel scale rather than as Watts
LR	Low Risk according to the IUCN Red List categories
m	Metre/s

M	Male
m. AMSL	Metres above mean sea level
Mb	Millibar
Mbd	Thousand barrels per day
MBOPD	Thousand barrels of oil produced per day
MPT	Magnetic Particle Testing
MCR	Maximum Continuous Rating
Measurement time interval - T_m	The total time over which measurements are taken (eg this may consist of the sum of a number of non-contiguous, short-term measurement time intervals)
Medieval period	An archaeological time period lasting approximately 800 AD to 1,500 AD
MENR	Ministry of Ecology and Natural Resources, Azerbaijan
MEP	Main Export Pipeline. An earlier alternative name for the Baku - Tbilisi - Ceyhan (BTC) oil pipeline
Mercaptan	The odoriser that is added to natural gas to make it easier to detect in case of a leak
Mesolithic	The archaeological l period between the Palaeolithic and the Neolithic (12,000-3,000 BC)
Mesozoic	Geological time period: see Geological Time Scale at the end of glossary
mg/eq	Milligrams-equivalent (measure of water hardness)
mg/l	Milligram per litre
$\mu r\ hr^{-1}$	Micro Roentgen per hour. Unit commonly used in the Soviet system for the measurement of radiation. Convert to Sieverts according to the following formula: $1\ \mu r\ hr^{-1} = 0.01 mSv\ hr^{-1}$
MIGA	Multilateral Investment Guarantee Agency
Miocene	Geological time period: see Geological Time Scale at the end of glossary
Mitigation	Measures that may reduce potentially significant adverse environmental impacts to acceptable levels
MJ	Mega joule
MLAs	Multilateral Lending Agencies
MMBOPD	Million barrels of oil produced per day
MMSCF/D	Million Standard Cubic Feet per Day
MMscmd	Million Standard Cubic Metres per Day
MMSCM/H	Million Standard Cubic Meters per Hour
MMSCM/D	Million Standard Cubic Meters per Day
Molasse	1) Specifically a sedimentary sequence deposited during the Miocene period; composed primarily of soft green sandstone associated with marl and conglomerates; or 2) Generically any similar sedimentary sequence to that described above
Mole	The mole is the standard method in chemistry for communicating how much of a substance is present. In one mole, there are 6.022×10^{23} atoms
MPN	Most Probable Number – used for microbiological analysis of water and wastewater
MPI	Magnetic Particle Inspection/Testing
MS	Mass Spectrometry
MSS	Manufacture Standardization Society
MSSOP	Maximum Steady State Operating Pressure
MT	Million tonnes
MT/A	Million tonnes per annum

Mtkvari	The Georgian name for the Kura River (see "Kura")
MW	Megawatt
N_2O	Nitrous oxide
NACE	The National Association of Corrosion Engineers
Nappes	A large, sheet-like rock unit that has been transported some distance forward over other rocks, either by thrust faulting, recumbent folding, or both
NEAP	National Environmental Action Plan
Neocene	Geological time period: see Geological Time Scale at the end of glossary
Neolithic	Geological time period: see Geological Time Scale at the end of glossary
NGO	Non Governmental Organization
NO_2	Nitrogen dioxide
NDT	Non-Destructive Testing
NORM	Naturally Occurring Radioactive Material (eg radium)
NO_x	Nitrogen Oxides
NREP	Northern Route Export Pipeline
NSPS	New Source Performance Standards (of the US EPA)
NTU	Nephelometric Turbidity Units
O_2	Oxygen
O_3	Ozone
OECD	Organization for Economic Co-operation and Development
OIEC	Oil Industries Engineering & Construction
Oligocene	An epoch of the early Tertiary period, after the Eocene and before the Miocene; corresponding worldwide series of rocks (37 to 23 million years ago)
OP	Operational Phase
Open cut crossing	Standard trenching technique for crossing a water body
OPIC	Overseas Private Investment Corporation
Orogenic	Mountain building process, or relating to the process by which great, elongate chains of mountains are formed
OSRP	Oil Spill Response Plan
OWS	Oil/Water Separator
Oxygen scavengers	Chemicals that convert available oxygen into an unreactive form
P&ID	Process and Instrumentation Drawings
PAH	Polynuclear Aromatic Hydrocarbons
Palaeocene	Geological time period: see Geological Time Scale at the end of glossary
Palaeogene	Geological time period: see Geological Time Scale at the end of glossary
Palaeolithic	Geological time period: see Geological Time Scale at the end of glossary
Paleocene	See "Palaeocene"
Pascal	A unit of pressure equal to $1N/m^2$
Pathway	Chain of reactions associated with a particular process
PCB	Polychlorinated Biphenyl
PCDP	Public Consultation and Disclosure Plan
PCU	Programme Coordination Unit
PDQ	Production and Quarters Platform
PE	Potential Evapotranspiration
PFC	Perfluorocarbons
PFD	Process Flow Diagram
pH	Measure of acidity/alkalinity

P&ID	Process and Instrumentation diagram
Pig	A generic term to describe a device that travels inside the pipeline. "Pigs" can be used for a number of purposes including cleaning, gauging and measuring the condition within the pipeline
Pigging	The process of cleaning or measuring internally the pipeline whereby a "pig" is sent though the line to clean/ measure the inside of the pipeline
P_{IN}	Inlet pressure
PIP	Priority Investments Portfolio
Pipe jacking	Construction method used on large diameter pipelines and involves the carrier pipe being installed behind a protective shield using a combination of normal mining techniques and hydraulic jacks to drive the pipe forward, with the excavated material being removed via the exposed end of the pipe
Pipe padding	A layer of material placed under the pipeline used to protect the pipeline surface
Pipe yard	The area used for the temporary storage of pipe prior to spread
Pleistocene	Geological time period: see Geological Time Scale at the end of glossary
Pliocene	Geological time period: see Geological Time Scale at the end of glossary
PM	Particulate Matter
PM_{10}	Particulate Matter of less than 10µm aerodynamic diameter
P_{OUT}	Outlet pressure
PPAH	Pollution Prevention and Abatement Handbook (World Bank publication)
ppb	Parts per billion (10^9)
ppm	Parts per million (10^6)
ppmv:	Parts per million by volume
Proluvial/Proluvium	Sediment being formed by turbulent streams in mountainous regions
PRMS	Pressure Reduction & Metering Station
PRS	Pressure Reduction Station
PSA	Production Sharing Agreement
PS	Pump Station
PVD	Property Value Database
QA	Quality Assurance
QRA	Quantified Risk Assessment
Quaternary	Geological time period: see Geological Time Scale at the end of glossary
RAP	Resettlement Action Plan
Receptor	The receiver, usually a living organism, of an input, stimuli or emission
Reference time interval - T_r	The specified interval over which an equivalent continuous A-weighted SPL is determined
Reid vapour pressure	Vapour pressure at 37.8°C corrected to 1 atmospheric based on ASTM method D323, 1996a
Re-instatement	The process of restoring the area to its prior state after pipeline laying (includes replacement of topsoil, vegetation, fences, etc to all disturbed areas associated with the construction of the pipeline or pipeline facilities after their installation)
Reinstatement crew	The crew that implements reinstatement

Residual impact	"Residual impacts are impacts that cannot be mitigated" (IAIA and the UK Institute of Environmental Assessment, 1999. Principles of EIA Best Practice)
Residual noise	"The ambient noise remaining at a given position in a given situation when one or more specified noises are suppressed" (ISO 1996-1). See also "ambient noise"
Restoration	The process of restoring the area to its prior state after pipeline laying
RH	Relative Humidity
Richter Scale	A logarithmic scale ranging from one to nine that expresses the magnitude (Richter magnitude) of an earthquake based on a measurement of the amount of energy dispersed during the event (named for Charles F. *Richter*).
Rip-rap	Large stones blocks from a quarry and which are placed on a riverbank to prevent erosion. The stones are sometimes embedded in concrete
Risk	The likelihood of an impact
ROW	The corridor area required for the construction and installation of the pipeline See also "FCI ROW"
RSK	The company RSK Environment Ltd
RTU	Remote Test Unit/remote telemetry unit
Safety Factor	A multiplier that is used to ensure that the maximum design load or capacity falls below the maximum value that could be sustained by a pipeline system component or structure without failure
Sakrebulo	Council for each group of villages in Georgia, operating as a local parliament
SCADA	Supervisory Control and Data Acquisition
Scoping	The process of identifying the key environmental and social issues in the development of a project and seeking agreement with interested parties in how these are to be addressed in the EIA and SIA process
SCP	South Caucasus Pipeline (previously termed Shah Deniz Gas Pipeline)
SCP Partners	The companies who sponsor the SCP project (ANS, BP, LUK Agip, OIEC, Statoil, TFE, TP, and Unocal)
SCP Owners	See PCDO
SDGP	Shah Deniz Gas Pipeline (see also SCP)
Sensitivity	1) The ability of a device or organism to respond to external stimuli; or 2) The degree to which a device or organism is affected by a particular stimulus
Shah Deniz Group	The group of partners generally based upon the partners in the Shah Deniz PSA, brought together to accomplish the export of Shah Deniz gas to Turkey in fulfilment of the agreement between SOCAR and BOTAS
SIA	Social Impact Assessment - the process of collecting data, consulting with interested parties, assessing significant social impacts and defining mitigation measures
Sierozem	A group of soils found in cool to temperate, arid regions that is brownish grey at the surface with a lighter layer below, which based in a carbonate or hardpan layer
Sm^3	Standard cubic metre
SMP	Social Management Plan
SO_2	Sulphur dioxide

SOCAR	State Oil Company of the Azerbaijan Republic
Solonetz	A group of soils that occur within grassland and parkland regions and consist of an upper hard surface that changes into a prismatic or columnar horizon underlain by saline/ calcareous material
Source	The point or place from which something originates
Special sections	Discrete pipeline sections where additional safety/ environmental protection/construction techniques are required
SpC	Specific Conductance – a measure of how well water can conduct an electrical current. Measured in ohms or, more recently, siemens per unit of length
Specific noise level - $L_{aeq,Tr}$	The equivalent continuous A-weighted SPL in dB at the measurement position produced by the specific noise source over a given reference time interval, in integer units
Specific noise source	The noise source under investigation for assessing the likelihood of complaints (usually measured as $L_{Aeq, T}$) Defined in ISO 1996-1 as “a component of the ambient noise which can be specifically identified by acoustical means and may be associated with a specific source”
Spent catalyst	Waste catalyst in which the active component has been fully consumed
SPL	Sound Pressure Level
Spoil	Any type of material removed during excavation that is typically stored temporarily before replacement or disposal
Spot backfilling	Replacing the excavated material as soon as practicable
Spread	1) All the personnel and equipment necessary to carry construction; or 2) The area covered for a given length by construction operations
Spread technique	The technique employed for pipeline construction whereby several different sequential construction phases may be in process at one time along the pipeline length
SPSS	Standard specialist software designed to assist in the analysis of data gathered through interviews and questionnaires
SSC	Suspended Sediment Concentration. Measured in mg/L
SSL	Suspended Sediment Load. Measured in %.
SSM	Start-ups/Shutdown/Malfunction
SRB	Sulphate Reducing Bacteria
ST	Short-term
Stakeholder	Stakeholders are “those people who are directly and indirectly affected by a project and other interested parties who have the ability to influence a project’s outcome, positively or negatively” (IFC, 1998)
STD	Sexually Transmitted Disease
Steady noise	Noise that gives fluctuations over a range not more than 5dB on a sound level meter set to frequency weighting “A” and time weighting “S”
STP	Sewage Treatment Package
Stringing crew	The crew that brings pipe sections from the pipe yard and lays them out along the Right Of Way ready for welding
Sv	Sievert – measure of radiation. 1 Sv = 1J/kg
SVOC	Semi Volatile Organic Compounds
Subsoil	The part of the soil that lies below the topsoil. Also referred to as “undersoil”. Also see “topsoil”

Survey crew	The crew that undertakes the initial topographical and alignment surveys of the pipeline route
Suspended solids	The amount of solid material held in suspension by the energy of water in a stream, river or discharge
Sweet natural gas	Natural gas, which has a low sulphur content
Synergetics	Social Assessment Company based in Baku
TACIS	Technical Assistance to the Commonwealth of Independent States. The TACIS Programme was launched by the EC in 1991 and provides grant-financed technical assistance to 13 countries of Eastern Europe and Central Asia
TCN	Third-Country National – someone from outside Georgia or different to the host-nationality of the contracting company to whom they are employed
TDS	Total Dissolved Solids. Measured in mg/l
TEG	Thermo-Electric Generators
Temperature	The level of heat energy of the atmosphere as measured by a thermometer and expressed on a given temperature scale, usually Celsius or Fahrenheit
Tertiary	The geologic sub-era or period of the Cenozoic era extending from the end of the Mesozoic era to the beginning of the Quaternary period, extending from 63 million to 1.6 million years ago
TMP	Transport Management Plan
Topsoil	1) The top portion of agricultural soil, usually richer in organic matter than the subsoil (Agronomy); 2) The surface layer of any soil (Geology)
TPH	Total Petroleum Hydrocarbons
TPAO	Turkiye Petrolleri Anonim Ortakligi (Turkish Petroleum Corporation)
TRACEACA	Transport Corridor Europe Caucasus Asia
Transboundary impact	Transboundary impact is “any impact, not exclusively of a global nature, within an area under the jurisdiction of a Party [to this Convention] caused by a proposed activity the physical origin of which is situated wholly or in part within the area under the jurisdiction of another Party” (Convention on EIA in a Transboundary Context, 1991)
Transformer rectifiers	Equipment to transform high voltage AC to lower voltage DC
Trenching	The process of excavating the trench for the pipeline
Trenching crew	The crew that implements trenching
TSS	Total Suspended Solids
True vapour pressure	Crude vapour pressure at pipeline input temperature
TV	Television
Tuff	A compacted or consolidated deposit of pyroclastic material composed of volcanic ash and dust
Turbidity	Turbidity is a unit of measurement quantifying the degree to which light travelling through a water column is scattered by the suspended organic (including algae) and inorganic particles. From environmental point of view, the series of turbidity-induced changes that can occur in a water body may change the composition of an aquatic community. Turbidity of measured in Nephelometric Turbidity Units (NTU) or Jackson Turbidity Units (JTU)
UAE	United Arab Emirates
UHC	Unburned Hydrocarbons
UK	United Kingdom

UKAS	United Kingdom Accreditation Service
UN	United Nations
UNAIDS	Joint United Nations programme on AIDS/HIV
UNDHR	United Nations Declaration of Human Rights
UNDP	United Nations Development Programme
UNHCR	United Nations High Commissionaire for Refugees
UNICEF	United Nations International Children's Emergency Fund
UPS	Uninterrupted Power Supply
URS	The company URS Corporation Ltd (formerly URS Dames & Moore)
USA	United States of America
US$	United States Dollar
US EPA	United States Environmental Protection Agency
US Ex Im	United States Export Import Bank
VA	Valuation Audit
Vapour pressure	The pressure at which a liquid turns to a gas
VHF	Very High Efficiency
VLCC	Very Large Crude Carriers
VOC	Volatile Organic Compounds
WBG	World Bank Group
WBH	Water Bath Heaters
Welding crew	The crew that welds the pipeline sections together
WHO	World Health Organization.
WMP	Waste Management Plan
Wobbe index	The ratio of the corresponding calorific value of gas per unit volume and the square root of its density under the same reference conditions. The Wobbe index reflects the gas/air relationship and combustion characteristics that express the heat impact which a burner is exposed to during combustion
Working width	The area within which the pipeline installation takes place, including topsoil and subsoil storage
Wrapping crew	The crew that wraps the pipeline (normally at joints) with anti-corrosion tape, FBE epoxy or other surface coating prior to testing and acceptance
WREP	The existing Western Route Export Pipeline operated by AIOC between Baku, Azerbaijan and Supsa, Georgia
WREPG	The Georgian section of the WREP

2.2 GEORGIAN PLACE NAMES

2.2.1 Town and village names

Gardabani District
Jandari (G)
Nazarlo
Kesalo
Kapanachi-Lelashka
Gardabani Town
Akhali-Samgori
Rustavi Town
Akhtagla
Karatagla
Krtsanisi
Kumisi
Birliki

Tetritskaro District
Akhali-Marabda
Dzveli-Marabda
Kotishi
Khaishi
Patara-Durnuki
Didi-Durnuki
Tsintskaro
Kosalari
Daget-Hachin
Samshvilde
Tetritskaro Town
Chivschavi
Ipnara
Jigrasheni
Ivanovka
Akhalsopeli

Borjomi District
Tabatskuri
Bakurianis Andeziti (Andezit)
Tsikhisjvari
Borjomi
Kodiani
Dviri
Sakire
Tadzrisi

Marneuli District
Marneuli Town
Jandari (M)

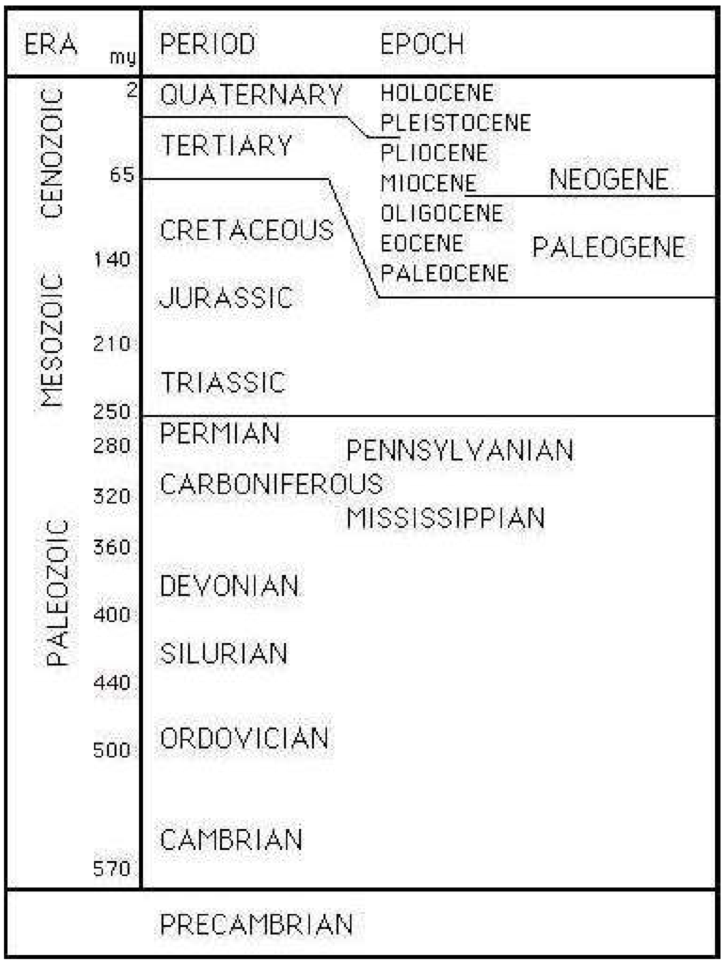
Tsalka District
Imera
Bashkoi
Akhaliki
Shapar-Haraba
Shipiaki
Beshtasheni
Tsalka
Kariaki
Santa
Tsintskaro
Ashkala
Jinisi
Gumbati
Avranlo
Kizil-Kilisa
Ozni
Rekha
Khando

Akhaltsikhe District
Tiseli
Tkemlana
Atskuri
Agara
Sakuneti
Zikilia
Tsnisi
Klde
Suburb of Akhaltsikhe
Akhaltsikhe Town
Tsira
Tskruti
Skhvilisi
Vale Train Station
Vale
Naokhrebi

2.2.2 River names

Mtkvari
Algeti
Ktsia
Potskhovi

2.3 GEOLOGIC TIME SCALE



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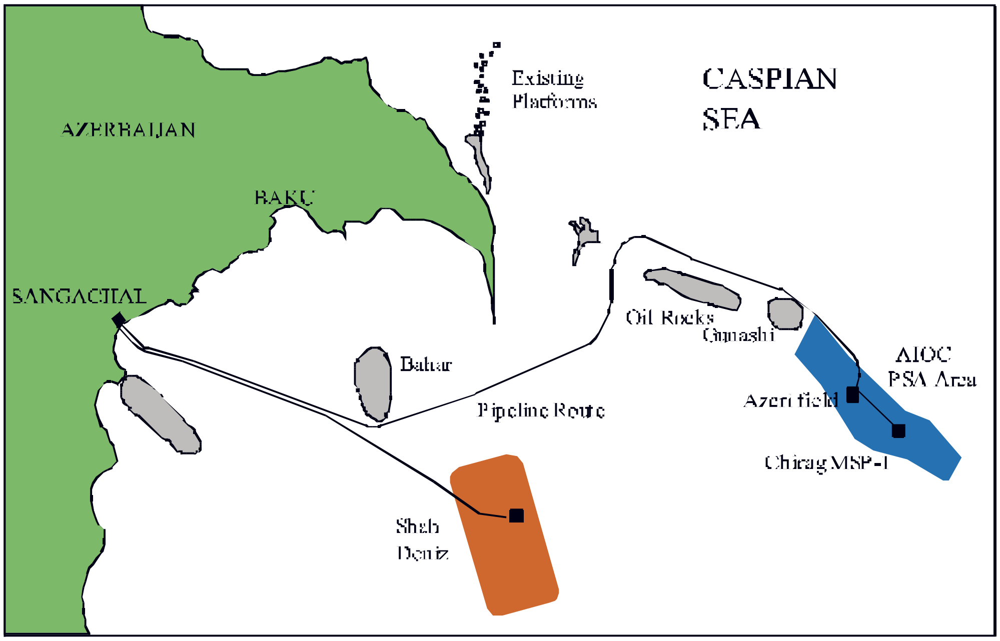
In mid 2002 the BTC Owners will form a company that will be known as the BTC Pipeline Company or BTC Co.

BTC Co will be responsible for construction and operation of the proposed pipeline in both Georgia and Azerbaijan, with construction in Turkey falling under the control of the State Company BOTAS.

Figure 3-1 Location of the Azeri-Chirag-Gunashi (ACG) oil field in the Caspian



BP has been nominated by the BTC Owners to lead the engineering design work for the project on behalf of the BTC Owners which currently includes the State Oil Company of the Azerbaijan Republic (SOCAR), Unocal, Statoil, TPAO, Itochu, Ramco, Delta Hess and ENI (see Figure 3-2). Negotiations are currently under way with other companies about possible involvement in the project. BP is also taking the lead in managing the environmental and social issues associated with the developments, and it has been agreed that BP Health, Safety and Environment (HSE) Policy will be adopted by BTC Co.

Figure 3-2 The BTC Owner Group

Throughout this document reference will be made to BTC Co as the organization responsible for construction and operation of the pipeline in Georgia and Azerbaijan, and therefore responsible for implementation of the commitments made in this ESIA.

During the design phases of the BTC project several international engineering firms have been contracted to provide expertise and resources to support the development of the project. Fluor Daniel conducted early engineering work. Bechtel has undertaken the detailed engineering work for the BTC pipeline system. Bechtel and John Brown Hydrocarbons (the lead engineers for the proposed Southern Caucasus gas pipeline) have been jointly responsible for all pipeline corridor and right of way (ROW) issues.

A bid process to select contractors to carry out the construction of the pipeline and associated above ground installations (AGIs) is under way, with contractors expected to be appointed sometime in the middle of 2002. It is possible that there will be different contractors for the pipeline and for the AGIs.

3.2 PROJECT RATIONALE

The Caspian Sea region has abundant oil and gas reserves. The domestic demand for oil in the Caucuses and Central Asia is low and unlikely to grow in the near future. Most of the expansion in production will therefore be available for export. This export potential is severely constrained owing to the land-locked geography of the Caspian and the very limited pipeline and rail networks serving the region. Oil exported from the Caspian is currently transported by rail and/or pipeline to ports located on the east coast of the Black Sea. From here the product is either transported to other ports on the Black Sea for further distribution within Central and Eastern Europe, or shipped via the Bosphorus Straits to the Mediterranean Sea and then onwards to world markets.

The BTC pipeline is being constructed in order to overcome the limited capacity of existing export options. At full capacity the pipeline will export one million barrels per day of crude oil from the existing Sangachal Terminal near Baku in Azerbaijan, through Georgia to Ceyhan in Turkey, where a new marine terminal is to be constructed. The pipeline will be buried for its entire length and the route has been selected to ensure that no communities will need to be re-settled. Initially the BTC pipeline will transport oil from the ACG Phase 1 Full Field Development (see Figure 3-1), followed at a later date by crude oil from other phases of the ACG development as well as other regional crude oil streams.

The BTC pipeline is considered to be the most suitable method to transport crude oil from the Azerbaijan sector of the Caspian to world markets when environmental, economic and political factors are taken into consideration, as discussed further in Section 4, Alternatives.

One of the key benefits of the BTC project is that it enables Caspian oil to be exported to the open market without an incremental increase in the volumes of oil shipped through the Bosphorus Straits.

3.3 PROJECT ALTERNATIVES

During preliminary work relating to the BTC project, alternative options for the transportation of oil were considered. These included road, rail and pipeline options, including the expansion of the existing Northern Route Export Pipeline (NREP), and/or expansion of the existing Western Route Export Pipeline (WREP).

Detailed investigations into the possibility of building a new pipeline were carried out, and on the basis of these considerations it was confirmed that the concept of transporting crude oil by pipeline from the Caspian to the Mediterranean, via Azerbaijan, Georgia and Turkey could be realized. In particular the project was considered to be a commercially viable and environmentally acceptable solution that was not contrary to the policies of either the host Governments or the Governments of the BTC Owners. A key consideration in arriving at this decision was the lower environmental risk associated with shipping through the Mediterranean rather than via the Bosphorus Straits.

A comprehensive route selection process was also followed to determine the optimum route for the line, considering political, environmental, social and engineering issues. The proposed route of the BTC pipeline across Azerbaijan, Georgia and Turkey is shown schematically in Figure 3-3. A detailed analysis of project alternatives, including route selection, can be found in Section 4 of this document.

Figure 3-3 Map of BTC pipeline route

3.4 PROJECT DESCRIPTION

The proposed BTC pipeline will be approximately 1,750km long and buried for its entire length. The 42" (1,066.8mm) diameter BTC pipeline originates at the Sangachal Terminal near Baku in Azerbaijan. Within Azerbaijan the new pipeline will, for the majority of its length, be constructed parallel to the existing WREP operated by the Azerbaijan International Operating Company (AIOC). On reaching Georgia, the pipeline converts to 46 (1,168.4mm) diameter and runs west towards Turkey. Within Turkey, the pipeline reverts to 42" diameter and heads south to the Mediterranean port of Ceyhan.

Construction is currently scheduled to start in the spring of 2003 and to be completed by the end of 2004.

Design of the BTC pipeline is being carried out at the same time as, and in alignment with, the design work for the South Caucasus Pipeline (SCP), which will transport gas from Azerbaijan to the Georgian-Turkish border. The proposed SCP will be approximately 690km long and will run parallel to the BTC pipeline between the Sangachal Terminal and the Georgian-Turkish border near Akhaltsikhe. The SCP has a planned completion date of one year later than the BTC pipeline and is addressed in detail in a separate ESIA report.

Figure 3-4 provides an overview of the routes of the WREP, NREP, SCP and BTC pipelines.

Figure 3-4 Overview map of WREP, NREP, SCP and BTC

Detailed pipeline routing and engineering design is an interactive and ongoing process. This ESIA is based on the information currently available. As the engineering design develops more information will become available and will be subject to environmental review.

3.5 SCOPE OF THIS ESIA

3.5.1 Geographical extent

The subject of this ESIA report is the onshore section of the BTC pipeline within the territory of Georgia. This is defined as the pipeline, and all associated facilities, between the Azerbaijan-Georgia border and the Georgian-Turkish border.

In addition to the pipeline itself, permanent facilities within Georgia necessary for the first stage of the BTC development will include:

- Two intermediate pigging stations
- Two pump stations
- 15 ball valve stations
- Four check valve stations

- One metering station (which will be co-located with the proposed SCP pressure reduction station (PRS)
- A cathodic protection (CP) system
- A fibre optic cable
- A computer-based control system

A detailed description of the BTC project in Georgia can be found in Section 5.

3.5.2 Project phasing

This ESIA describes the impacts that the BTC project as built will have upon the existing environmental and social conditions along the pipeline corridor in Georgia, and how these impacts will be mitigated. However, environmental and social assessment has also fed into every stage of the project design process, significantly influencing how the project will be developed. Therefore many of the potential impacts of the project will never be realized as steps have already been taken to avoid the impact occurring.

Figure 3-5 Index of potential environmental impacts

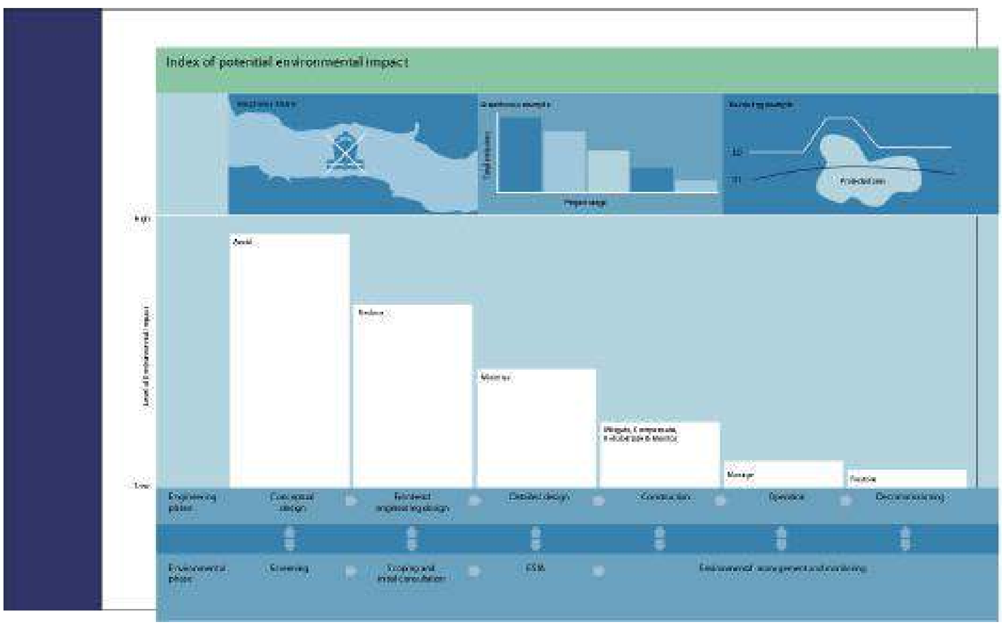


Table 3-1 below outlines the level of environmental and social analysis assigned at each stage of the project design process.

Table 3-1 Inter-relationship of environmental and social assessment with the engineering and construction process

BP Internal Phase	Project Phase	Degree of Environmental and Social Analysis
Appraise	Preliminary engineering	Screening
Select	Basic engineering	Scoping
Define	Detailed engineering	Environmental and social impact assessment (ESIA)
Execute	Construction	Environmental and social management plan
Evaluate	Operations	Environmental and social management systems

A comprehensive Environmental and Social Scoping Study document was produced during the basic engineering phase and provided to key stakeholders in Azerbaijan and Georgia. This highlighted the key environmental and social issues associated with the BTC development, and provided the basis of the full ESIA to be undertaken during the detailed engineering phase. This document summarizes that ESIA process.

The ESIA assesses the impacts of all phases of the BTC project development, from the start of construction, through commissioning, operation and eventual abandonment of the facilities.

3.6 OBJECTIVES OF THE BTC ESIA

The overall objective of the BTC ESIA process is to ensure that any potential adverse environmental or social impacts arising from pipeline construction and associated activities are identified, and where possible eliminated or minimized through early recognition of, and response to, the issues. The main issues considered during the preparation of this ESIA are listed below:

- Identification, quantification and assessment of environmental and social aspects
- Comprehensive integration of environmental and social considerations and constraints into the project planning and design activities
- Demonstration that environmental and social issues will figure prominently at all stages of the project
- Thorough addressing of company policy and legal requirements
- Consultation with all stakeholders and consideration of their concerns

Where it is not possible to eliminate or minimize impact through design, the ESIA details those environmental and social mitigation measures, which have been identified in conjunction with engineering teams and stakeholders and will be implemented by the BTC Co (Sections 10 and 11). Furthermore, where appropriate, additional environmental and community investment programmes will be implemented, and are discussed in the ESIA.

Potential impacts of all stages of the project have been evaluated against applicable environmental standards, regulations and guidelines, existing environmental conditions and issues raised by stakeholders (see Section 6, Legal and Policy Framework, and Section 16, Consultation).

In addition to these primary objectives, a guiding principle for the BTC ESIA process has been to build upon experience gained during the production of previous ESIA reports in the region, and to improve upon these earlier studies where possible.

The following issues have been given additional consideration during the BTC ESIA process, as a result of experience gained during production of the WREP EIA:

- Consideration of alternatives to the proposed pipeline and alternative export routes
- A greater emphasis on socio-economic impacts and opportunities for community investment and maximizing community and social benefits
- A comprehensive public consultation programme including a 60-day period for responses prior to finalization of the report
- Increased involvement of Georgian scientists
- Greater emphasis on geohazards (eg, seismic and geotechnical risk)
- Planning of ecological surveys involving local scientists to address seasonal aspects including dormant plants, animal migration and hibernation
- Reviewing methods for facilitating independent review of reports
- Issuing a scoping report and inviting feedback

3.7 CURRENT STATUS OF THE ESIA

This draft of the ESIA document has been prepared specifically for public disclosure and comment. The report will be widely disseminated and will be available for comment for a period of 60 days. Following the 60-day disclosure period all comments received will be incorporated as appropriate into the ESIA, prior to formal submission to the Government.

3.8 STRUCTURE OF THE ESIA REPORT

This ESIA document comprises two volumes: the ESIA report itself, and a volume of Appendices (incorporating technical appendices and environmental and social baseline reports).

The structure of this ESIA has been developed by the BTC project team in order to adhere to International Financing Institution (IFI) requirements, to meet the national host government requirements as defined in the Host Government Agreements (HGAs), and to provide alignment with ISO standards for Environmental Management Systems (EMS).

This ESIA report is divided into 18 Sections as detailed in Table 3-2.

Table 3-2 ESIA report structure

Section Number	Section Title
1	Non technical executive summary
2	Glossary
3	Introduction
4	Project alternatives
5	Project description
6	Legal and policy framework
7	ESIA methodology
8	Environmental baseline
9	Socio-economic baseline

Section Number	Section Title
10	Environmental impacts and mitigation
11	Socio-economic impacts and mitigation
12	Residual impacts
13	Cumulative impacts
14	Management and monitoring
15	Overall project assessment
16	Consultation
17	ESIA contributors
18	References

The appendices are:

Appendix A – Project Description	Annex I - Reinstatement Summary Plan
Appendix B – Policy and Legal Framework	Annex I - HGA Annex II - BP Policies
Appendix C – Environmental Baseline	Annex I - Infrastructure and Traffic Study
Appendix D – Socio-Economic Baseline	Annex I - Community Survey Summary Annex II - Maps of Communities Surveyed
Appendix E – Environmental Impacts and Mitigation	Annex I - Landscape Management Plan Annex II - Air Quality Modelling Study Annex III - Cultural Heritage Management Plan Annex IV - Oil Spill Modelling Assessment (Groundwater, Overland, Surface Water) Annex V - Oil Spill Response Plan Framework
Appendix F – Socio-Economic Impacts and Mitigation	Annex I - Public Consultation and Disclosure Plan

Copies of the full ESIA report and a Non-Technical Executive Summary will be made widely available, with copies in Georgian, English and Russian.

Where possible, the structure of this report has been developed in such a way as to allow direct comparison between the ESIAs produced for Georgia and Azerbaijan. A number of the sections are common to both countries, and have therefore been reproduced in the same form in the two documents. A common impact identification and assessment methodology has been applied. However, within some sections, particularly Section 10, Environmental Impacts and Mitigation, there are differences in the presentation of information, which reflect the level of analysis required for specific subjects in each country.

3.9 ASSOCIATED ESIAS

Environmental and social issues along the BTC pipeline route are covered in three separate ESIA documents, subdivided as detailed below:

- BTC ESIA Azerbaijan - 442km of pipeline, from the Sangachal Terminal to the Azerbaijan-Georgian border

- BTC ESIA Georgia - 248km from the Azerbaijan-Georgian border to the Georgian-Turkish border (this document)
- BTC ESIA Turkey – 1,060km from the Georgian-Turkish border to the Ceyhan Terminal on the Mediterranean Coast

A Grand Executive Summary has also been produced to summarize all ESIAs in a single volume.

Separate ESIA reports will or have also been produced covering the following related projects:

- Shah Deniz (SD) Gas Field Development and Production (offshore development, subsea pipeline and onshore terminal)
- SCP gas export project in Azerbaijan
- SCP gas export project in Georgia
- ACG Phase 1 Upstream Oil Project (offshore development, subsea pipeline and onshore terminal)

Finally, a regional assessment entitled "Environmental, Social and Economic Review of ACG Full Field Development and Export in a Regional Context" has been prepared for the International Finance Corporation (IFC).

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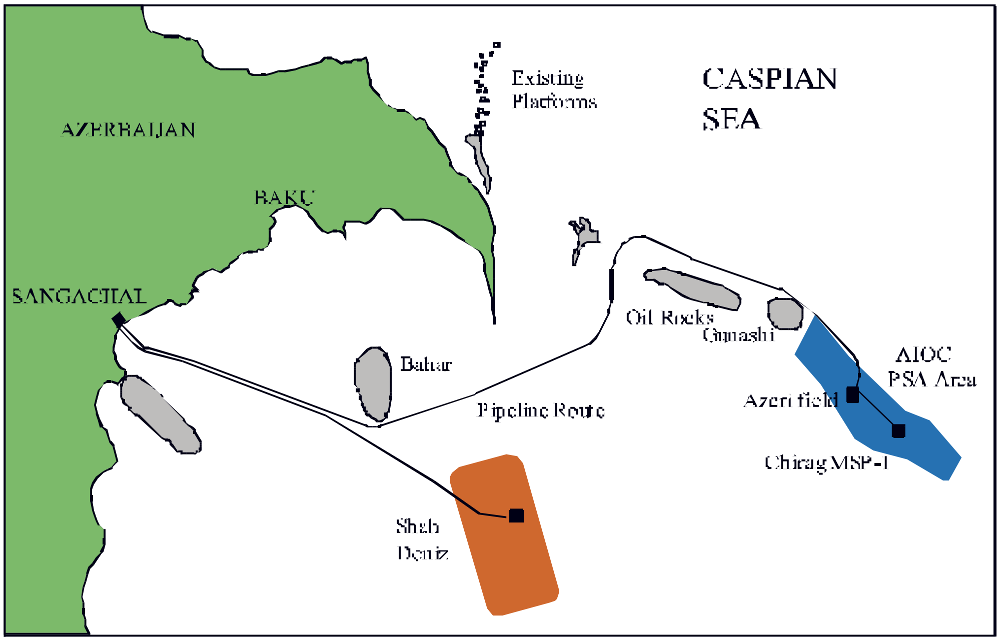

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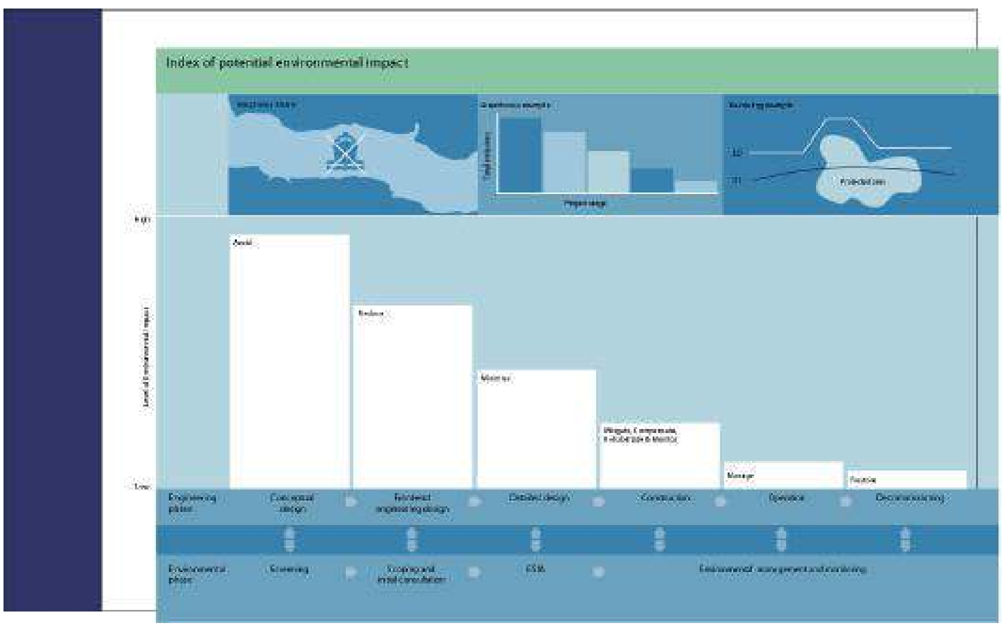

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- Comprehensive integration of environmental and social considerations and constraints into the project planning and design activities
- Demonstration that environmental and social issues will figure prominently at all stages of the project
- Thorough addressing of company policy and legal requirements
- Consultation with all stakeholders and consideration of their concerns

Where it is not possible to eliminate or minimize impact through design, the ESIA details those environmental and social mitigation measures, which have been identified in conjunction with engineering teams and stakeholders and will be implemented by the BTC Co (Sections 10 and 11). Furthermore, where appropriate, additional environmental and community investment programmes will be implemented, and are discussed in the ESIA.

Potential impacts of all stages of the project have been evaluated against applicable environmental standards, regulations and guidelines, existing environmental conditions and issues raised by stakeholders (see Section 6, Legal and Policy Framework, and Section 16, Consultation).

In addition to these primary objectives, a guiding principle for the BTC ESIA process has been to build upon experience gained during the production of previous ESIA reports in the region, and to improve upon these earlier studies where possible.

The following issues have been given additional consideration during the BTC ESIA process, as a result of experience gained during production of the WREP EIA:

- Consideration of alternatives to the proposed pipeline and alternative export routes
- A greater emphasis on socio-economic impacts and opportunities for community investment and maximizing community and social benefits
- A comprehensive public consultation programme including a 60-day period for responses prior to finalization of the report
- Increased involvement of Georgian scientists
- Greater emphasis on geohazards (eg, seismic and geotechnical risk)
- Planning of ecological surveys involving local scientists to address seasonal aspects including dormant plants, animal migration and hibernation
- Reviewing methods for facilitating independent review of reports
- Issuing a scoping report and inviting feedback

3.7 CURRENT STATUS OF THE ESIA

This draft of the ESIA document has been prepared specifically for public disclosure and comment. The report will be widely disseminated and will be available for comment for a period of 60 days. Following the 60-day disclosure period all comments received will be incorporated as appropriate into the ESIA, prior to formal submission to the Government.

3.8 STRUCTURE OF THE ESIA REPORT

This ESIA document comprises two volumes: the ESIA report itself, and a volume of Appendices (incorporating technical appendices and environmental and social baseline reports).

The structure of this ESIA has been developed by the BTC project team in order to adhere to International Financing Institution (IFI) requirements, to meet the national host government requirements as defined in the Host Government Agreements (HGAs), and to provide alignment with ISO standards for Environmental Management Systems (EMS).

This ESIA report is divided into 18 Sections as detailed in Table 3-2.

Table 3-2 ESIA report structure

Section Number	Section Title
1	Non technical executive summary
2	Glossary
3	Introduction
4	Project alternatives
5	Project description
6	Legal and policy framework
7	ESIA methodology
8	Environmental baseline
9	Socio-economic baseline

Section Number	Section Title
10	Environmental impacts and mitigation
11	Socio-economic impacts and mitigation
12	Residual impacts
13	Cumulative impacts
14	Management and monitoring
15	Overall project assessment
16	Consultation
17	ESIA contributors
18	References

The appendices are:

Appendix A – Project Description	Annex I - Reinstatement Summary Plan
Appendix B – Policy and Legal Framework	Annex I - HGA Annex II - BP Policies
Appendix C – Environmental Baseline	Annex I - Infrastructure and Traffic Study
Appendix D – Socio-Economic Baseline	Annex I - Community Survey Summary Annex II - Maps of Communities Surveyed
Appendix E – Environmental Impacts and Mitigation	Annex I - Landscape Management Plan Annex II - Air Quality Modelling Study Annex III - Cultural Heritage Management Plan Annex IV - Oil Spill Modelling Assessment (Groundwater, Overland, Surface Water) Annex V - Oil Spill Response Plan Framework
Appendix F – Socio-Economic Impacts and Mitigation	Annex I - Public Consultation and Disclosure Plan

Copies of the full ESIA report and a Non-Technical Executive Summary will be made widely available, with copies in Georgian, English and Russian.

Where possible, the structure of this report has been developed in such a way as to allow direct comparison between the ESIAs produced for Georgia and Azerbaijan. A number of the sections are common to both countries, and have therefore been reproduced in the same form in the two documents. A common impact identification and assessment methodology has been applied. However, within some sections, particularly Section 10, Environmental Impacts and Mitigation, there are differences in the presentation of information, which reflect the level of analysis required for specific subjects in each country.

3.9 ASSOCIATED ESIAS

Environmental and social issues along the BTC pipeline route are covered in three separate ESIA documents, subdivided as detailed below:

- BTC ESIA Azerbaijan - 442km of pipeline, from the Sangachal Terminal to the Azerbaijan-Georgian border

- BTC ESIA Georgia - 248km from the Azerbaijan-Georgian border to the Georgian-Turkish border (this document)
- BTC ESIA Turkey – 1,060km from the Georgian-Turkish border to the Ceyhan Terminal on the Mediterranean Coast

A Grand Executive Summary has also been produced to summarize all ESIAs in a single volume.

Separate ESIA reports will or have also been produced covering the following related projects:

- Shah Deniz (SD) Gas Field Development and Production (offshore development, subsea pipeline and onshore terminal)
- SCP gas export project in Azerbaijan
- SCP gas export project in Georgia
- ACG Phase 1 Upstream Oil Project (offshore development, subsea pipeline and onshore terminal)

Finally, a regional assessment entitled "Environmental, Social and Economic Review of ACG Full Field Development and Export in a Regional Context" has been prepared for the International Finance Corporation (IFC).

PROJECT ALTERNATIVES

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4 PROJECT ALTERNATIVES

4.1 INTRODUCTION

The BTC crude oil export pipeline project, as described in Section 5 of this report, represents the results of a process of assessment of alternative options for the export of oil produced from the ACG field in the Azerbaijan sector of the Caspian Sea to world markets. This process has taken over five years. This Project Alternatives section describes the process that has led to the adoption of the BTC project as described in Section 5.

The assessment of alternative export options was a phased process, starting with a review of the best method for transportation of the oil, followed by a comprehensive assessment of the best corridor for a pipeline and then looking in great detail at the exact route alignment within that corridor. This process is described in detail in Section 4.3, Transportation Method and Section 4.4, Routing, below.

The options for transporting line-pipe and equipment to the host countries, and onward to the project construction areas have also been the subject of a detailed assessment. This review of logistics options has also included a consideration of access roads, worker camps, and line-pipe storage areas, that could be utilised for the project. The assessment of alternatives for these issues is dealt with in Section 4.5, Logistics Options.

Considerable effort has also gone in to optimising the design of the pipeline system to maximize its operability, minimize its cost and minimize environmental impact where practical. The assessment of alternative design options is described in detail in Section 4.6, Design Options.

However, before embarking on a detailed study to assess the relative merits of various export options it was necessary to consider the impacts of the "No-development Option", that is what would be the results of not developing any additional export capacity for Azerbaijan oil. In this way an informed decision on the merits of pursuing an export solution could be made.

4.2 NO-DEVELOPMENT OPTION

No development of the BTC project would remove all potential environmental and social impacts owing to construction and operation.

A number of potential positive effects were identified that would not be realised should the project not proceed, including the financial benefits to Georgia arising from the transit of oil. The no-development option would also mean that specific environmental and social benefits that may accrue as a result of the BTC project, such as increased employment opportunities, infrastructure upgrades and other community benefits would not occur.

If the BTC project were not to be progressed alternative export options would need to be found. In addition the development of the ACG oil fields in the Caspian Sea would not be viable with wide ranging negative impacts on the economy of Azerbaijan and neighbouring countries.

If the BTC pipeline were not developed this would increase the demand for alternative export solutions from the Caspian and may lead to other projects being proposed that entail a greater degree of environmental risk, for example proposals that require:

- Shipping of oil through the Bosphorous strait
- Alternative pipeline routes through areas of higher risk (terrain and security)

The no-development option was therefore discounted on financial, environmental and social grounds, and the decision made to identify the most suitable export option for oil from the ACG fields in the Caspian Sea.

4.3 TRANSPORTATION METHOD

Once it had been determined that it was appropriate to assess methods for exporting Azerbaijani oil to world markets the primary transportation method required assessment. A number of transportation options were considered, including:

- Road
- Rail
- Pipeline
- Shipping
- A combination of the above

Various routes and final destinations for these transportation options were assessed. Two key environmental studies were carried out to investigate the relative environmental risks and benefits of these options:

1. An Analysis of key environmental issues associated with exporting ACG volumes from the Caspian, completed in 1997. This desk top report examined and summarised the major environmental sensitivities along each of the potential export routes.

2. The second study, a semi-quantitative Environmental Risk Assessment (ERA), studied the relative risk of oil spills associated with transportation by pipeline and shipping, for the following options, to a common point in the Mediterranean:
    - Baku to Supsa
    - Baku to Supsa with a by-pass of the Bosphorus
    - Baku to Novorossiysk
    - Baku to Novorossiysk with a by-pass of the Bosphorus
    - Baku-Tbilisi-Ceyhan

The study concluded that Baku-Tbilisi-Ceyhan was the lowest environmental risk option. Rail and road transportation options were discounted, as part of an earlier screening study, in part owing to high relative spill risk, and in part owing to the logistical difficulties and social and environmental impacts in transporting the large volumes required by these methods.

As a contingency, a study was also commissioned that looked at alternative export options that would enable 450 – 500mbd of oil to be exported from the Caspian Sea by end 2004, so securing an export route for at least the early ACG Phase 1 development volumes.

The options considered in the latter study included various scenarios for the expansion of the existing oil export lines from the Azerbaijan sector of the Caspian, the WREP and NREP. Screening of all potential expansion options identified four that were subject to more detailed assessment:

- Expansion of the existing northern route pipeline through upgrade of the pump stations to 200mbd capacity
- Expansion of the northern route pipeline to 350mbd through upgrade of the pump stations and addition of a looped 700mm (28") line from the Sangachal Terminal
- Expansion of the western route pipeline to 300mbd by means of a new pipeline within Azerbaijan and upgrade of the pump stations in Georgia

Environmental and social assessments (including baseline studies and risk assessments) were conducted for all of these expansion options. These highlighted that while feasible they all involved onward transportation of oil through the Bosphorus Straights from Supsa (WREP) or Novorossiysk (NREP). The options for expansion were all also limited in terms of the volumes that could be transported and therefore did not represent long term export solutions.

Development of a new pipeline, from Baku to Ceyhan was therefore considered the most acceptable transportation method for the Azerbaijani oil as it has the lowest environmental risk associated with it. Pipelines are universally considered to be the safest, most cost effective and environmentally sound method of transporting hydrocarbons.

4.4 EXPORT COUNTRY

Azerbaijan does not share a common border with Turkey. Routing options from Azerbaijan to Turkey included transiting via Iran, Armenia or Georgia.

When considering the use of Armenia as a possible transit country, the wishes of the BTC primary Host Government, BTC Partner and owner of the ACG crude to be transported, Azerbaijan, have to be respected. Despite the ceasefire with Armenia in 1994, it has still not been possible for Azerbaijan and Armenia to reach settlement over the Nagorno Karabach issue. Therefore, owing to the ongoing political uncertainty over this issue, allied with the terrain and engineering constraints that this route would pose, it was decided not to pursue the possibility of BTC pipeline construction through Armenia.

Owing to continued sanctions against Iran, the involvement of US investors and partners in the ACG Production Sharing Agreement (PSA) and BTC project precluded the use of Iran as a transit country.

Options to export via Russia were also considered but discounted owing to the commercial implication of the distance to the Mediterranean Sea and need to ship oil via the sensitive Bosphorus Straits.

Therefore the route through Georgia was selected based on the willingness and support offered by Georgia and Turkey to be transit countries; subsequently this support was enacted into leading edge transit and investor protection laws. The routes through Georgia and Turkey were found to be commercially competitive.

4.5 ROUTING

The BTC pipeline route delivers a major environmental benefit enabling Caspian ACG crude volumes to be exported from the land-locked Caspian Sea, to open market, without an incremental increase in volumes shipped through the Bosphorus Straits. Turkey was selected as the most suitable export destination, as it is the nearest country to Azerbaijan with access to the Mediterranean Sea, which provides the nearest open market point of delivery. Georgia was selected as the intermediate transit country. See Figure 4-1 below, for a regional geographical overview.

Figure 4-1 Regional map

4.5.1 The routing process

4.5.1.1 General

Following the decision to use Georgia as the transit country for the new pipeline an intensive routing process was initiated to evaluate all possible routing options through Georgia. The corridor selection process was driven by the requirements of the Host Government Agreement, described in detail in Section 6, which defined a four stage development process follows:

- Corridor Selection (10km corridor of interest)

- Route Refinement (500m preferred corridor)
- Route Definition (100m specified corridor)
- ROW Alignment (32m construction corridor)

4.5.1.2 Principles of pipeline routing

For linear development such as pipelines, the key process for managing potential negative environmental and social impacts is to identify the least sensitive route. A rigorous and robust corridor and route selection process is therefore essential to the successful development of any pipeline project to ensure that, wherever possible, environmental and social impacts are avoided. Managements of this process was achieved through implementation of the BP Route Assurance Process throughout the corridor selection and subsequent route development.

Throughout the development of the route the primary mitigation in terms of environmental and social impact of the pipeline during construction and operation has been to avoid sensitive areas by re-routing the pipeline. Implementation of this philosophy has resulted in successful achievement of the following goals:

- Sensitive environmental locations have been avoided to minimise the potential effects pipeline construction will have on the environment
- Known cultural monuments have been avoided
- Main areas of population density have been avoided to minimise the potential effects pipeline construction will have on the public
- High-risk geohazard locations have been avoided to minimise the potential effects of geohazards and ensure the long-term integrity of the pipeline system
- Pipeline alignment has been optimised to facilitate construction of major crossings, minimise land take and maximise reinstatement potential
- Security sensitive areas have been avoided to ensure the long-term security of the pipeline

4.5.1.3 Route assurance methodology

Pipeline routing is, by definition, an iterative process and development of the pipeline route has been carried out in the following three distinct stages, which align with the defined HGA process:

- Stage 1: Corridor Selection Process (10km corridor)
- Stage 2: Route Refinement Process (500m corridor)
- Stage 3: Route Definition Process (100m corridor)

The process involves identification and assessment of key routing constraints and selection criteria in progressively more detail in order to refine the route and subsequently meet the above goals. The key assessment and selection criteria considered at each stage can be summarised as follows:

- Environmental and social issues; including flora, fauna, hydrogeology, landscape, livelihoods, cultural heritage, etc
- Terrain evaluation and geohazard assessment; including seismic faults, landslides, slope stability, etc

- Constructability and long term integrity; including access and logistics, reinstatement, river, gorge and gully crossings, etc
- Security: including terrorisms/sabotage, civil unrest, etc

During each stage of the evaluation process a broadly similar set of tools was used to refine the route, although greater definition was obtained to enable a more detailed assessment to be carried out at each stage. Tools employed during each stage of the evaluation process included:

- Satellite imagery
- Aerial photography
- Maps (geological, terrain, etc)
- Terrain maps
- Literature reviews
- Desk top studies
- Baseline studies
- Field "ground truthing" surveys
- Detailed field studies

At each stage of the process, multidisciplinary teams were employed to carry out numerous desktop reviews and field surveys. The teams consisted of personnel with the following recognised expertise:

- Pipeline engineers
- Environmental engineers
- Sociologists
- Botanists
- Archaeologists
- Geomorphologists
- Engineering geologists
- Zoologists

The following sections describe in detail the route assurance methodology applied during development of the route and the three stages of evaluation and selection previously discussed.

4.5.1.4 Stage 1: Corridor selection process (10km corridor)

BP initially identified three potential corridors based on previous high-level studies undertaken by various third parties all of whom were seeking a pipeline export route for Caspian oil and gas resources. These three corridors formed the basis of the route selection and development process to determine the optimum pipeline route through Georgia.

A common corridor was sought for both the BTC Oil Pipeline and the SCP which would substantially reduce the potential social and environmental impacts should both projects proceed. The selection and development of a common corridor ensures alignment with the Project's Environmental and Social Goals (see Section 6, Regulatory and Policy Framework) summarised as follows:

- Reduction in total area of land clearance; habitat and agricultural land lost
- Reduction in number of temporary facilities (camps, pipe storage yards, access roads, etc) required

- Potential for co-location of permanent facilities so reducing land-take

The choice of pipeline route in Georgia was to some extent dependant on the point of entrance of the pipeline into Georgia and on the exit point into Turkey. The agreement reached with the Turkish Government specified the length of national border where the pipeline had to enter into Turkey. The point of entry into Georgia from Azerbaijan was established near the town of Gardabani, to the south of the Jandari Lake where the WREP also enters the country.

Methodology

As discussed above, the corridors were assessed in terms of environmental and social issues, terrain and geohazard constraints, constructability, including ease of reinstatement, and security.

- Environmental and Social Issues**:** A desktop study was conducted to identify potential environmental and social constraints over the entire geographical area (Southern Georgia) traversed by the three proposed pipeline corridors. Georgian specialists were commissioned to collate and analyse available data to identify the constraints that could influence selection of the pipeline corridor and ensure that the impacts on environmental and social issues are minimised.

  Composite maps were created depicting all "severe" constraints in order to compare the differences between the three corridors. The severe constraints (those which have a direct influence on the corridor selection) represented the following:
  - Flora
  - Fauna
  - Protected areas
  - Geohydrology
  - Landscape
  - Archaeology
  - Population density

Comparison tables were subsequently produced from the composite maps to summarise the differences between the three corridors and estimate the percentage of constraints within each potential corridor.

- Terrain Evaluation and Geohazard Assessment: A desktop terrain evaluation and geohazard assessment was carried out on the three potential pipeline corridors. The study comprised a geomorphological, engineering geological and geotechnical interpretation of satellite imagery, aerial photography, geological maps, and topographical maps.

  The desktop study was supported by a literature review. The information was used to subdivide the geographical area covered by the three route corridors into a series of terrain units. Each terrain unit was assessed for potential geohazards that could occur within the units. The output of the desktop study was a series of 1:100,000 maps detailing the terrain unit boundaries and a table giving an broad assessment of the geohazards including a judgement of their subsequent impact

- Constructability and Long Term Integrity: A preliminary pipeline routing desktop study was undertaken to assess the following characteristics for each of the three potential pipeline corridors:

  - Access and logistics
  - Seasonal constraints
  - Pipe trench excavatability
  - Suitability of trench backfill and construction materials
  - Special construction techniques for river, gorge and gully crossings
  - Reinstatement and erosion control
  - Requirement for sections of special pipeline construction techniques

  In order to ensure integrity of the pipeline during both construction and operation, an assessment of each of the corridors was carried out based on:

  - Avoiding difficult terrain where possible
  - Designing special trench and construction methods as needed in areas of unstable ground and at fault line crossings
  - Undertaking ground stabilisation measures
  - Undertaking special crossing designs at rivers, gorges, etc

- Security**:** BP's regional security departments undertook a security risk review of the three potential corridors and assessed the vulnerability of pipeline system assets to the following perceived threats:

  - Terrorism/Sabotage
  - Civil unrest
  - Criminality
  - Kidnapping

  These threats were assessed in terms of impact, probability, risk and manageability.

Following completion of the desktop studies a multidisciplinary field trip was arranged to review the three proposed corridors utilising a combination of 4x4 vehicles and helicopter transportation to access the more difficult sections of the corridors. The main purpose of the field trip was to verify and "ground truth" results obtained during desktop studies and refine the environmental, terrain geohazard and constructability assessment criteria.

Assessment of the corridors

The three potential corridors are shown in Figure 4-2 and described below.

Figure 4-2 Alternative pipeline corridors through Georgia

The **Western Corridor**[1] runs parallel to the Georgian section of the existing Western Route Export Pipeline (WREP) up to Surami Ridge, at which point it leaves WREP and continues south west following the Mtkvari River Valley to Akhaltsikhe before turning south-south-west towards Vale and continuing to the Turkish Border. This proposed corridor passes through extremely difficult rugged terrain along the upper reaches of the Mtkvari River Valley, where it also passes through the Borjomi-Kharagauli National Park, established in 1929. This section poses significant technical challenges, which are compounded by the densely populated areas along the narrow valley bottom of the Mtkvari River that restrict any potential for optimising the pipeline route and minimising environmental and social impact. This corridor is the longest of the three options and contains areas of instability including landslides and debris flows, in addition to difficult river and deep gorge crossings.

The **Central Corridor** generally parallels the WREP up to the village of Akhali Samgori where it turns in a west-north-westerly direction and heads towards the towns of Rustavi, Marneuli and Tetritskaro. To the west of Tetritskaro the corridor heads northwest towards and onto Bedeni Plateaux and then heads west towards Tsalka. The corridor continues west passing to the south of Mt Tavkvetili and to the north of Tabatskuri Lake before turning southwest and traversing the Trialeti Mountain Range towards Aspindza. The corridor descends the Trialeti Mountain Range near the village of Damala, turns and continues in a westerly direction through some very difficult rugged terrain, consisting of narrow rocky ridges separated by steep valleys with unstable slopes, towards the Mtkvari River and the town of Akhaltsikhe. The corridor crosses the Mtkvari River and continues heading west on the north side of the Potskhovi River towards the town of Vale where it turns southwest crosses the Potskhovi River and continues to the Turkish Border.

(1) [1] The corridors are described as Western, Central and Eastern based on the location of their respective crossing points into Turkey.

The **Eastern Corridor** crosses the Azerbaijan/Georgian Border south of the Mtkvari River and heads in a northwesterly direction towards the town of Marneuli. The Eastern Corridor shares the same alignment as the Central Corridor from Marneuli to Lake Tsalka where it turns and heads southwest, following the plains between the Samsari and Javakheti Mountain Ranges. The corridor continues in a general southeasterly direction to the Turkish Border crossing point near Lake Kartsakhi. This corridor represents the shortest pipeline route through Georgia and, in common with the Central Corridor, optimises the overall route length traversing relatively good pipeline terrain and minimises potential problems associated with scour and instability at river crossings, gullies and landslides. This corridor also avoids major areas of rugged terrain over the central volcanic plateau, however, faces the same environmental problems associated with the Central Route in the vicinity of Tetritskaro. In addition there are significant security issues associated with the corridor passing through the districts of Ninotsminda and Akhalkalaki which includes substantial Russian Federation military facilities.

Following assessment of the three potential corridors, the Central Corridor with some modifications was selected for submission to the Georgian government as the "Corridor of Interest" as defined in the HGA. In summary:

The Western Corridor was rejected owing to the length, the severe rugged terrain and environmental constraints associated with the Borjomi-Kharagauli National Park. The significant environmental impacts of this corridor out-weigh the potential construction benefits from utilising the existing WREP corridor.

While the Eastern Corridor presented some potential advantages in terms of the physical terrain available for engineering and construction and fewer environmental constraints between Lake Tsalka and the Turkish Border, the presence of the Russian Federation military facilities in the district of Akhalkalaki raised serious security concerns. Additionally, the Akhalkalaki District, like other areas throughout Georgia, is extremely poorly served by transportation and other infrastructure linking it to the rest of the country. When combined with the foregoing security concerns, these issues would have presented significant constraints to any efforts by Government and Project personnel to implement effective risk mitigation and emergency response efforts. On this basis, and supported by the Government of Georgia, the military facilities within the district of Akhalkalaki were considered to present unacceptable HSE and other risks for pipeline routing and the Eastern Corridor was discounted.

Taking the above into consideration the Central Corridor was selected by the sponsors, as the corridor of interest for further studies and further modified. Modifications of the Central Corridor were based on the need to relocate the corridor outside the district of Akhalkalaki, away from the Akhalkalaki military facilities. The modified Central Corridor essentially follows the same alignment as the original Central Corridor until Tabatskuri Lake where the modified corridor continues heading west following the Ktsia River up to its headwaters at the top of Tskhratskharo Pass. The corridor encompasses both the alpine ridgeline that forms the Tsikhisjvari/Bakuriani valley and the Bakuriani Area, descends generally onto the river terrace near the village of Tiseli and continues in a westerly direction, crossing the Mtkvari River before reaching the town of Akhaltsikhe where it turns southwest towards Vale and the Turkish border.

While this modified central corridor encroaches sensitive landscapes, the route optimises the overall length traversing relatively good pipeline terrain, minimises potential problems associated with scour and instability at river crossings, gullies and landslides, and maximises reinstatement potential.

4.5.1.5 Stage 2: Route refinement process (500m corridor)

The work undertaken during Stage 1 identified the main routing constraints and identified the 10km corridor of interest. The Route Refinement Process, Stage 2 of the BP Route Assurance Process, was used to further develop this corridor in sufficient detail to allow selection of a refined 500m pipeline route corridor.

Methodology

Continuing with the methodology adopted during Stage 1 and the key assessment criteria considered during the corridor selection process, the route refinement process was carried out in the following progressive steps:

- More detailed desktop studies on the key issues highlighted in the desktop assessments done during Stage 1
- Multidisciplinary pipeline routing reconnaissance field trips
- Environmental baseline literature review and baseline walk over surveys

Detailed desktop studies

The first step of the route refinement process was to undertake detailed desktop studies based on the issues highlighted in the desktop assessment produced during Stage 1 of the BP Route Assurance Process. The detailed desktop assessment considered the following key criteria:

- Constructability (terrain, access, types of ground condition, etc)
- Logistics and interface with existing transportation infrastructure
- Possible utilisation of existing corridors
- Existing infrastructure
- Seismic activity
- Proximity to politically sensitive regions
- Proximity to areas of known or potential cultural heritage interest
- Future development
- Technical (excessive bridging, erosion, flooding, etc)
- Building proximity and design factor
- Overall route length and wall thickness requirements

Multidisciplinary pipeline reconnaissance field trips

Numerous multidisciplinary pipeline reconnaissance field trips were initiated during this stage to review the various corridor options identified by desktop studies.

The primary objective of the reconnaissance field trips was to assess the technical feasibility of each corridor option within the 10km corridor utilising terrain, geohazard, geotechnical, geomorphological and pipeline construction specialists. The main purpose of the field trips can be summarised as follows:

- Ensure the pipeline corridor avoids areas of instability

- Identify unavoidable areas requiring detailed site investigation
- Further refinement of the geohazard and constructability issues
- Prepare conceptual construction methodologies

Environmental and social baseline literature review

During and subsequent to the refinement process an environmental baseline literature review was conducted. The baseline literature review, focusing broadly on the 500m corridor, assessed the following environmental issues:

- Archaeology
- Monuments
- Quaternary Deposits
- Engineering Geology
- Protected Areas
- Flora
- Fauna
- Soils
- Landscapes

Following initial identification of potential 500m corridors, field surveys were conducted. These were carried out using both 4x4 vehicle and on foot. These surveys resulted in recommendations that key sites identified during the survey would be subject to more detailed studies to fully understand the impact pipeline construction may have in these areas. The detailed environmental studies were undertaken as an iterative process, as the engineering team identified the potential 500m corridor options. Specific results of the detailed studies are included in the following discussions of the 500m corridor options that were assessed.

At this stage, a social baseline survey was also undertaken. Given the different nature of social issues, the area of potential social impact was defined as being approximately 2km either side of a nominal center line of the identified 500m corridor. This area was defined based on experience of social impacts from WREP and other pipelines regionally. While this was done primarily as an ESIA exercise to assess impacts and design mitigations, the social baseline was used to inform corridor choices. For instance, the baseline identified areas where the corridor crossed areas of orchards or where it crossed irrigation systems, both of which are economically important assets, which the ultimate route would seek to avoid.

Assessment of the corridors

The identification of an acceptable 500m corridor is perhaps the most important step in the routing process. It is at this stage that a corridor avoids the main environmental and social impacts and at the same time the major technical and construction criteria are identified. In recognition of this, numerous corridor options were considered during this stage of the Route Assurance Process.

There were six key areas where a significant number of corridor options were evaluated. These six areas and the options assessed are summarised as followed and are discussed below:

- Azerbaijan Border to Marneuli (approximately KP 0-50)
- Tetritskaro Area (approximately KP 70-90)

- Lake Tsalka area (approximately KP 108-126)
- Kizil-Kilisa to Tabatskuri / Ktsia Tabatskuri Area (approximately KP 145-170)
- Tskhratskaro and Tsikhisjvari Area (approximately KP 175-195)
- Mtkvari River to Turkish Border (KP 221 - 248)

Azerbaijan Border to Marneuli (approximately KP 0-50)

Field reconnaissance surveys identified three potential 500m corridors in the area between the Azerbaijan Border crossing and Marneuli. These options, shown in Figure: Map 4-1, are:

Option A: Crosses the Azerbaijan/Georgian Border south of the Mtkvari River and heads northwest towards Marneuli
Option B: Crosses the Azerbaijan/Georgian Border north of the Mtkvari River and heads northwest towards Marneuli
Option C: Crosses the Azerbaijan/Georgian Border north of the Mtkvari River and continues north before turning at Akhali Samgori and heading west towards Rustavi and Marneuli

The three alternatives traverse predominantly flat agricultural and grazing land with very similar terrain and geological features.

Option A is the shortest crossing the flood plain of the Khrami River and marshes associated with the seasonal River Kovu. Owing to the potential sensitivity of the marshes as wildlife habitats, a zoological survey was conducted. The faunal survey indicated that despite human disturbance and small area, the site appears to attract large numbers of waterfowl and other birds that depend on wetlands. The site is also important as a staging place for raptors. In total, twenty-seven (27) bird species were recorded during both surveys including two Georgian Red Data Book (GRDB) species: the Black stork (*Ciconia nigra*) and Great white heron (*Egretta alba*).

This option also runs close to the multiple border of Armenia, Azerbaijan, Georgia and was considered sensitive for security reasons by the Georgian State Agencies. In addition the corridor crosses an area assigned by the Georgian government for military development.

As a result, Option A was discounted and two alternatives – Options B and C – were identified.

Option B crosses the border north of the Mtkvari River and to the south of Lake Jandari. The corridor continues from Lake Jandari towards the town of Gardabani before turning north-west between the towns of Gardabani and Rustavi, crossing the Mtkvari River and proceeding in a generally westerly direction towards Marneuli.

This corridor avoids the majority of environmentally sensitive areas within the region, however it crosses a section of riparian forest located in the alluvial flood plain of the Mtkvari River and some remnant Tougay forest near Gardabani. The corridor also crosses numerous canals that form the Gardabani irrigation system that would require diversion during construction. Ultimately, this corridor was discarded based on the above and on the fact that the western section, towards Marneuli, crossed the same area assigned by the Georgian government for military development as Option A.

Option C was selected as the only viable option that met the Georgian Government's routing criteria to avoid specific areas of concern between the Azerbaijan/Georgia Border and Marneuli. This corridor parallels WREP up to Akhali Samgori where it turns west to cross the Mtkvari

River north east of Rustavi and heads west, northwest towards Kumisi Lake. No features of environmental significance are present along this section of the corridor with the exception of the crossing of the Mtkvari River. This is described in more detail in Section 8 - Environmental Baseline. This corridor does, however, pass through areas of significant urban and industrial development, which are described in Section 9 – Social Baseline.

Tetritskaro Area (approximately KP 70-90)

Three alternative options, A, B and C, have been evaluated in the Tetritskaro area during the course of the route selection and development process. These are discussed below and shown in Figure: Map 4-2.

Option A passes north east of Tetritskaro and heads in a northwesterly direction towards Bedeni Plateau. The corridor passes through several sections of dense mountain forest on the ascent to Bedeni Plateau. As a result, an environmental assessment of the area was undertaken to establish the potential impact of the pipeline. The assessment confirmed that the corridor would affect 5.5km of primarily undisturbed forest. Four main forest types were identified:

- Beech forests (*Fagus orientalis)* occupying approximately 50% of the forests in the study area and located on southern-eastern and southern-western slopes of deep gorges
- Forests of high-mountain oak (*Quercus macranthera)* with hornbeam (*Carpinus caucasica)* mostly occupying the upper zone of forests. This type of forest constituted approximately 10% of all forest in the study area
- Subalpine park forests of high-mountain oak (*Quercus macranthera)* with birch (*Betula pendula)* and high-mountain maple (*Acer trautvetteri)*, mostly found in the upper forest zone. This type of forest occupied approximately 10% of the forests in the study area
- Hornbeam forests (*Carpinus caucasica)* with beech and high-mountain oak found in the middle and upper forest zones. This type of forest constituted approximately 30% of the forests in the study area

The first three types of forest are unique for this region (easternmost part of Trialeti ridge). These forests are of primary origin, mostly intact and characterised by high growth rate. Two rare species of the Georgian flora: elm (*Ulmus glabra)* and high-mountain oak (*Quercus macranthera)* and four rare tree and bush species of the local flora: high-mountain maple (*Acer trautvetteri)*, birch (*Betula pendula)*, raspberry (*Rubus idaeus)*, blackberry (*R. caucasicus)* occur here.

Beech forests are of particular significance in the region. In addition, raspberry and blackberry have an economic value for the local population.

The forested sections of Option A were also remarkably rich in plant food (fruits, nuts and berries) and likely to support a high diversity of fauna. They may also be important as wintering grounds for large mammals during their altitudinal seasonal migration. Therefore, the area has been classified as one of the sites of high conservation value for fauna.

In order to avoid the significant environmental impacts that would result from utilising Option A for construction of the pipeline, it was discounted as a viable option.

Option B passes south west of Tetritskaro and avoids the primary forests described above. The total length of forested areas crossed by this alternative is approximately 6km. A team of botanists and zoologists undertook a detailed survey to characterise in detail the floral associations present along the proposed corridor and to evaluate the importance of the region as a habitat for mammals.

Three main forest types found in this area can be summarised as follows:

- Forests of Georgian oak (*Quercus iberica)* with hornbeam up to the altitudes of 1,300m
- Hornbeam forests (*Carpinus caucasica)* at the altitudes of 1,100 – 1,700m
- Hornbeam-oak forests (*Carpinus caucasica-Quercus macranthera)* in the upper forest zone, at the altitudes of 1,400 – 1,700m

Eleven sites of high conservation value were identified comprising various primary forest types mostly dominated by GRDB species such as high-mountainous oak (*Quercus macranthera).* One site was a pure beech forest fragment, an extremely rare forest in the Tetritskaro District. The total length of high conservation sites to be crossed by the corridor was approximately 5km.

In addition to forest value, the following floral species of high conservation value were recorded as growing within or immediately adjacent to the proposed corridor:

- A population of Georgian endemic pasqueflower (*Pulsatilla georgica*) was recorded on the meadow communities between the forest fragments. This species is regarded as a local endemic as it grows only in three localities in Georgia within Trialeti area
- A solitary individual of young small-leaved elm (*Ulmus minor*), a GRDB species, was discovered on the west bank of the River Chiv-chavi
- A population of white water-lily (*Nymphaea alba*) was found to float on the surface of Cherepanovka Lake, which was immediately adjacent to the proposed route. It is known to grow only in the lakes and wetlands of Trialeti region of Georgia and is an extremely rare plant on a national level

A faunal survey of the area was also carried out in April 2001. The total area covered by the faunal survey was approximately 40km^2 with altitudes ranging from 1,000 to 1,700m. The total length of the pipeline corridor crossing the study area was about 13km.

The survey results indicate that the study area was characterised by a number of favourable features, such relatively well-preserved forests, high productivity and richness in mast species, low to moderate disturbance. These made the area a perfect habitat for breeding birds and mammals including large mammals. In addition, the area can be considered as a bridge between two larger forested areas located to the north and west of Tetritskaro and, as such, is important for the integrity of the whole ecosystem and especially large mammal populations.

In total, twenty-four (24) bird species were observed in the study area. The following important mammal species were recorded during the survey: Wolf (*Canis lupus)*; Brown bear (*Ursus arctos)*; Lynx (*Felis (Lynx) lynx)*, Roe deer (*Capreolus capreolus)*.

This corridor also crosses areas of significant archaeological interest, including passing adjacent to the Nadarbazevi Palace complex, an important large medieval site (12th Century AD) with many structures visible on the surface.

As a result of the environmental and cultural heritage value of this area, Option B was also discounted. Additional studies were initiated to identify another alternative corridor that would further minimise potential impacts of the pipeline.

Option C follows the same general corridor as Option B, however the alignment utilises existing clearings wherever possible by running parallel to and alongside existing railway infrastructure, overhead electricity power lines and an existing forest vehicle track. This revised alignment has resulted in multiple railway crossings on the ascent to Bedeni Plateau, which in turn increases construction costs. This option will, however, ensure that little significant additional habitat fragmentation will occur as a result of pipeline construction. In addition this revised corridor also avoids a number of known archaeological sites, thus reducing impacts on cultural heritage.

Option C is the proposed current route and is described further in Section 8 – Environmental Baseline, of this report.

Lake Tsalka Area (approximately KP 108-126)

Three alternative route options, A, B and C have been evaluated in the Lake Tsalka area (a fresh water reservoir) during the course of the route selection and development process. These are discussed below and shown in Figure: Map 4-3.

Option A descends the south side of the Bedeni Range and continues in a westerly direction towards Lake Tsalka before descending onto the agricultural plains, which form the lake basin. The corridor continues heading west in the flat cultivated land that forms the lake basin, passing between the village Bestasheni and lakeshores and continuing west on the northern shores of the lake before ascending gradually and heading towards the village of Santa.

Construction of the pipeline in this corridor would have taken place within a protection zone imposed by current Georgian legislation that prohibits major construction activities within 300m of surface water reservoirs. Additional problems evaluated during assessment of this corridor included crossing the Tsalka Tectonic Fault at an undesirable angle on the descent to the lake basin and the presence of at least six potential Bronze Age features (3,500-800 BC) within the corridor. As a result Option A was discounted and alternative corridors were evaluated.

Option B descends the north side of Bedeni Plateau and continues in a westerly direction along flat cultivated land towards Lake Tsalka avoiding several wetlands along the way. The corridor passes to the north of the village of Sharpar Haraba before gradually climbing and continuing in a westerly direction along the ridge to the north of Tsalka Lake towards the village of Santa.

Initial assessment of this corridor confirmed the problems associated with option A were resolved, the corridor is located away from the reservoir and Tsalka Tectonic Fault is crossed at an acceptable angle. Further evaluation and subsequent field surveys revealed that the chosen descent from Bedeni Plateau would cross potentially unstable ground and further west the corridor passes very close to the protected zone around an archaeological feature known as the Knole settlement (VIII-VI century BC) and to the Eli Baba mountain where two cyclopean fortresses (XIV-XII century BC) are located.

The risks associated with installation of the pipeline in potentially unstable ground and the impacts of pipeline construction on sensitive archaeological sites were assessed and considered unacceptable, option B was therefore discounted.

Option C in common with option B, descends the north side of Bedeni Plateau and continues in a westerly direction towards Lake Tsalka passing to the north of Sharpar Haraba and Bestasheni. Although slightly longer, this corridor is located away from the reservoir, crosses

Tsalka Tectonic Fault at an acceptable angle and avoids the area of instability on the descent from Bedeni Plateau. Considerable effort has also been expended to ensure the final alignment avoids the numerous wetlands present in the area and the known archaeological and cultural heritage features identified during field surveys. For example, an additional 600m was added to the corridor length to ensure the pipeline avoids the archaeological protected zone described above.

Option C is the proposed current route, minimising the overall environmental and heritage impact of the pipeline through this section and is discussed in more detail in Section 8 - Environmental Baseline, of this report.

Kizil-Kilisa to Tabatskuri / Ktsia Tabatskuri Area (approximately KP 145-170)

Four alternative corridor options, A, B, C, and D, have been evaluated in the Kizil-Kilisa to Tabatskuri / Ktsia Tabatskuri area during the course of the route selection and development process. These are discussed below and shown in Figure: Map 4-4.

Option A passes south of Mt Tavkvetili, a dormant volcano with ancient boulder streams slopes, avoiding the Narianis Veli Wetland and continues heading west towards the village of Tabatskuri. The corridor turns passing north of Tabatskuri Lake and continues heading in a westerly direction generally following the River Ktsia Valley towards Tskhratskharo Pass. This option was discounted because it passed through the Akhalkalaki District.

In order to avoid passing through Akhalkalaki District, **Option B** was identified. It ascends the shoulder on the north side of Mt. Tavkvetili and continues over a small plateau. The corridor intersects the Narianis Veli Wetlands within the Ktsia Tabatskuri Managed Reserve before joining Option A and following the River Ktsia River Valley to Tskhratskharo Pass. An initial assessment confirmed that both Narianis Veli Wetland and the Upper Ktsia Reaches were potentially delicate ecosystems, and detailed floral and faunal studies were undertaken.

Narianis Veli wetland

As a result of a detailed floristic and phytosociological research of the plant communities in the study area, three sites of high conservation value were identified, comprising wet meadows supporting endemic and / or rare plant species. The total length of high conservation sites crossed by the proposed corridor was nearly 1km.

The following individual species of high conservation value were recorded growing within or in the immediate vicinity of the proposed ROW:

- Primrose (*Primula luteola)*, endemic of the Caucasus. A small population was found on a wet meadow
- Gentian (*Gentiana angulosa)*, endemic of the Caucasus. A small population was observed on a wet meadow
- *Scilla rosenii* populations were observed on two sites
- Populations of *Thymus grossheimii* were observed on two sites
- Approximately 10 individuals of the lychnis (*Dactylorhiza euxina)* were found on one site. Populations of this species are in decline owing to destruction of habitats

A number of mammal species were also recorded on Narianis Veli, including: Weasel (*Mustela nivalis*), Fox (*Vulpes vulpes*), Brown bear (*Ursus arctos*), Badger (*Meles meles*) and Wolf (*Canis lupus*).

In total, 29 species of birds were recorded on Narianis Veli, including three species of conservation value. These species are: GRDB species - Grey partridge (*Perdix perdix*), populations of which are in decline throughout the country; GRDB species - Common crane (*Grus grus*); and Corncrake (*Crex crex*), which is included in the IUCN Red List as a globally threatened species. Caucasian black grouse - an endemic species of the Caucasus, included in the GRDB, was observed in the sub-alpine meadows.

On the basis of the botanical and faunal studies it was concluded that the Narianis Veli Wetland was a high conservation habitat, despite the degradation to which it has been subject in the recent decades, and supported a multitude of wildlife as well as floral species.

As a result, the section of Option B that crosses Narianis Veli Wetland was discounted and an alternative corridor to avoid the wetland was sought.

Route C avoids the majority of the wetland and traverses the slightly higher terrain to the north. It then joins Option A to follow the River Ktsia River Valley to Tskhratskharo Pass. Although this corridor avoids the main Narianis Veli wetland it crosses the narrower eastern section of the wetland before ascending onto the higher ground to the north. In addition this corridor still follows the Ktsia River Valley, which was identified as an area of potential ecological value being one of the water sources for Narianis Veli Wetland.

Upper Ktsia Reaches

The Ktsia River is a small alpine stream that flows in an easterly direction from its upper reaches on the east side of Tskhratskharo Pass towards the flat expanse of wetlands of which Narianis Veli is a component. In addition to the ecological value of the Narianis Veli Wetland, discussed previously, concerns were raised with regard to the impact of any potential sediment release in the river during construction.

Option C was subsequently discounted owing to the potential impact to the area during construction as well as an area of potential land instability that was identified during a detailed geomorphological survey of the valley sides.

Option D was subsequently identified as the only feasible route alternative that would avoid the sensitive areas around Narianis Veli Wetland and the Ktsia River Valley. This corridor descends Mt. Tavkvetili and turns southwest to skirt around the south side of the wetland whilst keeping to the higher ground away from the flat wet areas. The corridor continues heading west passing to the north of Tabatskuri before turning south west and ascending onto hills above the northwest shore of the lake. The corridor continues in a westerly direction, crossing the Ktsia River, and then moving along the higher ground away from the Ktsia River Valley towards Tskhratskharo Pass.

Option D presented less visual intrusion, would not encroach on wetlands and associated ecosystems, would not pose any significant risk of sediment discharge to the Ktsia stream, and avoids Akhalkalaki District. Option D is the proposed current route and is discussed in more detail in Section 8 - Environmental Baseline, of this report.

Routes outside of Ktsia Tabatskuri Managed Reserve

Although outside the agreed 10km corridor of interest, options to avoid the entire Ktsia-Tabatskuri Managed Reserve area were assessed during summer 2001. Two potential alternatives, Options E and F, which pass to the north of the managed reserve, were evaluated. These are discussed below and shown in Figure: Map 4-5**.**

Any alternatives to the south of the managed reserve were discounted owing to significant lengths of the corridor passing through Akhalkalaki District.

Ultimately both Options E and F were rejected owing to the fact that construction of two large diameter pipelines in this area would result in significantly more severe environmental impacts and significantly higher construction safety risks than construction in corridor Option D.

Option E follows the Gujaretistskali River Valley. Following a detailed field survey which included pipeline engineers and environmental specialists, this option was rejected owing to the following:

- Deeply incised river gorges (500m wide and 250m deep in some cases)
- River valleys too narrow for even a reduced construction corridor
- Steep valleys dissected by incised gullies
- Presence of mature forest
- The need to re-direct the river in order to construct safely
- Instability of valley sides
- Impracticality of removal and disposal of excavated material
- Lack of access

Option F leaves the current proposed route south west of Rekha and ascends a narrow ridge line within the Trialeti Range, ultimately overlooking Bakuriani to the south. While this corridor was deemed technically feasible, the environmental impacts were considered to be so much more severe and construction so much more complex than Option D, that this option was also discounted. Environmental impacts included:

- Crossing 25km of forest, as compared to 4km for the currently proposed route. This would have significant floral and faunal impacts including habitat fragmentation
- Construction on top of narrow ridges for approximately 18km. The widths of the ridges vary considerably but are as narrow as 2 metres in some places. Construction would involve flattening of ridges, some of which are forested. Reinstatement of these ridges would be impossible and re-vegetation of the ridges would take several years
- One section of the corridor follows a narrow forested ridge that overlooks the Bakuriani Ski Resort. Construction of the pipeline would cause significant visual impact for several years, and lasting visual impact as the ridge could not be reinstated to its original condition
- Difficult if not impossible crossing of a deep river gorge with near vertical sides
- Significant amount of benching across side slopes, in addition to flattening ridges, would require significant spoil disposal sites
- Construction in a catchment for several fresh water springs used by villages in the surrounding area

Tskhratskaro and Tsikhisjvari Area (approximately KP 175-195)

Selecting a corridor through this area has been the subject of extensive evaluation of potential alternatives in an effort to minimise the impact of the pipeline on the surrounding area and maximise reinstatement potential. The sensitivity of the region is owing to the presence of landscapes of high value, primary forests of high conservation value and sensitive water resources. The latter issue is particularly sensitive because the surface waters around Tsikhisjvari collect into the Borjomula River that flows through the Borjomi mineral water park.

While every effort has been made to avoid this sensitive area, there is only one alternative that would avoid the Akhalkalaki District and the lower valleys around Tsikhisjvari. That option basically follows the very narrow rocky alpine ridgeline that rises to over 2,800m and forms the Tsikhisjvari/Bakuriani dish valley. Construction of two large diameter pipelines along this ridge would be technically very difficult and present significant safety challenges. No detailed field studies were done on this option because desk based assessment and ground-truthing resulted in identifying the following impacts associated with this option:

- Reduction in height of the ridgeline by up to 30m in places in order to have sufficient construction ROW
- Major earthworks and blasting to facilitate benching or ridge-top flattening
- Excavation and removal of vast quantities of rock to establish the ROW
- Major long-term visual impact owing to excavated soil and rock falling down the steep ridge slopes
- Loss of primary forest habitats that currently cover the ridge slopes
- Impossible re-vegetation of the scarred ridge slopes
- Impossible re-profiling and reinstatement of flattened ridges and severe side cuts
- Major construction safety risks owing to the presence of rock escarpments with near vertical sides
- Major long-term and short-term visual impact as the ridgeline can be seen from as far away as Bakuriani

Taking into consideration the constraints imposed by these narrow rocky ridges and the requirement to avoid the Akhalkalaki District, the only feasible route through this area is to descend towards Tsikhisjvari along the valley leading to Tskhratskaro Pass.

Owing to the sensitivity of this area, a desktop assessment was carried out on several options through this section. Following completion of the desktop evaluation, four feasible options, A, B, C and D (See Figure: Map 4-6), were selected for field survey and multidisciplinary teams were mobilised to carry out the detailed field assessment.

Approximately 85% of **Option A** crosses areas of high ecological significance. It comprises large areas of dense high-mountain primary woodland represented by various types of mixed, coniferous and broad-leafed (beech) forests that are important high-mountain habitat for flora. High mountainous oak, a Red Data Book species of Georgia, is common. Overall, the habitat support high biodiversity and is rare in southern Georgia. The mixed forest provides important habitat for fauna, including bear, wolf, roe deer and wild boar.

Option B goes along the edge of a ridge following an existing track through dense forest dominated by both conifers (spruce, pine) and broad-leaved trees (beech, maple, wild pear). The western most part of the corridor passes through a highly sensitive area of sub-alpine crook-stem forest dominated by birch. The forest provides important habitat for wildlife and represents a landscape of high esthetic value.

Option C goes through a dense mixed forest with spruce being the dominant species. High mountain oak, a Georgian Red Data Book species, is common. A number of highly productive economic plants are associated with the forest such as dog-rose and buckthorn. The forest is rich in edible mushrooms which are collected by the local population. In addition to the high conservation value, the forest plays an important role in stabilizing the steep slopes.

Options A and B were both discounted owing to their potential impacts on flora, fauna and livelihood of local populations. As such, an alternative options that minimised environmental and social impacts as much as possible was sought. Option C was discounted owing to the presence of a large deep seated land slide complex which could compromise the integrity of the pipeline.

The selected corridor, **Option D**, was found to be the most acceptable with regard to the potential landscape impacts, potential for successful reinstatement, least impact on continuous fragments of primary forest, maximum use of forest clearings, and distance from the surface water resources of the area. The length of forest crossed by this corridor is less than the other options, and the overall level of human disturbance in the area is significantly higher than in the forests crossed by the other options.

Mtkvari River to Turkish Border (KP 221 - 248)

Three options, A, B and C, were evaluated from the Mtkvari River to Turkish Border. These are discussed below and shown in Figure: Map 4-7.

Option A crosses the Mtkvari River south east of Akhaltsikhe downstream of the convergence with the Uraveli River. The corridor continues heading in a westerly direction passing to the south of Akhaltsikhe and remaining on the south side of the Potskhovi River. The corridor continues towards the Turkish Border passing to the south of Vale before crossing the Potskhovi River and turning south to cross the border.

The terrain along this corridor is typically rolling countryside separated by several deep and, in some cases, incised gully crossings. Potential instability exists in some areas which is confirmed by the presence of relatively recent landslides on the steeper sections. In order to permit a feasible crossing point at some of the deep gully crossings, the route would have to pass very close to a significant number of villages. In addition, the corridor traverses predominantly cultivated land along the larger terraces, and through established orchards and vineyards closer to the villages.

The social impact of Option A would be significant owing to the close proximity of the route to the local population and the destruction of mature orchards and established vineyards, which provide an important source of income for local populations. Taking into consideration the potential social impact, as well as the technical problems associated with land instability and difficult gully crossings, option A was discounted.

Option B crosses the Mtkvari River north east of Akhaltsikhe downstream of the convergence with the Potskhovi River. The corridor continues heading in a westerly direction passing to the north of Akhaltsikhe and remaining on the north side of the Potskhovi River. It then continues heading west towards the Turkish Border crossing a mixture of cultivated and grazing land before turning south, crossing the Potskhovi River and continuing to the border. The terrain on the north side of the Potskhovi River is similar, in terms of pipeline construction, to that on the south side of the river however there are significantly fewer villages along the route.

Although this corridor is preferable in terms of reducing the social impact of the pipeline, technical and environmental issues associated with the numerous gully crossings and areas of potential instability necessitated further detailed studies. These studies ultimately indicated that an alternative should be sought that avoided the areas of instability and optimised the gully crossings. This would reduce the overall environmental impact of the pipeline, maximise reinstatement potential and assure the long-term integrity of the pipeline.

Option C initially follows the same alignment as Option B, crossing the Mtkvari River north east of Akhaltsikhe and continuing in a westerly direction on the north side of the Potskhovi River. Through this section, the corridor is situated in the lower ground to utilise the shallower gully crossings and avoid the potential instability observed on the steeper slopes further north. The corridor then continues in a westerly direction before turning south, crossing the Potskhovi River and continuing through flat terraces to the west of Vale. From this point, the corridor turns west, crosses the Potskhovi River again and continues in a south-westerly direction towards the Turkish Border.

Although this option crosses the Potskhovi River twice, the crossings locations have been carefully selected to facilitate installation of the pipeline, maximise reinstatement potential and minimise environmental impact. The potential impact of the two river crossings is more than offset by the avoidance of steep terrain and areas of instability associated with the other alternatives. In addition Option C utilises flat open areas wherever possible, reducing visual impact and facilitating ease of reinstatement.

Option C was therefore chosen as the preferred corridor for this section.

4.5.1.6 Stage 3: Route definition process (100m corridor)

Stages 1 and 2 of the BP Route Assurance Process established the optimum 500m route corridor through Georgia. The route definition process was used to further develop the pipeline route. Having completed detailed studies at the 500m corridor stage, the 100m corridor was initially identified to correspond generally with the centre line of the 500m corridor. The 100m corridor was modified through the route definition process taking into consideration the key assessment and selection criteria utilised during previous stages, namely, environmental and social issues; terrain and geohazard issues, construction and long-term integrity issues, and security and safety issues.

The philosophy adopted throughout the route definition process was to avoid both environmentally and socially sensitive locations and terrain geohazards, where practicable, by routing the pipeline through areas where environmental and terrain related risks are minimal or can be mitigated through engineering design or specific mitigation measures. It is at this stage the engineering design is used more often to mitigate impacts rather than re-routing, although localised re-routes are undertaken as needed to support the engineering design.

The route definition process, which resulted in identification of the 100m corridor, was carried out in the following progressive steps:

- Detailed terrain geohazard assessment

- Multi discipline pipeline routing surveys
- Detailed environmental surveys
- Detailed site investigation

Detailed terrain geohazard assessment

A detailed terrain geohazard and geotechnical assessment was carried out on the 500m refined corridor and subsequent route options that evolved during the route definition process (identification of 100m corridor). As a result of this process potential terrain geohazard and geotechnical issues were evaluated continuously throughout development of the route. This continuous evaluation has resulted in a defined route that avoids the high-risk locations and minimises the potential effect of geohazards on the operating pipeline, thereby minimizing risk of damage to the pipeline as a result of geohazards.

The common geohazards identified during the route definition process included landslides, slope instability, surface erosion and river channel migration.

Although major high-risk geohazard areas have been avoided during development of the pipeline route, there are several locations where avoidance has not been possible because of other constraints, including environmental, which have prevented selection of other corridors. The risks at these locations are considered to be low and can be further reduced. For example, at landslide areas, the pipeline can be installed below the depth of the basal shear surface. These locations can be classified as either areas of potential or actual slope instability and have been subject to site-specific geohazard investigations to confirm the field judgment of landslide depth and hence the feasibility of installing the pipeline beneath the basal shear surfaces.

Multidisciplinary pipeline routing surveys and field trips

As was the case during Stage 2, several multidisciplinary pipeline routing surveys were undertaken to review the refined pipeline route corridor and the various route options resulting from the previously done environmental, terrain geohazard and constructability evaluations. The route surveys were carried out using a combination of 4-wheel drive vehicles and on foot where vehicular access to the route was difficult.

The main objectives of the route surveys can be summarised as follows:

- Optimise the pipeline geometry
- Confirm the final alignment for topographic survey
- Confirm the pipeline route avoids known constraints to ensure minimal overall impact
- Establish preliminary design criteria for special sections and crossing points
- Identify specific areas that cannot be avoided that require detailed site investigation in order to design mitigations

Detailed environmental surveys

The bulk of the environmental and social surveys were done at the 500m corridor identification stage. At the 100m stage, the environmental surveys were focused on specific 100m corridor routes that were identified by engineers as technically feasible. Each 100 metre corridor was then assessed from an environmental point of view in order to identify how impacts could be minimized through local re-routing, design factors or other mitigation measures. In every case, the 100m corridor options were evaluated by the environmental team.

Geotechnical site investigation

A detailed geotechnical site investigation was carried out along the identified 100m defined route corridor, which corresponded generally to the center line of the 500m corridor. The main objectives of this site investigation were to supplement and confirm the desktop assessments and subsequent field interpretation to enable accurate selection of construction techniques for pipeline special sections and major road, rail, gully and river crossings. Precise definitions of these techniques helps to minimize environmental and social impacts, and to identify where impacts must be mitigated.

The main geotechnical issues identified during the site investigation include:

- Very difficult trenching conditions across the volcanic plateau as the area underlain by strong to very strong volcanic rocks (basalts and andesites)
- Limited availability of backfill on the volcanic plateau
- Presence of swelling/shrinking soils across the volcanic plateau will affect foundation design
- Presence of aggressive saline soils throughout the lower level sections of the route
- Presence of (silty) loess soils in the plains south and east of Tbilisi
- Difficult reinstatement owing to thin upland soils
- Deep soils prone to erosion between Sakire and Akhalksikhe

Assessment of the 100m "Specified Corridor"

Development of the 500m preferred corridor involved assessment of many route alternatives to ensure the selected route avoids the majority of routing constraints identified and minimises environmental and social impacts. The 100m specified corridor essentially follows the centre line of the 500m corridor, and was generally identified based on technical grounds. In most instances however, the 100m route corridor did not require the detailed environmental analysis of several alternatives because the 500m corridor had been selected on the basis of avoiding major environmental constraints. In some instances it has however been necessary to evaluate benefits and potential impacts associated with more than one option and choose a final alignment that would minimise impacts, and enable optimisation of the pipeline design and construction parameters.

The only areas where detailed considerations of more than one 100m route corridor has been required were:

- Wetland areas
- Known archaeological sites
- Forest clearings
- Reinstatement potential
- Geohazards
- Tectonic fault Crossings

A summary of potential impacts avoided during optimisation of the 100m corridor and their respective locations follows.

Wetland areas

Tsalka: The 500m corridor included a small wetland/pond with potential significance for migrating birds. Realignment located the route south of the main road to Tsalka thus reducing potential impact on the wetland.

Mt Tavkvetili: Small wetland areas were identified on the shoulder of Mt Tavkvetili (approximately KP 152-154). Various types of wetland communities dominated by *Carex inflata* are found in both Greater and Minor Caucasus. Sedge dominated high-mountain wetlands are becoming extinct or floristically impoverished in many areas of Georgia. Fragment of wetland vegetation in the subalpine belt falls under the category of high conservation value owing to rarity, heavy anthropogenic pressure and low restoration potential. Minor alignment changes were carried out to avoid the wetland areas and at the same time minimise the need for benching across the side of the slope.

Archaeological sites

Detailed studies of potential archaeological sites were carried out within the 500m corridor, resulting in several re-routes.

River Ge ti: The alignment west of the River Geti crossing (approximately KP 73) was modified to avoid a site of a potential feudal period settlement.

Tsalka: Approximately 600m metres was added to the pipeline length in order to stay out of the protected zone of Knole and away from the archaeological features of Eli Baba.

Forest clearings

Tetritskaro and Tsikhisjvari: In both the Tetritskaro and Tsikhisjvari forested areas, minor changes to the route alignment were carried out to maximise the use of existing forest clearings and reduce the need for tree felling.

Reinstatement potential

In several cases, the alignment was adjusted to maximise reinstatement potential.

River Geti: Three alternative alignments were assessed at the River Geti Crossing (approximately KP 73). Given the severity of the terrain in the vicinity of the crossing and the deep gorge, complete reinstatement of the crossing would be difficult. An alignment with the highest reinstatement potential, that also avoided know archaeological sites, was identified through a series of multidisciplinary field trips.

Tskhratskaro Pass: The original concept on the Tskhratskaro Pass descent was to keep away from the existing pass road. Following a detailed geomorphological and construction assessment the route alignment was modified to descend the pass crossing the road three times. This alignment avoided potential debris flow on the steeper slopes, which would be very difficult to reinstate and would probably require ground stabilisation measures, and located the route into an area already disturbed by construction of the mountain pass road, thus minimising impact on undisturbed areas.

Geohazards

Owing to a combination of routing constraints, mountainous terrain, deeply incised gullies, erosion and the presence of large areas of potential instability there are two small areas of instability that could not be avoided.

Kodiana Pass: This area (approximately KP 188 to KP 192) contains four gully crossings with areas of potential mudslide and landslide instability problems within and between the gullies. The route alignment was initially modified to avoid a relative large active landslide, however owing to the presence of larger areas of potential instability, a detailed geomorphological site survey was carried out to determine the most stable route through this section. Following selection of the preferred route a detailed geotechnical site investigation was carried out to determine the safe burial depth for the pipeline below the basal shear surface. At the same time, an environmental evaluation confirmed the acceptability of the preferred route and suggested measures to minimize impacts.

Minadze Plain: Routing through this area (approximately KP 216) requires crossing a mudslide. In common with Kodiana Pass a detailed geomorphological site survey was carried out to determine the most stable route. The safe pipeline burial depth, to ensure the long-term integrity of the pipeline, was subsequently confirmed following a detailed geotechnical site investigation.

Social impacts

Minor adjustments were made in various places to minimise long-term social impacts. This included re-routing around orchards or vineyards, as well as avoidance of small land allotments, especially in areas where fertile agricultural land is rare.

Sakire: The route alignment was modified to avoid impacts on a summer village used by residents of Sakire. This village is used during the summer months when residents of Sakire take cows and sheep into the alpine meadows for grazing. Owing to the steep valley sides, the optimal route for construction passed through the village and would have required demolishing several of the wooden buildings. Given the severity of this social impact, an alternative route that passes to the north of the village, requiring removal of only a small animal shelter, was identified. This alternative route requires felling of additional trees as it is in the tree line north of the village, but this was considered an acceptable trade-off in order to avoid the need to relocate structures.

Tectonic fault line crossings

Detailed seismic analysis was carried out at each of the identified fault line crossings near Rustavi, Marneuli and Tsalka. The results of this analysis determined the preferred crossing angle to ensure maximum pipeline flexibility in the event of ground displacement during seismic activity.

The route alignment was subsequently modified to ensure the correct crossing angle was implemented at each fault line. This would ensure the pipeline could accommodate ground displacement during a seismic event without damaging the pipeline and affecting its long term integrity.

4.5.1.7 Alignment of "Construction Corridor"

Following selection of the 100m specified corridor, additional work was carried out to further refine determine the 44m *"Construction Corridor"*. This formed the basis of the Facilities Construction and Installation Right of Way (FCI-ROW) as defined on construction drawings and specifications.

The final alignment for construction of the pipeline was selected to minimise any residual impacts following Stages 1, 2 and 3 of the Route Assurance Process and comprised of the following key activities:

- An environmental impact assessment process, the result of which is this document, which identified remaining environmental impacts and suggested measures to mitigate impacts
- Assessment by social specialists of communities adjacent to the corridor; consultation with these communities to identify any potential issues and to develop mitigation measures
- Detailed assessment of cultural heritage sites in the ROW in order to inform the level of excavation and recovery needed
- Detailed reinstatement survey, including the classification of potential erosion areas and existing flora requiring reinstatement
- Detailed geotechnical surveys and laboratory testing analysis of landslide and mudslide areas
- Detailed river hydrology survey of the major river crossings including topographical. cross sections up and down stream of the proposed crossing points
- Collection of river bed sediment samples for calculation of river scour depths
- Detailed assessment of dry gorges and the identification of potential mudslide areas
- Final refinement of seismic survey data to confirm proposed fault line crossing design
- Detailed topographical surveys

4.6 LOGISTICS OPTIONS

4.6.1 Transport of pipe and equipment

The vast majority of materials and equipment for the SCP and BTC pipelines will, by necessity, be manufactured outside the host countries – Azerbaijan and Georgia. A number of modes of transport have been assessed for the transport of line-pipe, materials and other large equipment to the host countries, and within the host countries to the project areas. Options considered have included:

- Sea
- Land
  - Rail
  - Road
- Air
- A combination of the above

The determination of the most suitable transport method has included consideration of issues such as safety, the quantities of pipe and material that could be transported, delivery schedules, environmental impact and cost.

Based on assessment of the above it was determined that transport by ship was the most appropriate primary method of delivering line-pipe and large equipment for the project.

The only viable routes into the project host countries by ship are through the Black Sea and the Volga Don canal. The Volga Don is blocked to traffic for periods of the year by ice, and therefore not a reliable transport alternative for the ongoing delivery of line-pipe. Therefore it was decided to bring all line-pipe into Georgia, via existing ports on the Black Sea coast. These ports eg Poti and Batumi generally have adequate or improvable facilities with good road and rail connections for onward transport of equipment.

From the port facilities it is necessary to move pipe and equipment to the project area. Three options were considered for this onward transport, road, rail and air.

4.6.1.1 Road, rail and air

Rail transport is generally much safer than road transport as an option for transporting line-pipe, materials and other equipment as there is less interaction with other users. It also provides a more fuel efficient transport option, and has less negative environmental and social impact in terms of emissions, noise and general nuisance.

The road network is generally in a bad state of repair, would require a high degree of upgrade, and does not generally conform to the pipeline route. Therefore, to transport line-pipe, materials and other equipment from the ports in Georgia to storage areas by road would result in a greater impact on the local population in terms of noise, dust and interference.

Air is by far the most expensive of the options for moving line-pipe, materials and equipment. However, the safety record of air transport is superior to road transport. There is a problem with the availability of resources of an appropriate standard in country, both in terms of airplanes and air-fields. Therefore, if air transport were to be used for moving line-pipe, materials and equipment it would be necessary to construct new facilities. As a result air transport is being considered only for rapid evacuation or emergency response scenarios as opposed to transport of equipment or pipe.

For these reasons rail transport is preferred as the primary mode of transporting line-pipe and equipment to project laydown areas where it will be transferred to truck for onward movement to the workfront. Some upgrade of existing rail spurs will be required to improve the available infrastructure, and provide access to identified storage areas.

4.6.2 Worker camps, pipe yards and associated access roads

Field surveys have identified a number of potential locations for worker camps, pipe yards and the associated access roads from these locations to the pipeline ROW. These potential locations have been subject to environmental and social assessment, and focused consultation has been conducted in communities adjacent to these areas.

It is the responsibility of the construction contractor to determine which of these alternative locations will be adopted, based on the construction strategy and schedule.

If the construction contractor proposes any previously unidentified camps or storage yards then the contractor must undertake environmental and social assessments of these locations.

A number of criteria were used in the determination of these potential sites, as described below.

4.6.2.1 Worker camps

Criteria used to determine the potential worker camp locations included:

- No adverse impact upon environmental sensitivities
- Located sufficiently far from settlements as to not cause a nuisance but without removing the opportunity for positive social interaction (eg supply of goods and services)
- Ability for transport to and from the site to the project areas to meet the HSE objectives, ie no night driving
- Provide room for expansion if required
- Proximity to the ROW
- Proximity to reliable local utilities services eg electricity and water

4.6.2.2 Line-pipe storage yards

Criteria used to determine the potential worker camp locations included:

- No adverse impact upon environmental sensitivities
- Located sufficiently far from settlements as to not cause a nuisance
- Proximity to exiting or upgradeable rail spur access
- Ability for transport to and from the site to the project areas to meet the HSE objectives ie no night driving
- Proximity to the ROW
- Proximity to reliable local utilities services eg electricity and water

4.6.2.3 Access roads

The route of the temporary access roads from the camps and line-pipe storage areas to the ROW is dependent upon the location of these facilities in relation to the ROW. Existing roads, some of which will require upgrade, will be used wherever possible. The ROW will also be used as a running track for the movement of line-pipe to the construction spread.

4.7 DESIGN OPTIONS

The engineering design of the pipeline is an iterative process, with increasing definition being added to the base case design as more information becomes available, as more studies are completed, or as external circumstances change, eg political and commercial requirements.

This section describes some of the key design decisions that have been necessary, and explains how these have been arrived at. It also places the preferred base case project design described in Section 5 in a wider context.

Key engineering decisions described in more detail below include:

- Use of adjacent or geographically separated corridors for BTC and SCP pipelines
- Selection of design contractors
- Pipeline diameter
- Pipeline wall thickness
- Number and location of block valves
- Number and location of pump stations
- Pump driver selection
- Operational power and fuel requirements for pump drivers

Each of the above is discussed on the following pages.

4.7.1 Use of adjacent or geographically separated corridors for BTC and SCP pipelines

It is proposed that the BTC pipeline and the SCP pipeline share adjacent corridors through Georgia. From an environmental and social perspective this has the following benefits:

- It reduces the total area of clearance and therefore temporary habitat and agricultural land-loss
- It reduces the number of temporary facilities (camps, pipe storage yard, etc) established within Georgia during the proposed construction periods
- It provides BTC facilities with future access to SCP gas with the minimum additional infrastructure development. Future operation of BTC facilities using SCP gas will provide a number of environmental benefits (discussed below)
- The potential co-location of permanent facilities reduces the combined project land take
- Joint use of a corridor carefully selected to minimise environmental and social impacts where practical

Cumulative impacts posed by pipeline construction within same corridor are discussed in Section 13.

4.7.2 Selection of design contractors

A competitive tender process was used to select the contractor company to conduct the engineering design for the BTC pipeline project. Retaining the correct contractor was considered to be an essential aspect of optimising project design and ensuring overall success of the project.

The successful contractor was selected after review of bids against a number of criteria, including:

- Relevant experience (projects and regional)
- Experience of personnel
- Cost
- Environmental and social performance
- Health and safety performance
- Schedule

Following the tender review process Bechtel were selected as the lead engineers for the BTC project. Bechtel have a great deal of experience in the design of regional pipeline systems worldwide.

Bechtel and John Brown Hydrocarbons, lead engineers for the SCP gas line, share responsibility for pipeline corridor and ROW issues.

4.7.3 Pipeline diameter

Hydraulic engineering design has demonstrated that a 1168.4mm (46") pipeline with 2 pump stations provides the optimal solution. Alternatives were considered, including a 1066.8mm (42") diameter pipeline, although this option required additional pump stations and therefore imposed additional environmental impact.

The benefits of the chosen pipeline configuration include:

- Improved safety
- Reduced permanent land take for the project
- Reduction in greenhouse gas and nitrogen dioxide emissions from project operations
- Likely reduction in waste from construction and operation
- Reduced environmental risk from crude topped distillate transportation to / from a third facility
- Reduced environmental risk

4.7.4 Pipeline wall thickness

The selection of the material properties and the wall thickness of the line pipe to be used for each section of the BTC pipeline have been determined on the basis of:

- International standards and design guidelines
- The loads that will be applied to the pipe, internal pressures
- Local environmental and social sensitivities, including seismic zones, river crossings, proximity to existing communities and their likelihood for future expansion
- Manufacturers' standard production specifications
- Limiting factors associated with the constructability of the BTC pipeline (eg ease of welding) and the robustness of the line pipe during construction operations

As a result of engineering analysis, it is anticipated that the minimum pipewall thickness will be 12.7mm.

4.7.5 Number and location of block valves

Block and check valves are to be installed on the pipeline to provide the capability to isolate sections of the line in case of accidental leakage or damage and for maintenance or repair purposes.

A comprehensive environmental risk assessment has been carried out, the results of which were used to refine the placement of pipeline valves. Section 10.4 explains the results of this process.

Valve placement has therefore been determined to a large degree by the environmental sensitivity of the surrounding environment and a desire to minimise the volume of any potential spill on sensitive receptors.

4.7.6 Number and location of pump stations

During basic engineering a preliminary design for the pipeline was prepared based on five pump stations in Azerbaijan and Georgia and a pipeline diameter of 42" throughout.

A further review of pipeline hydraulics was conducted during the detailed engineering phase. This hydraulic analysis was conducted in a number of phases, with each phase reducing the number of options being considered, with remaining options being considered in increasing detail.

Initially the base case of five pump stations from the basic engineering phase was compared against ten other possible system designs. This was narrowed down to six options for the second pass, and three options for the third pass.

Finally, a preferred option of a total of four pump stations in Azerbaijan and Georgia, with a dual diameter pipeline system of 42" in Azerbaijan and 46" in Georgia was selected.

Selection of preferred option was made on the basis of:

- Capital and operating costs
- Environmental impact, including emissions, land take and visual impact
- Location of pump station and flexibility in location
- Number of pump stations
- Pipeline diameters (consistent generally considered to be preferable to dual diameter)

A key aspect of the preferred option was that it entailed one less pump station in Georgia with the corresponding benefits in terms of environmental impact (less emissions and reduced visual impact) and capital and operational costs. Pump station emissions in Georgia are discussed in Section 10.

4.7.7 Pump driver selection

Provision of a reliable local supply of electrical power from the national grid is not currently possible within Georgia, and remotely generating electricity was not technically preferred or economically feasible. Therefore mainline crude oil pumps within Georgia will be mechanically driven.

At an early engineering stage, reciprocating engines and gas turbine drivers were considered and subject to a selection study. The gas turbine driver proved to be the preferred option on the basis that it provided significant environmental benefit from lower emissions.

In order that the driver systems are operated efficiently, a programme of installation of several smaller units will be undertaken rather than meet the required duty with a single large unit over the project lifetime.

4.7.8 Operational power / fuel requirements for pump drivers

Reduction in the quantity of emissions to air has been a key objective of the engineering design team throughout the various phases of the project development. The main source of emissions associated with the operational phase of the project is the pump drivers at the pump stations. Therefore selection of pump drivers has been a key component of the emissions reduction programme.

The power requirement of major plant (ie the mainline oil pumps) has been studied and assessed in the context of the preferred environmental option. At peak export, mainline crude oil pumps will be required to provide approximately 32MW of hydraulic power at each of the two pump station sites. Therefore these sites will demand a significant and reliable fuel supply, and the following options were considered:

- Gas, available from the proposed SCP pipeline in the its operational phase
- Crude oil (from the mainline)
- Distillate (derived from the mainline crude by a crude topping plant)
- Diesel

Given the environmental requirements for emissions, it was decided that systems would not operate on mainline crude, as the emissions would not meet the required standards. Currently, local reliable supplies of natural gas are not available. Therefore, the preferred environmental option for early export would be to operate on a liquid fuel (similar to diesel) generated from the mainline crude. Based on the characteristics of the crude this liquid fuel is expected to have a lower sulphur content than diesel fuels commercially available within Georgia.

Operation of combustion plant on natural gas provides a number of environmental benefits, particularly in terms of operational emissions. Therefore turbine drivers will be 'duel fuelled', that is, capable of operating on either natural gas or liquid fuels. The turbines would operate on Shah Deniz gas as soon as practicable after the installation of the proposed SCP pipeline.

The key design changes relating to pipeline diameter and pump driver selection, and the high level impact on emissions especially those of carbon dioxide and nitrogen oxides, are summarized for the entire BTC pipeline in Table 4-1 below.

Table 4-1 Impacts on emissions owing to changes in design

Project Phase	Change	Impact on Emissions (CO_2 and NO_x)	
Basic Engineering	Base case in Azerbaijan and Georgia changed from crude burning reciprocating engines to gas turbines on SCP gas, with crude fuelled drivers as back-up	Reduction	Reduction
Detailed Engineering	Pipe diameter in Georgia increased to facilitate removal of a pump station in a remote and sensitive part of Georgia	Reduction	Reduction
	SCP programme altered requiring BTC to rely on crude to fuel drivers	Increase	Increase

A cost benefit analysis was undertaken of other options for increasing the efficiency of the pipeline system and reducing emissions and considered:

- Provision of centralised power at each facility
- Use of combined heat and power where and if appropriate

This cost benefit analysis, conducted using the BP Environmental Performance Guidelines, concluded that direct coupling of the drivers to the pumps was the best solution.

4.8 CONSTRUCTION

4.8.1 Selection of construction contractors

A competitive tender process is underway to select contractor companies to construct the pipeline and associated facilities and AGIs. This may result in one contractor constructing both the pipeline and AGIs or separate contracts being awarded.

It is recognised that selection of a qualified and experienced contractor and ensuring that the appropriate requirements are incorporated into the contract is an integral component of achieving the commitments set out in this ESIA report.

Therefore both environmental and social issues were afforded a high degree of priority in the invitation to tender documents. Requirements to implement the mitigation measures set out in this ESIA are set out in the invitation to tender documents and will be further addressed in pre-contract award negotiations.

The successful contractor/s will be selected after bid review, on the basis of a number of criteria, including how they have addressed environmental and social concerns.

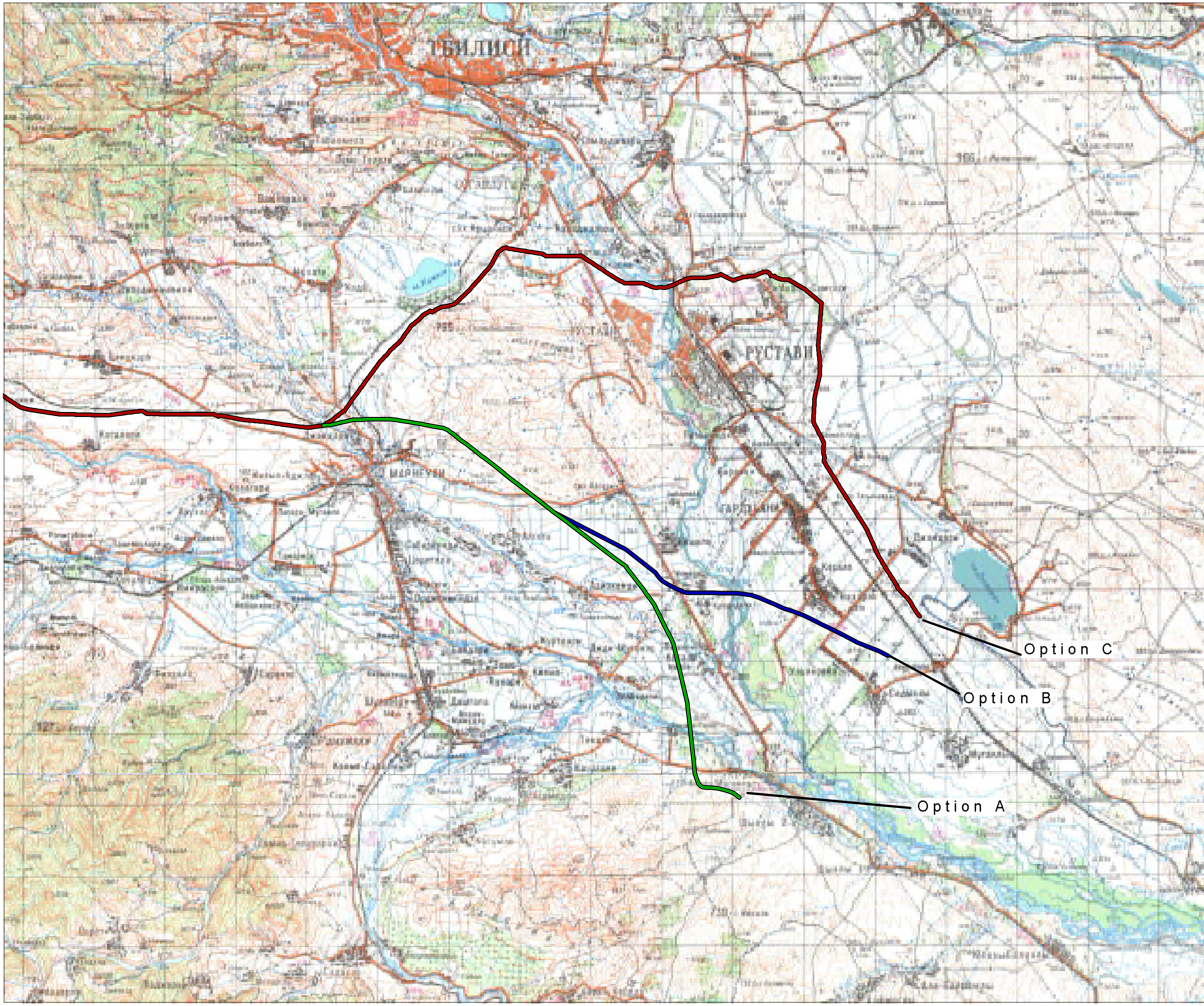
Specifically, from an environmental and social perspective, the bids will be reviewed against:

- Training plans for HSE issues
- Proposals for managing environmental and social issues eg maximising local employment and management of wastes
- The project environmental goals and project social objectives
- Compliance with relevant standards, policies and regulations
- Demonstrated awareness of relevant environmental and social issues
- Responses to an environmental and social questionnaire
- Proposed resources and structure for managing environmental and social issues
- Training plans for HSE issues

The selected contractor/s is required to develop an environmental and social management plan outlining how the commitments made in their bid will be implemented during construction.

4.9 BASE CASE PROJECT DESIGN

This section has summarised some of the key project alternatives and options that have been assessed which have a significant bearing on the overall environmental and social impact of the BTC project. This continual process of environmental and social input to the project design has contributed to the adoption of a base case for the BTC project in Georgia. This base case design is described in detail in Section 5, Project Description.



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NOTES

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PROJECTION: GAUSS-KRUGER
GEODETIC DATUM\SERVER\DATA MAIN PULKOVO (1942) ZONE 8
VERTICAL COORDINATE SYSTEM\SERVER\DATA MAIN
KRONSTADT (BALTIC SEA) DATUM

2. MAPPING IS BASED ON SCANNED 1:500,000

KEY PLAN

LEGEND

Optional Routes

BTC ESIA

TITLE:
Azerbaijan Border - Marneuli

SCALE: 1:200,000

Figure: MAP 4.1

URS

NOTES

1. COORDINATE SYSTEM PARAMETERS:
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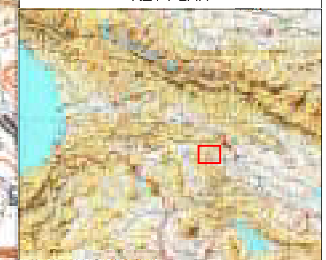
2. MAPPING IS BASED ON SCANNED 1:500,000

KEY PLAN



LEGEND

Optional Routes

bp

BTC ESIA

TITLE:
Tetritskaro Area

SCALE: 1:100,000

Figure: MAP 4.2

KEY PLAN

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PROJECTION: GAUSS-KRUGER
GEODETIC DATUM\SERVER\DATA MAIN PULKOVO (1942) ZONE 8
VERTICAL COORDINATE SYSTEM\SERVER\DATA MAIN
KRONSTADT (BALTIC SEA) DATUM

2. MAPPING IS BASED ON SCANNED 1:500,000

LEGEND

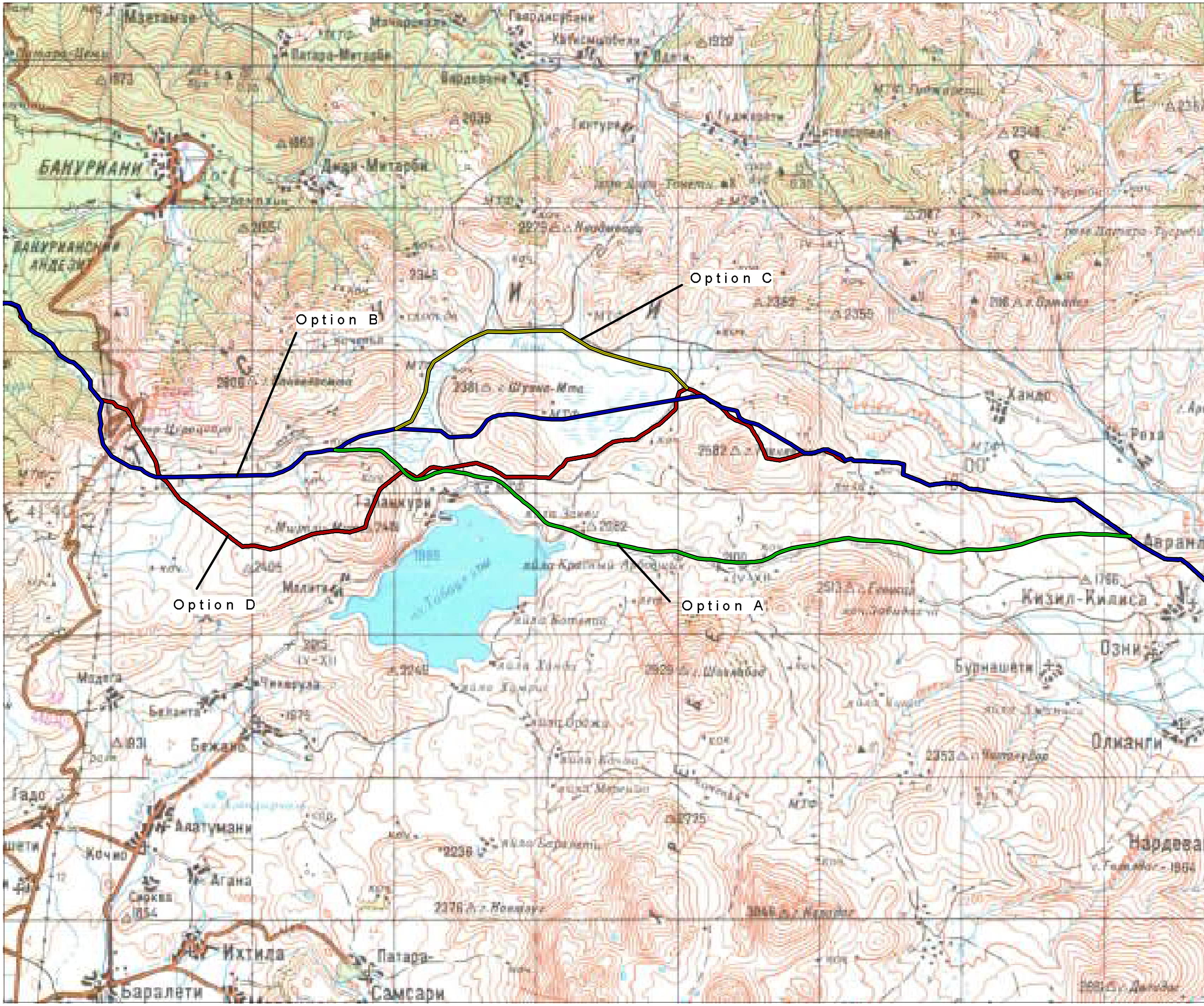
Optional Routes

BTC ESIA

TITLE:
Lake Tsalka Area

SCALE: 1:100,000

Figure: MAP 4.3



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NOTES

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VERTICAL COORDINATE SYSTEM/SERVER/DATA MAIN
KRONSTADT (BALTIC SEA) DATUM

2. MAPPING IS BASED ON SCANNED 1:500,000

KEY PLAN

LEGEND

Optional Routes

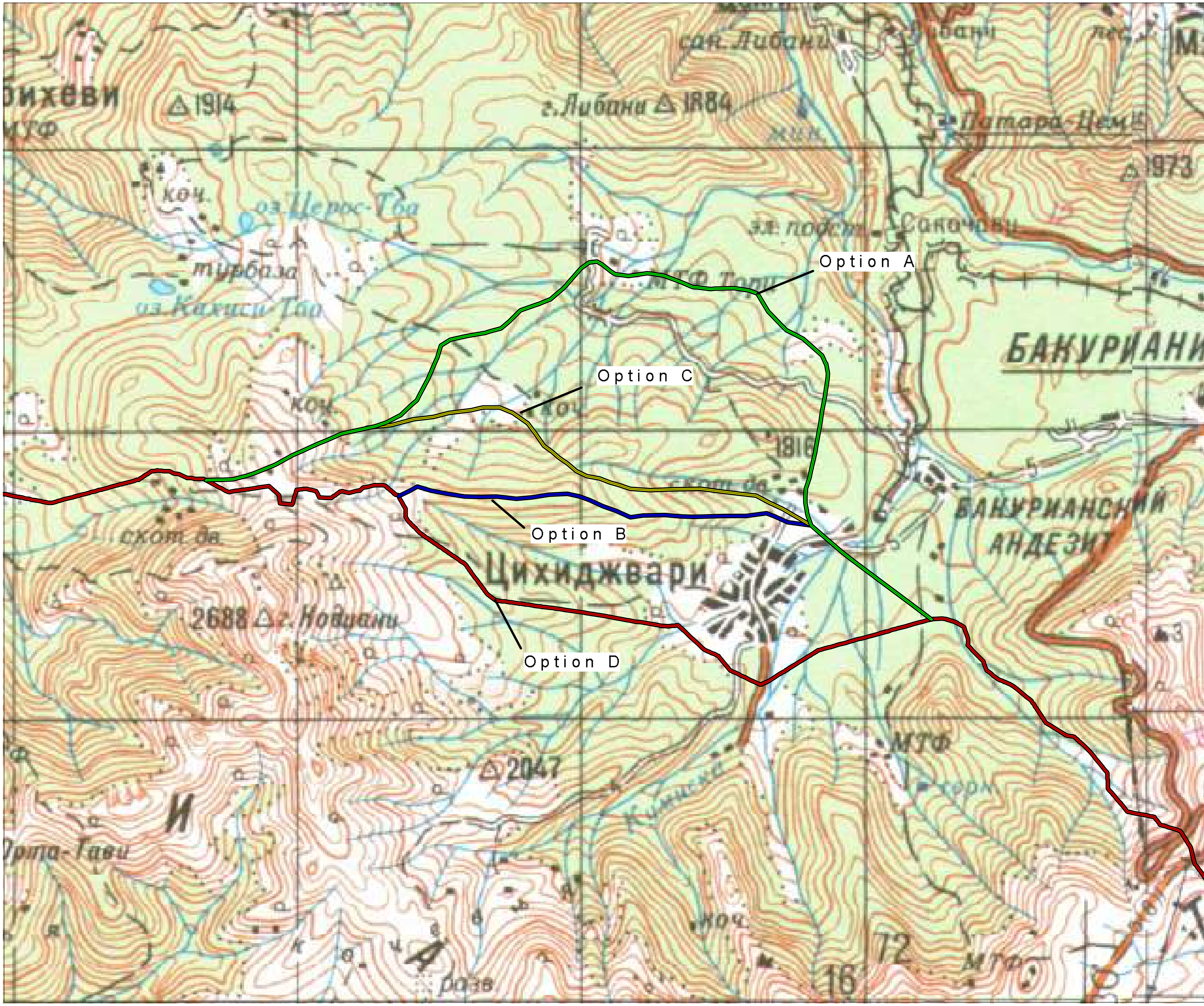
BTC ESIA

TITLE:

Ktsia Tabatskuri Area

SCALE: 1:100,000

Figure: MAP 4.4



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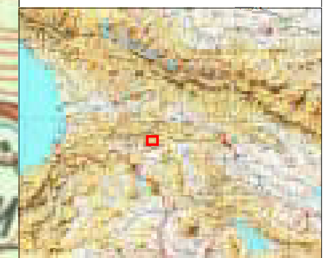
GEODETIC DATUM\SERVER\DATA MAIN PULKOVO (1942) ZONE 8
VERTICAL COORDINATE SYSTEM\SERVER\DATA MAIN
KRONSTADT (BALTIC SEA) DATUM

2. MAPPING IS BASED ON SCANNED 1:500,000

KEY PLAN



LEGEND

Optional Routes

BTC ESIA

TITLE:
Tskhratskaro - Tsikhisjvari Area

SCALE: 1:50,000

Figure: MAP 4.6

PROJECT DESCRIPTION

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5 PROJECT DESCRIPTION

This Section presents a description of the project and addresses those engineering aspects relevant to the Georgian section of the BTC pipeline, covering the following areas:

- Basis of Design, including the technical and performance requirements, and codes and standards used
- Description of the pipeline and facilities required
- Description of the construction activities involved
- Description of testing of the pipeline and facilities (including hydrotesting and pigging)
- Commissioning of the BTC pipeline and facilities
- BTC system operation and maintenance
- Decommissioning and abandonment

Where appropriate, this Section presents details of the project in a wider sense (eg beyond the confines of Georgia). Where kilometre points (KPs) are noted for Georgia, KP0 represents the point at which the BTC pipeline emerges from the Azerbaijan-Georgian border.

5.1 PROJECT OVERVIEW

The BTC overall pipeline route is presented in Section 3, Introduction, and the Georgian section is illustrated in detail in Figure: Maps 5-1a-e Pipeline Route Summary.

With respect to the environmental impact of the project, the key features of the pipeline system design are as follows:

- The pipeline and all block valves will be buried throughout the route
- The pipeline route has been selected with the aim of minimizing impact on socially or environmentally sensitive areas
- As a result of careful pipeline route and facilities site selection, it is not anticipated that any permanent resettlement of people will be required
- It is intended that the system will be built, operated and decommissioned in line with international standards

A description of the BTC pipeline route is presented in Section 4 (Project Alternatives). Each of the principal features of the system is described in greater detail within this Project Description.

When fully operational and running at its design capacity, the BTC pipeline is to have the capability to export 50 million tonnes of crude oil per year (Mta) from the Sangachal Terminal on the Azerbaijani Caspian coast, near Baku, through Azerbaijan, Georgia and Turkey to the Ceyhan Terminal on the Turkish Mediterranean coast. Initially the BTC pipeline will transport oil from the Azeri, Chirag and Gunashli (ACG) Phase 1 Full Field Development, followed at a later date by crude from other phases of the ACG development as well as other regional crude oil and condensate streams.

It is anticipated that the construction and commissioning of the system will be carried out in phases determined on the required transportation capacity and that the first phase will be completed by late 2004. The pipeline has been designed on the basis of a 40-year operational life.

The entire BTC pipeline system will be approximately 1,750km in length, sub-divided between the three countries as follows:

- Azerbaijan 442km
- Georgia 248km
- Turkey 1,060km

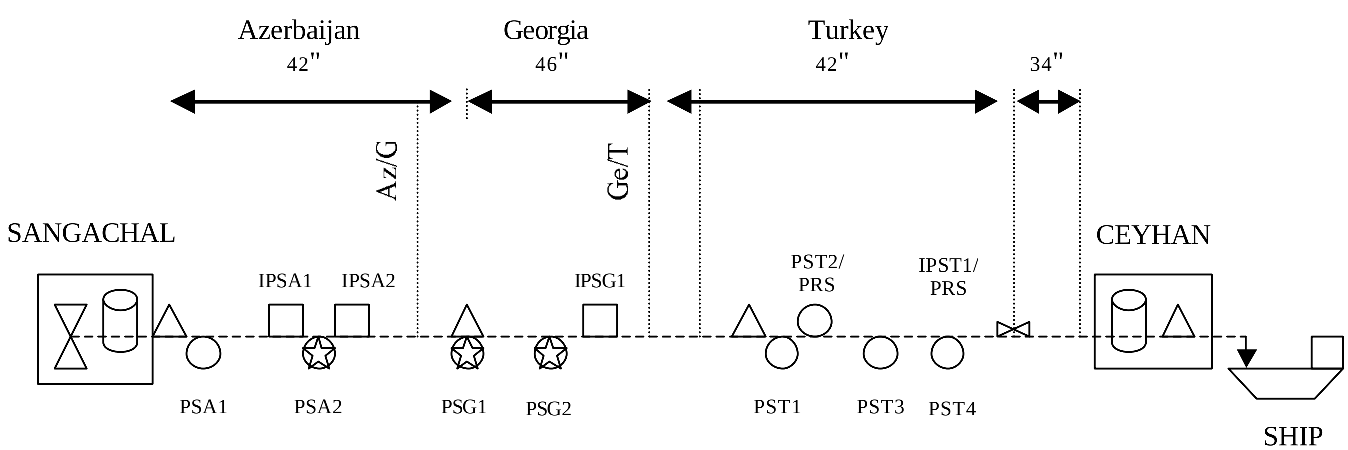
A comprehensive route evaluation process was undertaken to determine the optimum pipeline alignment (see Section 4, Project Alternatives). The preferred route for the proposed pipeline reflects a number of critical constraints, including:

- Physical and engineering properties of terrain
- Safety
- Proximity and suitability of existing infrastructure within Georgia
- Seasonal constraints
- Environmental impact (see Section 10)
- Social impact (see Section 11)

Figure: Maps 5-1a-e present the proposed pipeline route in Georgia topographically, superimposed on satellite imagery, and as an altimetric profile. The figure also presents the locations of facilities (eg pump stations and pigging stations) and other above ground installations (eg block valves) associated with the BTC pipeline – each of which is discussed later in this Section.

The Georgian section of the BTC pipeline will have an external diameter of 42" up to KP3.6, and 46" up to the Turkish Georgian Border. A summary of the export system is presented in Figure 5-1 below.

Figure 5-1 Summary of export system



There are planned to be two pump stations within Georgia (PSG1 and PSG2). PSG1 will be located near to the Georgian-Azerbaijan border (KP3.6). The second pump station (PSG2) will be approximately located at KP87, near to the town of Tetriskaro.

The BTC pipeline system will also include a dedicated intermediate pigging station in Georgia (along with two further pigging facilities integrated within the pump stations), a number of valve stations, a cathodic protection (CP) system, an optical fibre communications system, a leak detection system, and a computer-based Integrated Control and Safety System (ICSS) design has been based on fully automatic operation.

The basis for overall BTC pipeline control is centralized control from the control room at the Sangachal Terminal communicating with Process Control Units (PCUs) at pump stations, block valves and metering facilities. Flow rate control will be carried out by adjusting the numbers and speeds of the pumps operating at the Sangachal Terminal and at the intermediate pump stations.

An overview of project features is presented in Table 5-1.

Table 5-1 Development summary

Total pipeline length (Sangachal to Ceyhan)	Approximately 1,750km
Pipeline length in Georgia	Approximately 248km
Pipeline diameter	42" up to KP3.6, 46" up to Turkish border
Pipeline material	High grade steel pipe with a 3-layer polyethylene anti-corrosive coating
Normal pipeline burial depth	1m from top of pipe
Operating pressure range (at 1,000mbd)	76-142barg
Number of pumps stations in Georgia	2
Block Valves	15 ball valves, 10 check valves, with an additional ball valve at the intermediate pigging station
Other AGIs in Georgia	1 intermediate pigging station (IPS) (a possible second maybe built), and 1 metering station (which will be co-located with proposed SCP Pressure Reduction and Metering Station (PRMS).
Peak oil export	~1,000mbd

The control room at the Sangachal Terminal will be shared with AIOC, ACG, SCP and SD Upstream project though the control systems will be independent.

5.2 PROJECT DEVELOPMENT

The project details and scope presented in this Section are correct at this stage of the project development to the best of our knowledge. Some of these details are likely to change as the project design becomes refined and more detailed over time. The project design is the subject of a separate regulatory approvals process. Nonetheless, the current level of detail is sufficient to enable potential environmental impacts to be determined and assessed, and appropriate mitigation measures developed. Where possible, these mitigations have already been incorporated into the design premise.

In accordance with BP policies and international best practice (as described in Section 6, Legal and Policy Framework), the BTC project's social and environmental interaction with the host countries has been subject to assessment and review since its inception. As a result, environmental and social considerations have been implicit in each element of the project's development, including conceptual design, front-end engineering design (FEED) and detailed design. The importance of environmental and social considerations is reflected in the project management commitment to world-class performance, and in the pipeline and facility design as described in the remainder of this Section.

Several specific measures have been implemented to ensure that appropriate consideration has been given to environmental and social issues. These measures include:

- The inclusion of a team of environmental and social experts in the project management team, with dedicated personnel located in the United Kingdom, Azerbaijan, Georgia and Turkey
- The inclusion and routine involvement of environmental engineers and environmental management professionals within the engineering design teams
- Incorporation of clauses into the contracts for the main engineering design contractors to ensure that the design would involve environmental expertise, commensurate with host government agreement requirements, BP's policy, and the scale and nature of the BTC project
- Routine involvement of the environmental specialists in project design and management meetings
- The involvement of locally and internationally respected environmental and social consultants in all key phases of the project (including conceptual review, goal setting, regional review, project scoping, routing, engineering design and environmental/social assessment)
- The involvement of internal environmental and social experts drawn from the world-wide staff of the project partners to conduct peer reviews of the environmental/social aspects of the project and to provide peer assistance to the project team
- The collection and assessment of extensive environmental and social data for the proposed pipeline route in Georgia
- An ongoing programme of benchmarking against similar projects conducted elsewhere in the region and around the world
- The inclusion of environmental and social provisions in external agreements made on behalf of the project. For example, the environmental standards that have been developed and adopted for the project form an integral component of the tender documentation for the pipeline and facilities construction contracts
- The requirement for all contractors to develop environmental protection plans prior to the commencement of work on any aspect of the project
- Ongoing liaison with stakeholder groups including the Georgian Government, the Project Partners, local stakeholders, IFIs and Non-governmental Organizations (NGOs)

The environmental management of the project is currently being formalized through the development of an ISO 14001 compliant Health, Safety, Environmental, and Social (HSES) Management System to be implemented during the project's execution phase. It is anticipated that the same HSES Management System will also be adopted for the project's operational phase.

5.3 PROJECT SCHEDULE

The design and preliminary survey work required for the BTC pipeline commenced in 2000 and is ongoing. It is anticipated that the main BTC construction contract(s) will be awarded in mid to late 2002 with the aim of the main construction work commencing in Spring 2003. The pipeline construction period in Georgia is likely to last for approximately 15 months. Filling and commissioning of the line is dependent on the completion of associated projects in Azerbaijan, Georgia and Turkey and is programmed to commence in mid-2004. It is anticipated that the entire BTC pipeline system will become operational by early 2005.

Some preparatory construction works are intended to commence in late 2002, and it is intended that all construction works will be completed by mid 2004. Cleaning and testing of the pipeline system is scheduled to take place in mid 2004, and oil fill in late 2004.

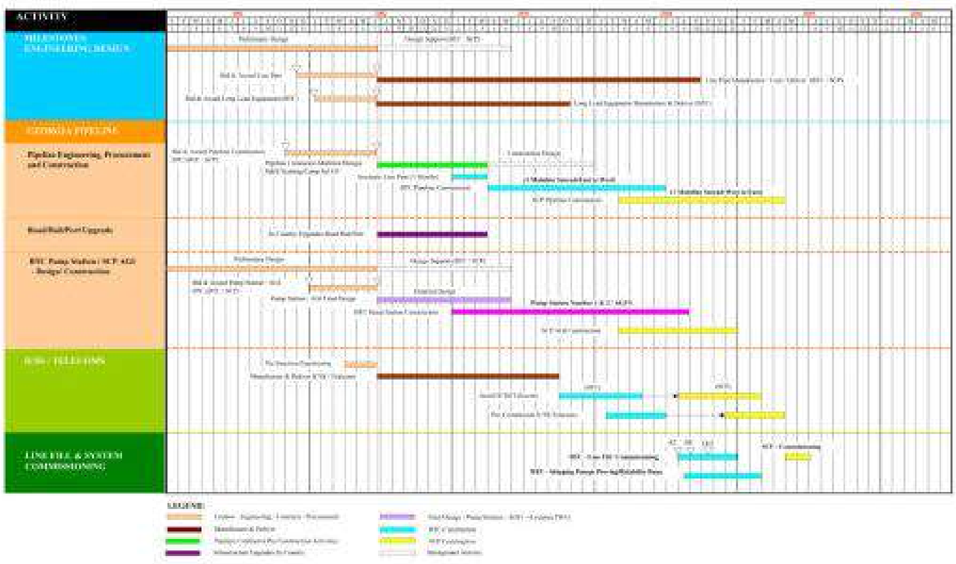
The period between the award of the construction contract and the commencement of the pipeline construction work will be used by the Project Management Team and the pipeline and facility construction contractors for various enabling and preparatory works including:

- Staff mobilization and training
- Detailed design and procurement
- Clearance and establishment of temporary facilities (worker camps, pipe yards, temporary roads, etc)
- Field verification of identified environmental and social receptors
- Stockpiling of materials
- Upgrading of infrastructure (eg roads, railways, etc)

It is currently anticipated that the construction of the SCP will commence within one year of the completion of the BTC pipeline. The relationship between the construction and commissioning programmes for the two pipelines is discussed in greater detail in Section 13, Cumulative Impacts.

Figure 5-2a presents a schematic summary of the anticipated project schedule including the key events associated with the completion of the BTC project.

FIGURE: 5.2 BTC / SCP OVERALL KEY EVENTS SCHEDULE



5.4 PROJECT PHASES

The BTC pipeline project is a phased development focused on the following targets:

- The BTC Phase - 1 Development will enable the BTC Pipeline System to transport approximately 500 mbd of crude oil
- The BTC Phase - 2 Development will increase the capacity of the BTC Pipeline System from approximately 500 mbd to 1,011 mbd and will include expansion of certain facilities developed during the Phase - 1 Development

The Georgian permanent facilities, as discussed in this Section, will be established for both project phases.

5.5 PROJECT DESIGN BASIS

The following Sections are applicable to the whole BTC pipeline except where otherwise stated.

5.5.1 Design life

The proposed BTC pipeline has a 40-year design life. Facilities (eg pump stations, pigging stations) and other AGIs will be designed for a 30-year design life, with the exception of the mainline oil pumps and drivers that will have a design life of 20-years.

Routine maintenance measures will be applied during these periods to ensure that all facilities operate as designed for their intended lifetime.

5.5.2 Crude oil characteristics

The basic physical characteristics of the ACG crude oil as supplied to the BTC pipeline from the Sangachal Terminal are anticipated to be as follows:

- Density: 861kg/m^3 @ 5°C, 852kg/m^3 at 15°C
- Reid Vapour Pressure: 69kPa
- True Vapour Pressure: 100kPa at pipeline input temperature
- Specific Heat Capacity: 1.8 kJ/kgK at 0°C, 1.9 kJ/kgK at 20°C
- Pour Point: -6°C
- Wax Appearance Temperature: 37.7°C

The main part of the hydraulic modelling work carried out during the design process has been based on these physical properties. Additional work has been carried out to assess the implications of variations to this base case data. Given the density stated above, the planned operational flow of 50Mta equates to a peak hydraulic design capacity of 1,011mbd, which in turn is equivalent to 6,697m^3/h.

Whilst the intention is that the BTC pipeline will transport predominantly ACG crude, provision has been made for the transport of other crudes originating in the Caspian region and condensate from natural gas production activities. The physical and chemical characteristics of differing crude oil and condensate blends will vary slightly from those of pure ACG crude. The degree of divergence will be dependent on the characteristics of each blended material and the proportions in which they are blended. It is not anticipated that the potential variations in the physical characteristics of the transported material will materially affect the operation or safety of the BTC pipeline.

5.5.3 Codes and standards

The BTC oil pipeline and associated system components will be designed, fabricated, constructed, tested and commissioned in accordance with the requirements of ASME 31.4 and 31.3 (1999) supplemented by other selected International Standards (American Petroleum Institute (API), British Standards Institute (BSI), International Standards Organisation (ISO), The Institute of Petroleum (IP), Manufacture Standardization Society (MSS) and The National Association of Corrosion Engineers (NACE)).

5.5.4 Design safety factors

In the context of engineering design, the term “safety factor” is understood to mean a multiplier that is used to ensure that the maximum design load or capacity falls below the maximum value that could be sustained by a pipeline system component or structure without failure. Such factors are used to ensure that a design is conservative. In accordance with normal engineering practice, and the requirements of the engineering standards adopted for the project, safety factors have been incorporated in each element of the engineering design for the BTC pipeline.

Where required by the applicable design standards or considered appropriate by the engineering teams, additional safety factors have been incorporated into the design to reflect key sensitivities. As a result, more conservative design factors have been applied for BTC pipeline sections close to:

- Areas of geotechnical (potential subsidence or settling) and seismic (earthquake and landslip) sensitivity where aspects of design (eg trench configuration, material, welding) increase flexibility and limit the influences of external forces
- Road and rail crossings where the design also includes additional cover to alleviate excessive loads on the pipeline

5.5.5 Design pressures and temperatures

The design pressure of the BTC pipeline system in Georgia will be 100barg, with a maximum operating pressure of approximately 120barg. As with the use of safety factors in the design process, the adoption of an operating pressure lower than the design pressure reflects a conservative approach to the design of the BTC pipeline system. Pressure control systems will be provided so that the pressure in the BTC pipeline system does not exceed a safe level.

The operating pressure of the pipeline will vary along the pipeline route owing to changes in elevation, hydraulic losses and pump inputs. This necessitates changes in wall thickness along the route.

The BTC pipeline has been designed for an external temperature range of minus 24^{o}C to plus 43^{o}C.

5.5.6 Pipeline diameter

The pipeline diameter selected for each major route section for the entire BTC export system has been designed upon the basis of:

- Export crude volume
- Crude physical properties (particularly viscosity and density)
- Optimization of the modelled hydraulic conditions that may be encountered along the pipeline route under various steady-state and transient flow regimes
- The placement and rating of pumping stations to provide positive crude pressure at discrete locations along the proposed route

In Georgia crude oil exported from the Sangachal Termina l will be transported through a 42" diameter pipeline for the first 3.6km, the remainder of the route in Georgia being 46" diameter.

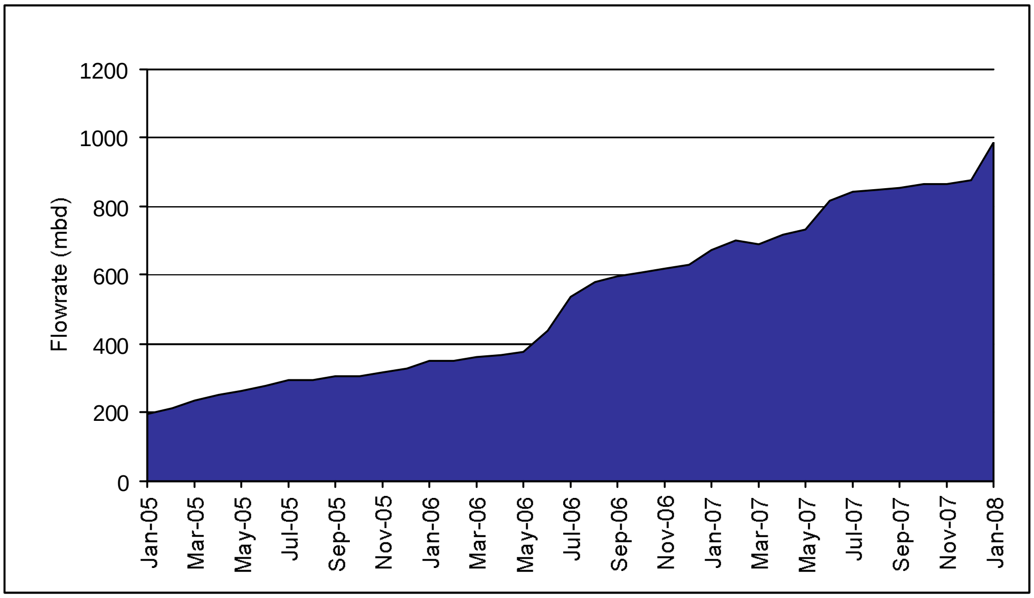
5.5.7 BTC pipeline capacity

The BTC pipeline system has been designed to accommodate a flow rate of 50Mta, which equates to 1,011 mbd of ACG crude. The principal sources of the crude are anticipated to be:

- Existing Early Oil Project (EOP) crude production at the Chirag oil field in the Azerbaijan sector of the Caspian Sea
- The proposed development of the ACG oil fields in the Azerbaijan sector of the Caspian Sea for crude production
- Condensate production from the Shah Deniz gas field

As illustrated in Figure 5-2b, the pipeline flowrates are projected to start at around 200mbd in year one, increasing to 1,011mbd by the end of year three.

Figure 5-2b Projected flow profile



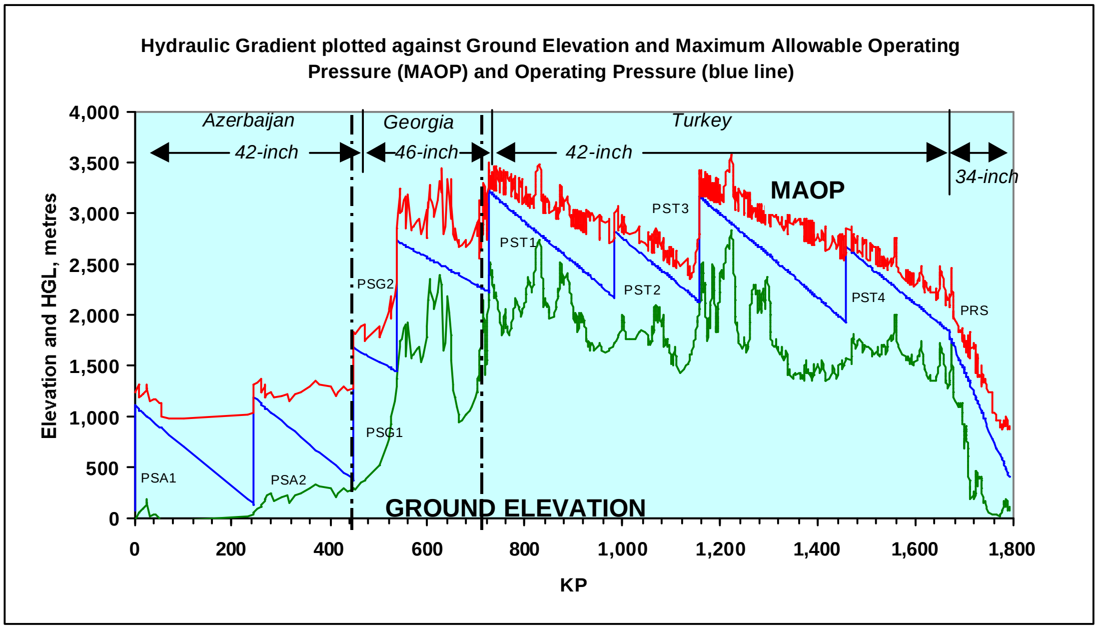
5.5.8 Hydraulic design

The engineering design team has conducted a detailed analysis of the hydraulic conditions that may be encountered along the BTC pipeline route for various flow regimes and design assumptions. This analysis has been used to support the selection of the final design (eg pump stations, pipe wall thickness, etc) of the BTC pipeline system.

The main part of the hydraulic modelling work has been based on the physical properties of ACG crude, however additional work has been carried out to assess the implications of potential variations in the crude oil supplied to the pipeline.

Figure 5-3 presents the hydraulic profile at maximum throughput and steady state conditions.

Figure 5-3 Diagrammatic representation of hydraulic model



On the basis of flow capacity, hydraulic modelling, design pressures and generally available pipeline materials, a BTC pipeline diameter of 46" has been adopted in Georgia.

In order to accommodate the full 50Mta flow capacity at a pressureof not more than 95barg it has been determined that two pump stations will be required within Georgia. The proposed locations of these pump stations are:

- PSG1 near Gardabani (KP3.6)
- PSG2 near to the village of Tetriskaro (KP87.0)

5.5.9 BTC pipeline material

The selection of the material properties and the wall thickness of the pipe to be used for each section of the BTC pipeline have been determined by the engineering teams on the basis of:

- International standards and design guidelines
- The anticipated loads that will be applied to the pipe, including for potential seismic events
- Hydraulic optimization
- Local ground conditions
- Manufacturers' standard production specifications supplemented by specific project requirements to ensure/improve quality
- Limiting factors associated with the constructability of the BTC pipeline (eg ease of welding) and the robustness of the line pipe during construction operations

As a result of the engineering and constructablity analysis, and based on using API 5L Grade X70 grade steel, it is currently anticipated that five standard pipe wall thicknesses (12.7, 13.5, 14.3, 15.9 and 19.1mm) will be used for the project in Georgia.

Approximately 245km of 46" diameter pipe will be required for the Georgian portion of the pipeline, comprising approximately 20,000 pipe sections each just under 12m long. All pipe sections will be externally coated (prior to delivery) with a high-integrity three-layer polyethylene system. Welded joints will have a coating applied during construction. In each instance the coatings will be designed to protect the pipe from corrosion and damage.

5.6 OUTLINE OF THE BTC PIPELINE AND ASSOCIATED FACILITIES

5.6.1 The BTC pipeline

5.6.1.1 BTC pipeline route

The BTC pipeline route has been carefully selected to take account of social, engineering, geotechnical and environmental constraints. The route selection process and the alternatives considered are described in Section 4. The BTC pipeline route and the location of the key facilities/AGIs are illustrated in Figure: Maps 5-1a-e.

5.6.1.2 Corrosion protection

The BTC pipeline system will be protected from external corrosion by a combination of a high-integrity three-layer polyethylene coating system and an impressed current CP system. Sacrificial anodes will be used where the impressed current CP system is less effective.

Permanent pipeline cathodic protection will be provided by transformer rectifiers and shallow horizontal groundbeds located at the intermediate pump stations (PSG1 and PSG2) and selected block valve sites.

Following commissioning, regular monitoring activities will be carried out to ensure that adequate protection potentials are being achieved and that power sources are operating within their intended limits.

5.6.1.3 Leak detection

A modern leak detection system will be installed. It will operate by comparing actual profiles of flow, pressure, temperature and density with modelled profiles of the same parameters. Excessive differences between the real-time measurements and the modelled profiles indicate possible pipe failure and leakage. The time taken to detect a leak will be therefore dependent on the size of the leak and the accuracy of the flow measurement instrumentation.

The leak detection system will be designed in accordance with the requirements of API 1130 Computational Pipeline Monitoring (Oct 1995) and API 1155 Evaluation Methodology for Software Based Leak Detection Systems.

The leak detection algorithm will be designed with the aim of identifying any leaks in excess of 1.0% of the flow rate being measured (from start-up through full flow) or a pipeline rupture. The system may also be able to identify smaller leaks over a longer period of time.

The leak detection system will be designed to accommodate routine (steady-state) pipeline operating conditions, as well as transient conditions (eg pigging runs) and slack flow. Potential suppliers of the leak detection system are required to demonstrate the capabilities of their system in respect of the detailed requirements contained within the relevant specification.

5.6.1.4 BTC pipeline location identification

Low level marker posts will be provided at all station sites, cathodic protection test stations, road, track, rail and water crossings, AGI/facility fences, and any other locations deemed necessary to ensure identification of the BTC pipeline route. Each marker will be in line of sight contact with adjacent markers, to the greatest extent possible. Marker posts will be provided with identification plates that will include telephone contact numbers to be used in the event of a pipeline incident.

Aerial markers will be installed at significant changes in direction and every 1km along the route to assist in the event of aerial surveillance.

5.6.2 Pump stations

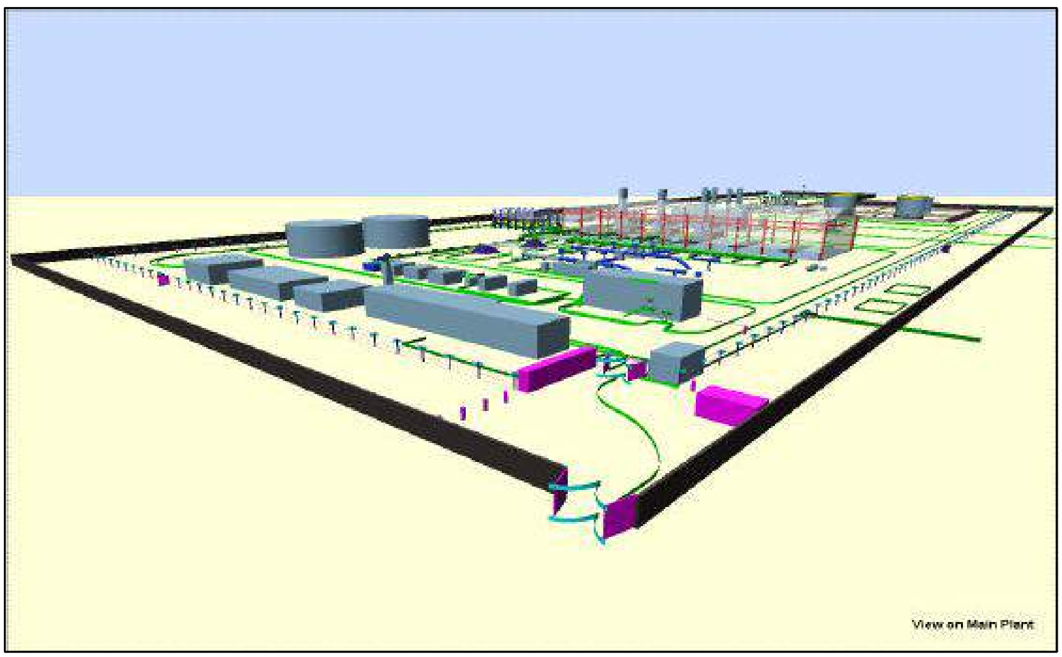
The proposed pump stations PSG1 (KP3.6) and PSG2 (KP87.0) are expected to occupy an area of approximately 8 to 9 hectares and will include the following facilities:

- Five mainline pumps and dual fuel turbine drivers in parallel (four would operate at 80% capacity or greater, with a fifth on standby)
- Station bypass piping
- Fuel storage facility with bunding
- Crude oil topping units and produced fuel storage (for fuel production should gas not be available from the proposed SCP. A dedicated flare will be associated with this facility if a crude topping plant is installed)
- Site for future installation of a fuel gas conditioning unit (pressure control, filtering, heating) and metering (provided by the SCP) in the event that Shah Deniz gas is available for the pump turbine drivers and site generators
- Utilities (power generation, potable water, nitrogen, air, open and closed drain systems
- Wastewater treatment facilities
- Firewater system including fire ring main, jockey pumps, an electrically driven fire pump, two diesel driven fire pumps, fire monitors, foam monitors, a deluge system within the pump house, sprinkler systems within all buildings, and a retention pond
- Three diesel/natural gas fuelled generators to provide on-site power generation
- Gas conditioning (including pressure control, filtering, heating, etc) and metering facilities (provided by the SCP facilities) in the event that the pump turbine and generator drivers are gas fuelled
- Fiscal metering package (PSG1 only). An additional gas metering package may be installed for fiscal metering of exported gas for the SCP Export project
- Local control room, controls and telecommunications system with an uninterruptible power supply (UPS), offices, warehousing, workshops, accommodation and a security gate house

- Lighting:
  - 400W high pressure sodium (HPS) mounted on 10m permanently erected columns for area lighting
  - 250W HPS mounted on 10m permanently erected columns for perimeter/security lighting and at the entrance of the main gate
  - 2x40W high efficiency fluorescent fittings as supplementary lighting at outdoor pumps and packages
- An emergency helicopter landing and takeoff pad (external to the site)
- Permanent accommodation (mess hall and single rooms with en-suite facilities) for up to ten operators
- Security gate-house
- Remotely operated Emergency Shutdown (ESD) valves at the inlet and outlet of the facility
- Pipeline inlet / outlet flow measurement
- Pig receiver and launcher suitable for accommodating intelligent and other pigs
- Wax handling and disposal system

For illustrative purposes only, Figure 5-4 presents the typical layout of a pump station.

Figure 5-4 Indicative pump station configuration



5.6.2.1 Mainline oil pumps

It is proposed that five pump units will be installed in parallel, and housed within a dedicated building. It is expected that three pumps would be installed initially, with a further two pumps installed approximately five years after initial production (in order to efficiently meet the production profile presented earlier). The main line crude pumps will be turbine driven (see below) and will have sufficient capacity for one pump and driver to remain on standby during normal operation (eg initially 3 pumps, followed by 5 pumps).

5.6.2.2 Mainline oil pump drivers

Each mainline oil pump will be driven by a dedicated dual fuelled turbine of Solar Mars 100 type or similar. Each turbine will provide approximately 8MW duty at peak production, and operate initially on crude topped distillate (CTD) fuel produced at PSG1 (see below). The preferred environmental option is for pump drivers to operate on natural gas, and therefore will be capable of operating on gas should this become available at a later stage from the SCP project. In order to use gas from the SCP for the pump drivers, a gas metering and pressure regulating station will be necessary at the pump station.

Pump drivers will be installed in two stages to meet the proposed production programme as noted above.

Each mainline oil pump will be driven by a dedicated dual fuelled (CTD and gas) turbine of Solar Mars 100 type or similar. Each turbine will provide approximately 8MW duty at peak production, and operate initially on CTD fuel produced at PSG1 (see below). The turbine systems will be designed to operate on gas (should this become available at a later stage from the SCP project). Pump drivers will be installed in two stages to meet the proposed production programme as noted above.

All emissions from turbine exhausts will be vented to atmosphere via stacks, the height of which has been determined on the basis of detailed air dispersion modelling. It is currently anticipated that the stacks will be at least 28m above prevailing ground level (see Section 10 Environmental Impacts and Mitigation). For further details on the emissions modelling process undertaken for the pump drivers, see Appendix E, Annex II.

For safety and performance maintenance, the turbines will have the ability to shutdown via the plant Emergency Shut Down (ESD) system.

5.6.2.3 Emergency shut down valves

During Phase 1 of the development, ESD valves will be installed at the perimeter of the pump station site. The valves will be full bore, hydraulically actuated, suitable for pigging operations, and will fail to the closed position.

Shut down of the BTC pipeline system will be initiated manually in response to an ESD situation or predetermined abnormal operating conditions.

5.6.2.4 Facilities power generation

Power generation at pump station sites will be achieved by three diesel generators, each providing 50% (1.2MW) of the sites power requirements. At any one time, two generators will operate while the remaining one generator provides a back-up. Exhaust gases from the generator engines will be emitted to atmosphere via appropriately designed vents. Emergency and essential power will be provided for instruments and telecoms.

5.6.2.5 Site storage tanks

A number of storage tanks will be included within the pump stations. The principal tankage will be as follows:

- Fire water storage tank
- Crude surge relief tank
- Storage tank for pump driver diesel supplies (contingent on the adoption of diesel fuel alternative for the pump drivers)
- Naptha/residue buffer tank

All hydrocarbon storage tanks will be provided with secondary containment designed to minimize environmental impact in the event of a spill.

5.6.2.6 Crude topping unit

The crude topping distillate fuel will be compositionally and physically and chemically similar to diesel. The distillation process would be undertaken at a purpose designed and built CTP located within the pump station facilities.

A summary of the key features of the CTP is presented below:

- The topping plant would be capable of producing up to $248m^3$/day of diesel
- Of the crude taken from the pipeline, approximately 30% will be converted into diesel fuel with the residual 70% that is unsuitable for use as diesel being re-introduced into the pipeline crude stream
- Sulphur content of the diesel is expected to be less than 0.1% by weight (based upon the sulphur content of the most common blend of exported crude)

The processed diesel will be stored in a dedicated storage tank located within the pump station facility.

It is proposed that at first export, one topping plant would be installed and would operated only at PSG1, meeting the demand of all AGIs during early operation. CTD would be transported to PSG2 and other AGIs by road tanker (approximately three tankers per day) or rail tanker.

Approximately five years after initial crude export, a second crude topping plant would be installed at PSG2 to meet increased CTD demand in later operation. Should Shah Deniz gas become available from the proposed SCP Export system, a second system would not be installed.

Emissions to the atmosphere from the operation of the CTP would be vented through an appropriately designed stack.

5.6.2.7 Metering package

A fiscal quality metering will be installed just west of the Azerbaijan-Georgian border at KP3.6 within PSG1. This package will allow the measurement of oil flow quantities for fiscal and custody transfer purposes.

5.6.2.8 Buildings

Table 5-2 lists the main buildings that will be present at the pump station.

Table 5-2 Building list for PSG1 and PSG2

Building title	Approximate Height (m)	Approximate Plan Area (m^2)
Gate house	4	20
Pump station control building	5	400
Sub-station	7	180
Pump shelter	10	2,200
Warehouse and maintenance area	6	600
Fire water pump house	5	150
Pig launcher/receiver shelters	5	100
Strainers maintenance shelter	5	500
Accommodation	4	600

5.6.3 Pigging facilities

A pipeline integrity gauge (PIG) is a device that is used for internally monitoring and cleaning pipelines. The specific characteristics of pigs are highly variable and depend greatly on the purpose for which they are to be used. This ranges from at the simplest cylindrical foam blocks used for cleaning to highly developed intelligent pigs used for remote detailed monitoring of pipeline wall thickness, corrosion and damage characteristics. In most instances the mechanism for transit through the pipeline is relative pressure and flow of the fluid within the pipeline. All pigging operations require a means of loading pigs into the pipeline and retrieving them from it. These locations are respectively referred to as pig launchers and pig receivers or collectively as pigging facilities. The BTC pipeline has been designed to facilitate the use of cleaning and inspection pigs.

Pigging operations will be controlled locally and will be performed for:

- Commissioning
- Cleaning, including wax and debris removal (to maintain pipeline efficiency)
- Corrosion control
- Pipeline inspections (eg intelligent pigging) for integrity management

Intelligent pigging will be carried out periodically (approximately every five to ten years) to check the integrity of the BTC pipeline. This is achieved by recording any changes in the BTC pipeline thickness and shape, and by inspecting for defects and cracks. Cleaning pigging will be undertaken more regularly, with the frequency being determined principally by the rate of wax build-up in the BTC pipeline. It is anticipated that such pigging will occur as frequently as once or twice a week for the duration of the BTC pipeline operation.

Three pigging facilities are proposed for the Georgian section of the BTC pipeline, at the locations shown in Figure: Maps 5-1a-e. Of these, two will be located at the pump station facilities, the third as a stand-alone facility (IPSG1 at KP182.7). A fourth IPS may be installed further downstream than IPSG1.

The number of the pigging stations has been determined for the BTC export system based on maintenance pigging by considering:

- Wax deposition rate(s) for the produced crude
- Degree of wax removal during pigging exercises
- Pigging frequency studies with and without intermediate pigging stations

The intermediate pigging stations will include the following features:

- Onsite power generation (two diesel or topped crude fuelled engine driven generator sets). These generators would be operated on SCP natural gas should this become available later in project development)
- Wax/crude transfer pump (for re-injection back into the pipeline from closed/open drain tanks or to road tankers for off-site disposal)
- Pig handling equipment, including cranage
- Pig launcher/ receiver
- Open and closed drain system
- Lighting
- Buildings, the most significant of which will be:
  - A security gatehouse ($22m^2$)
  - Administration/maintenance/warehouse building ($300m^2$)
  - Pig launcher ($100m^2$)
  - Maintenance shelter ($100m^2$)
  - Telecoms, ICSS and Power generation ($60m^2$)

The pigging stations will be self-sufficient in power (derived from diesel fuelled generating sets) and will be provided with uninterruptible power supply facilities to ensure essential and emergency supplies for instrumentation and telecommunications systems.

5.6.4 Pipeline valves

Valve stations will be located along the BTC pipeline route to facilitate maintenance and to isolate sections of the BTC pipeline in the event of accidental leakage. In each instance the valve bodies will be buried in-line with the pipeline.

Two forms of valve station are proposed:

- Block valve stations, housing valves that can be remotely operated (actuated) or can be closed manually (eg by operatives working at the valve site) to restrict or stop pipeline flow
- Check valve stations, housing simpler valve devices that rely on gravity/reverse flow to close automatically when the pipeline flow is interrupted. These valves cannot be manually or remotely closed. Check valve stations involve a minimal land-take and require no additional power to operate the valve

A quantified risk assessment (QRA) was conducted, which included environmental sensitivity risk factors, in addition to a block valve spacing study to support the selection and locations of valves. Environmental sensitivity risk information was provided by various consultants supporting the development of this ESIA and included:

- Major water courses including rivers or canals
- Lakes and reservoirs
- Wetlands
- Nature reserves and parks
- Features that channel water to underground aquifers
- Geohazards (eg landslides, geological faults)
- Areas of high population density or settlements considered to be particularly sensitive to disruption

The provisional locations for the valve stations are listed in Table 5-3 and illustrated on Figure: Maps 5-1a-e. Check valves have been located at specific sites to prevent backflow into environmentally sensitive areas in the event of a spill. To ensure check valve effectiveness, the valves are located such that adequate back-pressure will be generated to shut the valve. The final locations of these facilities will be defined through the ongoing detailed engineering design process.

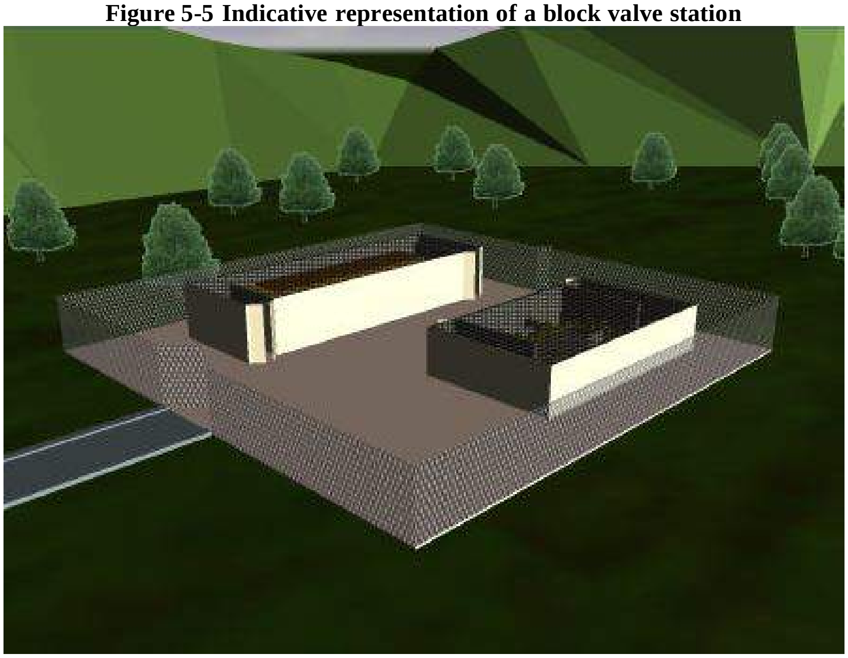
Table 5-3 Preliminary pipeline valve & facility locations

KP	Valve Type	Naming Convention
9.0	BALL valve	GB01
17.7	CHECK valve	GC02
28.3	BALL valve	GB03
34.9	CHECK valve	GC04
51.3	BALL valve	GB05
55.9	CHECK valve	GC06
76.5	CHECK valve	GC07
94.2	CHECK valve	GC08
109.5	BALL valve	GB09
119.0	BALL valve	GB10
128.5	BALL valve	GB11
137.0	BALL valve	GB12
138.5	CHECK valve	GC13
146.7	CHECK valve	GC14
154.4	BALL valve	GB15
161.3	BALL valve	GB16
178.8	BALL valve	GB17
187.3	CHECK valve	GC18
196.9	BALL valve	GB19
205.1	BALL valve	GB20
213.1	BALL valve	GB21
221.4	BALL valve	GB22
223.6	CHECK valve	GC23
237.9	BALL valve	GB24
243.5	CHECK valve	GC25

The block valves used for the remotely operated sites will be inline, full-bore and fully welded. They will be suitable for pigging operations and designed to fail in the "as is" position (eg the position in which they are at the time of failure). Each block valve station will be located within a compound measuring approximately 20m by 20m.

At the block valve sites, the valves themselves will be located underground with the valve actuator mechanism located above ground within a concrete structure. Each site will include an equipment room, which will also be within a concrete structure. A welded mesh wire fencewith thin section steel posts will define the perimeter of each site. The typical layout of a block valve is illustrated in Figure 5-5.

Figure 5-5 Indicative representation of a block valve station



Power supplies for the block valve sites will be provided by a diesel generator capable of providing the full power requirements for that site. Electrical power will be used at the sites both for the operation of the pumps associated with the hydraulic valve actuation mechanisms and for ancillary activities such as lighting, heating/ventilation/air conditioning (HVAC), PCUs, telecommunications and security system operation. Essential and emergency loads will be powered from an uninterruptible power supply.

No power supply is currently envisaged at the check valve sites. Full valve opening during intelligent pigging operations will be achieved using a manually operated device, which will be an integral component to each valve unit. Manual check valve opening will not be required for routine "maintenance" pigging activities.

Valve stations will not be manned under routine operating conditions. The communications system (described in detail below) will transmit data about block valve status, operating conditions (including temperature and pressure) and security to the Sangachal and Ceyhan control centres.

5.6.5 Control/telecommunication systems

The basis of the control philosophy is for a manned, centralized control room at the Sangachal Terminal. Full backup (alternate) control will be provided via the control room at the Ceyhan Terminal in Turkey. Remotely operated equipment will be installed at the block valve sites, metering, pump and intermediate pigging stations. These control units will contain the field interface instrumentation equipment for control, monitoring, supervision, shutdown and fire detection at the facilities.

A telecommunication system will be installed to provide inter-site communications along the BTC pipeline route. An optical fibre transmission system will be installed as the basis for this system. The optical fibre cable will be installed concurrently with the BTC pipeline in the same trench. The network will support a wide range of communications services including:

- Telephone and facsimile
- ICSS data communications
- Information technology data communications
- Closed circuit TV signals for security and surveillance
- Other miscellaneous traffic or signals

The telecommunications optical fibre system has been designed such that no single failure will cause loss of ICSS communications to any of the stations or the main operating areas at Sangachal or Ceyhan. This will be achieved by using a system configuration that has self-healing characteristics and is designed with an integral level of redundancy for the primary communications system and through the provision of a satellite back-up link.

If multiple simultaneous failures occur, communications will be lost to any stations between the failure points, but the operation and safety of the isolated sections of the pipeline system will be maintained under control of the local station ICSS. When operating under these conditions of isolation, the station is termed as being in “local mode”.

In the event of single or multiple failures of the communication system, communications satellite (INMARSAT) links will be available to provide essential voice co-ordination between operating personnel at strategic locations. Telephone/facsimile co-ordination of these strategic stations, operating in local mode, is expected to be an adequate contingency until primary communications are restored. The strategic stations will include all pump stations and the main control centres at Sangachal and Ceyhan.

5.7 OUTLINE OF PIPELINE SYSTEM CONSTRUCTION

5.7.1 Construction overview

Construction of the pipeline and associated facilities will be undertaken by a contractor, or multiple contractors, experienced in major pipeline construction, who will be contractually obliged to complete the works in accordance with applicable government regulations and requirements, project permits and authorizations and BP policies, plans and specifications.

Pipeline construction is a sequential process and comprises a number of distinct operations, undertaken by a large range of specialized and general crews (teams of workers and the necessary plant and equipment collectively referred to as the construction spread). Pipeline construction would be achieved using one or more conventional construction spreads to accomplish pipeline installation, and one or more special section crews (eg tie-in crews) to accomplish watercourse crossings and other specialized pipe installations.

The construction of the pipeline will require a number of temporary facilities, which will include worker camps and pipe storage yards. Each of these facilities is described in more detail below.

Although pipe lay rates of up to 800m / day could be achieved under ideal circumstances at this stage in the project it is estimated that a more typical pipeline lay rate estimate for BTC would be in the region of 500m / day. Such lay-rates are entirely dependent upon working conditions (solid and drift geology, hydrology, prevailing weather conditions), as well as factors such as construction programme and management and project management. The sequencing of the construction activities and the direction of construction will be at the construction contractor's discretion.

The construction programme will be conducted in accordance with the HGA and applicable government regulations, contractual requirements, applicable permits and authorizations, and company-approved drawings, plans, procedures and specifications. However, within this regulatory framework, the selection of many of the detailed construction methodologies and plant for the BTC pipeline project will be the responsibility of the successful construction contractor(s). As such, much of the more detailed approach in terms of construction methodologies has yet to be defined. This Section aims to present an indicative outline of the approaches that are likely to be adopted by the contractor, recognizing that some details may change at a later stage of the project.

Prior to the commencement of each element of the construction programme, the construction contractor(s) will develop detailed designs, drawings and method statements for the work to be performed. These documents will incorporate the reasonable requirements of landowners and occupiers, the mitigation measures outlined in this ESIA and the requirements of the regulatory authorities in Georgia.

5.7.2 Pipeline right of way

The ROW as referred to throughout this ESIA, is more correctly known as the Facilities Construction and Installation Right of Way (FCI ROW). The FCI ROW is the corridor that is required for the pipeline construction and installation activities and is generally 32m wide.

Where the proposed BTC pipeline route intersects particular environmentally sensitive areas, public roads and other elements of infrastructure, the ROW may be less than 32m. A schematic of the ROW is presented on the following page.

It should be noted that a reduced working width can only be achieved for a limited distance without seriously impeding construction activities, and that reduction of the working width can lead to other impacts such as additional access road construction. In such situations, an optimized construction technique will be selected with the aim of balancing all considerations and constraints.

At certain areas, particularly crossings (eg other pipelines, roads, watercourses, etc), additional temporary workspaces will be necessary to manage the additional spoil, plant areas and materials. These areas will be clearly identified along the ROW and approved prior to their use.

Figure 5-6 Indicative standard layout of Right of Way during construction

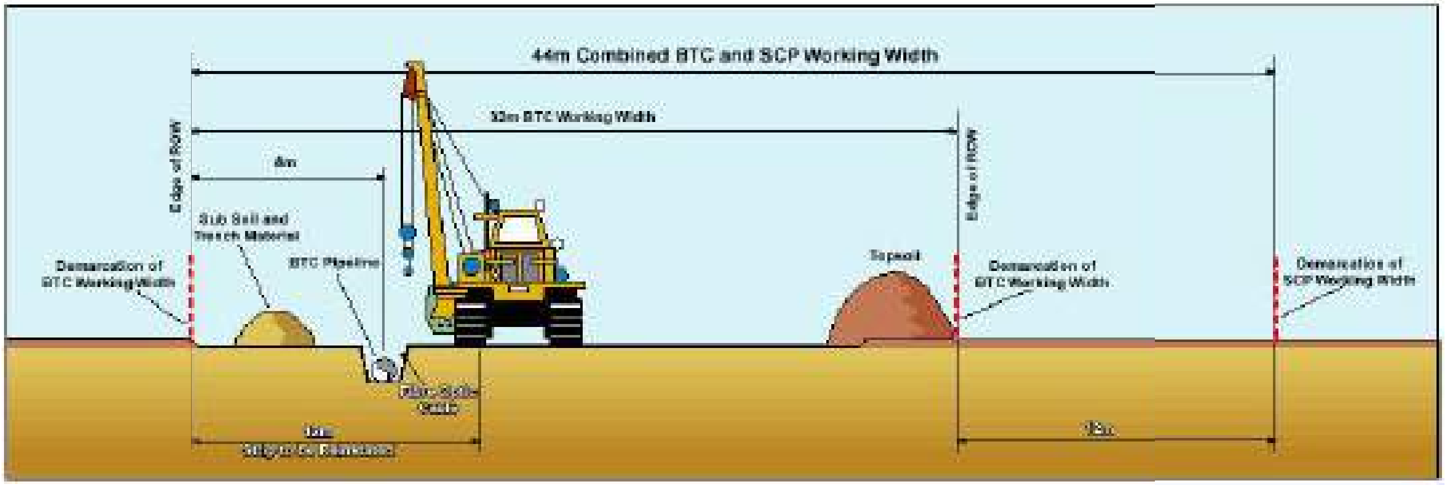
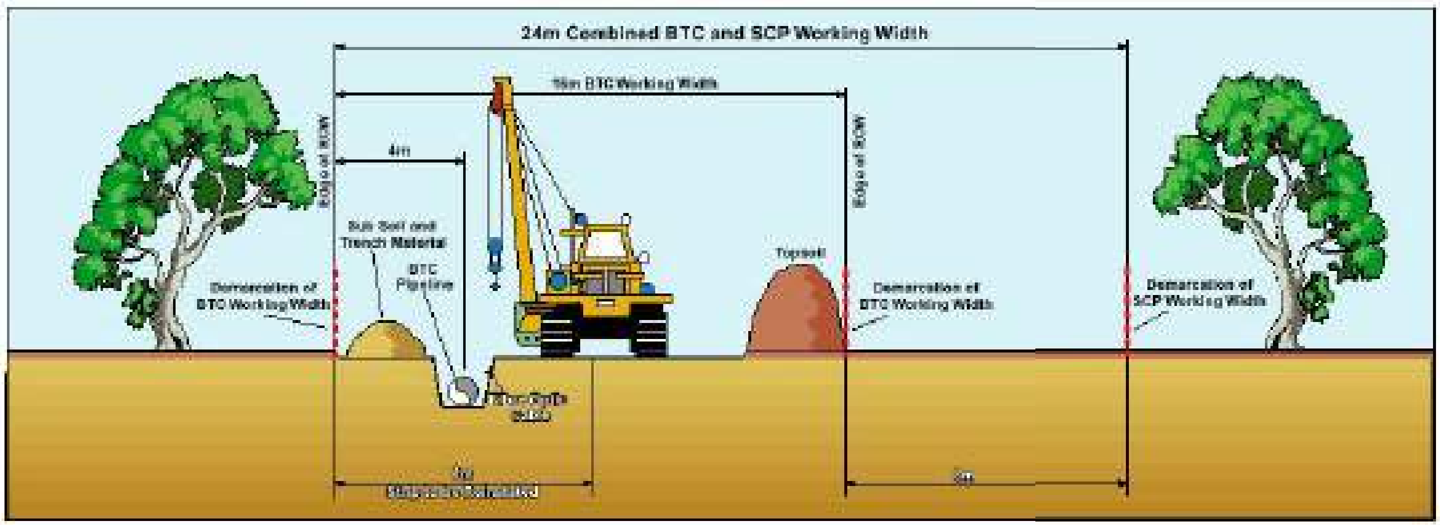


Figure 5-7 Indicative standard layout of Right of Way (through restricted areas) during construction



Not to Scale

5.7.3 Pre-construction works

All pipeline construction activities will be undertaken within the ROW. It should be noted however that a wider working width may be necessary at some locations, particularly where non-standard construction procedures are required (eg service and river crossings, the ends of hydrostatic test sections). All facilities and AGI construction activities will be conducted within fully demarcated working limit areas defined on the basis of the facility design and the construction contractors method statements.

Before construction begins the route will be surveyed and marked. This will establish precise route alignment particularly in relation to important environmentally, archaeologically or socially sensitive sites. As far as practicable, the route has been chosen to avoid and/or minimize direct impacts on these resources.

5.7.4 Access roads

The road conditions in a number of areas of Georgia are poor, with defects ranging from minor cracking of surface materials to significant potholing, and, in some cases, complete washout. To give adequate and safe access for equipment, materials and personnel to the construction sites and permanent facilities a number of existing roads and tracks will need to be upgraded and the construction of some new access roads will be required. Preference will be given to upgrading and/or widening existing routes rather than constructing new roads.

The details of any new permanent roads will be agreed in advance with the relevant authorities. Typically, a temporary access road will consist of a layer of crushed stone which can be removed when no longer necessary. Permanent road repair/upgrade will be in accordance with approved plans and specifications and will typically be achieved using a combination of asphalt, concrete and aggregate.

The engineering design team has identified a number of potential access routes, which will be investigated by the construction contractor(s) in terms of suitability for the logistical requirements of that contractor. Table 5-4 summarizes an estimate, generated by the engineering design team, of the road lengths that will either be established or, in the case of existing roads, used for the project. It also includes an estimate of the structures (principally bridges) that will require upgrade to allow them to sustain the anticipated traffic volumes and loads. These estimates are subject to ongoing review and verification.

Table 5-4 Potential roads and structures for use by the project in Georgia

Upgrade Category	Estimated Sum of lengths (km)
Upgrade / maintain existing highway	234
New access roads – retained all-weather	22 (one lane)
	<1 (two lane)
New access roads – removed / reinstated	14
Temporary bridges	1

5.7.5 Pipe and equipment transport to the ROW

An important aspect of the construction process is the road transport of pipe sections, plant and other equipment from established port and rail networks within Azerbaijan and Georgia to the construction areas, dedicated storage areas and worker camps. It is anticipated that the majority of such transportation will be accomplished through the use of the existing infrastructure in (port, road and rail). A description of the existing infrastructure within Georgia is presented in Section 8, Environmental Baseline.

5.7.5.1 Import of pipe and equipment

Pipe sections and construction and operational equipment will be imported to Georgia via either Poti or Batumi Port (the choice of port is at the discretion of the construction contractor).

Additionally, it is likely that pipe and equipment needed for construction of the Azerbaijan section of the route will also be imported through either Poti or Batumi. Transport quantities and associated activities are covered in the Azerbaijan ESIA.

5.7.5.2 Poti Port

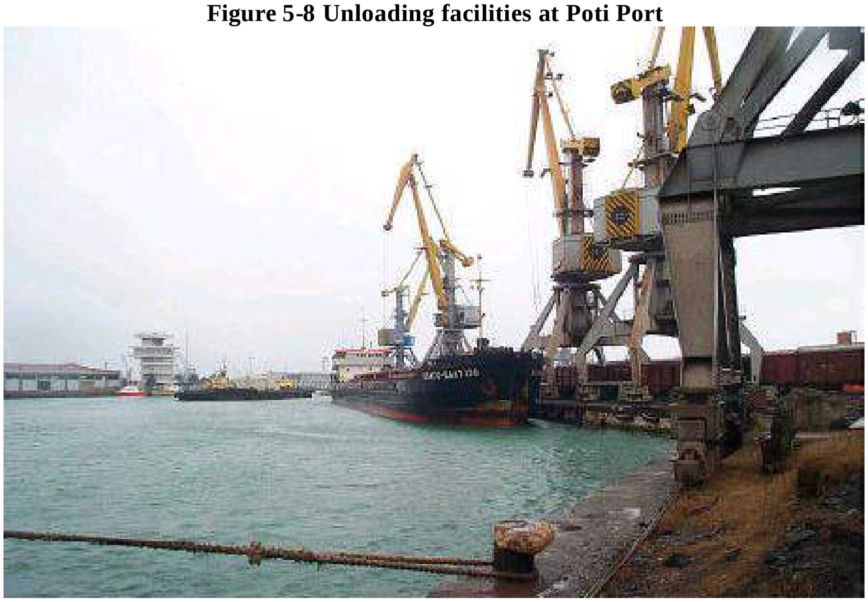
Poti Port is located on the eastern coast of the Black Sea and occupies a total area of approximately 49 hectares. Currently the port has 14 berths with a total frontage of 2,650m. 11 berths are equipped with portal cranes each with a capacity of between 6 and 40 tonnes. These berths are directly linked to railroad spurs. A full description of the port and its capabilities is given in Section 8, Environmental Baseline.

5.7.5.3 Line pipe delivery

Line pipe delivery represents the majority of shipping movements. Ships with a capacity of 10,000 to 15,000 tonnes will transport pipe sections to the port. For the import of pipe sections for the BTC project in Georgia, there will be between nine and fourteen ship movements, depending on the capacity of ships used. According to Port Authorities, the most suitable berth at Poti for BTC ship unloading is berth 3, owing to its size and crane capacity. This berth along with associated stevedores, crane operators and laborers was used for the handing of the pipe for the WREP.

There are two rail spurs serving berth 3, both of which are straddled by four unloading cranes. The rail spurs permit the positioning of up to 32 railcars in a double row alongside the discharging vessel thus minimizing the movement of cranes and traffic on the berth (Figure 5-8).

Figure 5-8 Unloading facilities at Poti Port



The rail spurs are directly connected to Poti City Railway Station approximately 4km from the port. Here, rail wagons will be assembled and prepared for taking delivery from ship. Rail wagons used are open 'gondola' wagons each with a capacity of 64 tonnes.

At Poti station, rail wagons will be inspected by railway mechanical engineers. Wheels, bearings, connections, dunnage, lashing, pipe end protection, and safety of loading will be checked. Each rail wagon will have its own railway goods consignment note detailing station of departure, station of receipt, importer, cargo count, cargo description and gross weight. Individual wagons will then be shunted together to form 'Block Trains'. The capacity of one Block Train is 45 wagons carrying a maximum of 2,500tonnes. Block Trains move up to Zestaphoni (approximately 129km) where a mainline engine takes over from the Poti Station engine and the train is split up into 'Transit Rail Wagons' and 'Local Delivery Rail Wagons'. These wagons then take pipe sections to designated pipe yards.

5.7.5.4 Associated equipment delivery

The source, amount and type of equipment to be delivered as part of the project will be determined by the construction contractor. Major stationary and mobile plant and equipment required for construction activities are detailed at the end of this section. The procedure for off-loading plant and equipment and onward transportation to the pipeline ROW will be the same as that detailed above for line pipe delivery.

If required, additional facilities are available for the storage of plant and equipment before transportation from the port. Three storage yards within 2km of the port have been proposed as potential contingency storage areas should rail wagons not be immediately available to receive cargo from ships. Each yard has its own rail spur link to the port. These yards are described in Section 8, Environmental Baseline.

5.7.5.5 Pipe and equipment distribution in country

A typical pipe block train consists of 45 rail cars (it should be noted that not every siding being considered can accommodate 45 rail cars therefore shunting trains would be necessary). Rail cars would be protected with dunnage to prevent damage to the pipe coating. Cranage would be required for the off loading and loading of pipes on to flat bed transport vehicles.

For road movements of pipeline sections it is anticipated that there would be three pipes to each truck resulting in the order of 6,600 truck movements to offload rail cars on to vehicles for transportation to dedicated pipe storage yards. A comparable number of movements would be required to deliver the pipe from the pipe storage yards to the construction corridor, where the pipe storage yards are not located adjacent to the ROW.

A number of suitable sites have been identified for pipe storage yards as presented later in this Section. Pipe sections would be delivered to the pipe storage yards, and consequently to the ROW by trucks using mainly established access routes.

5.7.6 BTC pipeline construction schedule

It is currently anticipated that the pipeline construction activities in Georgia will last for approximately 15 months.

It is anticipated that a single construction spread will be used for most of the pipeline installation. One or more special section crews will carry out construction at river crossings and other special features (eg geotechnically sensitive areas).

5.7.7 Temporary construction facilities

Temporary facilities comprise pipe/materials storage yards, warehousing, temporary project offices and worker camps. Earlier surveys have identified a number of suitable sites, however the final location and number of sites will be determined by the construction contractors and agreed with the BTC Management Team. The construction contractors will not be limited to the potential sites discussed in this section, however the construction contractor will be required to assess the environmental/social sensitivity of any additional or alternative sites prior to their approval for adoption.

The identified potential locations for temporary facilities and temporary roads are presented in Figure: Map 5-3. The characteristics of the anticipated temporary facilities are discussed in further detail in the following Sections.

5.7.7.1 Pipe and materials storage yards

Locations

The appointed construction contractor will decide which locations are to be used for pipe storage. The construction contractor will be responsible for the completion of environmental assessments to at least the same standard for any alternative locations to those currently identified.

Potential sites for pipe storage yards have been identified in earlier surveys based upon the following criteria:

- Availability of adequate rail siding or spur lines
- Sufficient ground for pipe storage to meet anticipated quantities
- Reasonable road access/egress

- Access to the ROW
- Communications (landline/mobile systems)
- HSE requirements, in particular those relating to transportation
- Availability of local labour force
- Route maintenance
- The duration of occupancy required for BTC/SCP

Table 5-5 presents a number of sites considered appropriate considering the above criteria and may be adopted for project construction.

Table 5-5 Proposed location of temporary facilities, Georgia

Proposed Locations	Total Area (m^2) / Pipe Storage Capacity (km)[a]	Remarks
Gardabani, two locations : Site 1	Not estimated	Large site adjacent to a power station. Large lay-down area available including 50x30m area of hard standing
: Site 2	Not estimated	Limited area at a small oil storage depot located adjacent to the main railway line
Gatchiani	18,000m^2, ~ 40km+	Former WREP storage yard, requiring little upgrade (apart from access road)
Marneuli	35,000m^2, unlimited pipe storage capacity	Located at the eastern town boundary of Marneuli, approx. 350m x 100m. Access track preparation required
Kotishi	Not estimated, potentially unlimited pipe storage capacity	Located approximately 7km from Marneuli on the main road to Tetriskaro
Tetritskaro	Not estimated, potentially unlimited pipe storage capacity	Located south of the town of Tetriskaro. May require preparation of the available rail spur and lay down area
Tsalka, two locations :Site 1	Not estimated, potentially unlimited pipe storage capacity	Located within the main rail location at Tsalka, to the south east of the village
:Site 2	Not estimated, potentially unlimited pipe storage capacity	Would require construction of a rail spur to run north west to the area. Access track may require upgrading
Borjomi	N/A	Rail siding only – pipe delivered here would be transported to Tsikhisjvarra or Andeziti via Bakuriani
Tsikisjvari	Not estimated, 46km	Pipe to this storage yard would need to be transported via road as no useable rail link exists (this site is about 34km by road from Borjomi)

Proposed Locations	Total Area (m^2) / Pipe Storage Capacity (km)[a]	Remarks
Andezit	Not estimated, 64km	Located between Bakuriani and Tsikkisjvara. No existing services at this site
Atskuri	Very limited at this rail link site	Current scrap metal operations are ongoing at this site. Very limited storage space exists for pipe storage at this site, however available surrounding areas may provide considerable pipe storage
Akhaltsikhe	50,000m^2, not estimated	Current metal storage occurring at potential lay down areas
Vale, two sites :Site 1	17,000m^2, not estimated	Near to Vale train station
:Site 2	Not estimated, 15km	Vale train station, located to the north of the town. Two lay down areas are available at this site, near to an oil depot and pumping / metering station
[a] Values are estimates only		

5.7.7.2 Facilities

It is anticipated that the pipe yards will include the following facilities:

- Fabrication and pre-test area
- Double joint yard
- Pipe carrier turning circle
- Workshop
- Tyre bay area
- Inspection facility
- Electrical generators
- Diesel fuel storage tanks with secondary containment
- Accommodation area
- Medical facilities
- Canteen facilities
- Soak away areas
- Offices
- Communications including radio and mobile systems
- Waste material storage and handling
- Equipment storage areas
- Concrete coating and fabrication shop
- Security
- Waste storage and potentially incineration facilities

Electrical power for the pipe yards will be generated locally by diesel generator sets. A diesel powered emergency generator will also be provided to maintain a non-interruptible electrical supply. As the pipe storage yards will be manned, wastewater and sewage collection and treatment will be provided. The system and the method of disposal will comply with the project HSE policy and waste management strategy.

5.7.7.3 Worker camps

Locations

Potential sites for worker camps have been identified in earlier surveys based on the following criteria:

- Location
- Suitability of ground
- Communications (landline/mobile systems)
- HSE requirements, in particular those relating to transportation
- Access and egress, routes to ROW and national road system
- Availability of local resources, including labour force
- Their required period of occupation

It is anticipated that the camps will be located:

- At or near to construction sites of proposed AGIs
- At or near road/ rail depots
- On previously developed sites where space may be offered

A number of worker camps will be erected in Georgia and each of these facilities will be located in accordance with the project environmental and social assessments. The final locations of the camps are to be decided by the construction contractor, however, the locations which have been identified by preliminary assessments carried out by the project team in Georgia are indicated in Figure: Map 5-3.

It is considered very likely that the contractor will choose to adopt two or more of these locations as their worker camps. Should the contractor choose to use alternative sites they will be required to undertake additional environmental and social assessments to at least the same standard and to justify their selected sites to the Project Management Team.

Facilities

It is anticipated that each camp will measure at least 500m by 500m and include the following facilities:

- Accommodation and offices
- All relevant utilities – water supply and treatment, electricity
- Medical suite
- Site security – security hut at gate
- Helipad / airlift facilities (if deemed necessary as a result of the development of the project Emergency Response Plan)
- Maintenance building
- Warehousing
- Kitchens, canteens and cold storage
- All communications – telephone, data and postal services, pay phones

- Paved roads and hard standing for lorries and car parking (concrete or asphalt)
- Boundary fences/walls
- External lighting to roads and walkways
- Storm water drainage
- A prayer room or mosque and other necessary worship facilities
- Fuel storage
- Waste storage and incineration facilities
- Sewage treatment and disposal
- Recreation facilities
- Laundry
- Equipment storage
- Welding gas storage
- Radiographic equipment storage

All power supplies necessary for the camps will be generated locally by diesel generator sets.

Wastewater and sewage collection and treatment will also be undertaken at the camp site. The system and the method of disposal, although currently under development, will comply with the project HSE policy and project waste management strategy.

5.7.8 Construction procedures

5.7.8.1 Setting out/staking of the pipeline route

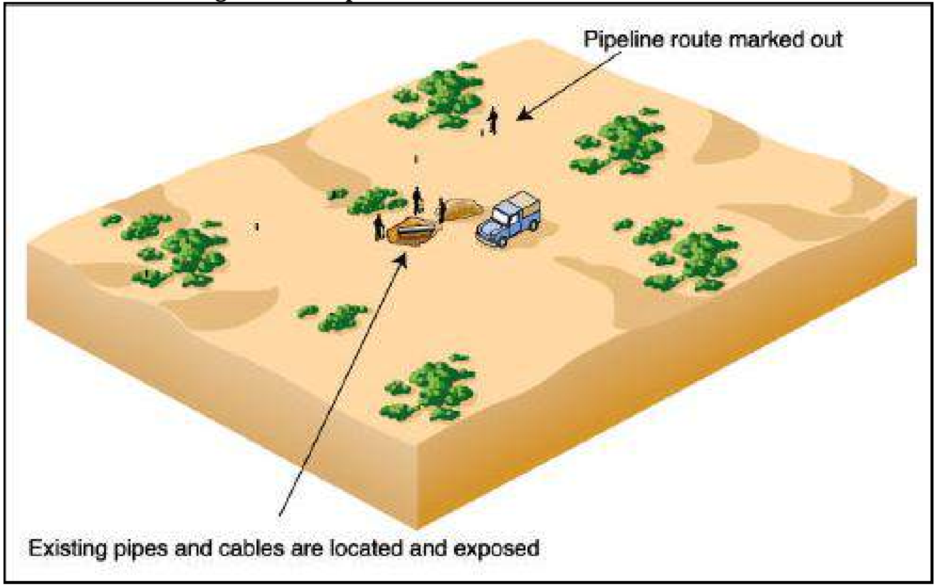
The initial activity associated with BTC pipeline construction is the final surveying and setting out or staking of the ROW, including the pipeline centreline and any additional temporary workspaces. This may include flagging to indicate the construction workspace boundaries. Environmental compliance personnel will participate in the pre-construction resources identification (eg flagging) to indicate environmental resources to be protected during the construction process. Examples of such resources include:

- Identified cultural resources (eg archaeological and monument sites)
- Identified ecological resources (eg tree or plant specimens to be protected)
- Watercourses, setbacks/buffer zones, and wetlands
- Key faunal populations

Sensitive faunal populations that are identified may also need to be relocated.

The following figure illustrates some typical activities associated with the preparation of the ROW.

Figure 5-9 Preparation of the construction corridor



Environmental activities may also comprise additional data collection, rare plant translocation, immediate pre-construction surveys for rare or protected wildlife. In some instances sensitive faunal populations that are identified may also need to be relocated. Other activities such as the location and exposure of existing pipelines and other services will also be conducted at this time.

5.7.8.2 Surface preparation and grading

The BTC pipeline route will need to be cleared and graded to permit the safe installation of the BTC pipeline and associated facilities/AGIs. This process will include the levelling and 'benching' (ie the establishment of flat areas or terraces) of the terrain, stripping of cultivated areas and the removal of scrub, trees and shrubs. Clearance work will be undertaken using hand tools, construction vehicles and earth-moving plant.

To ensure that the ROW can be properly reinstated and to allow the re-growth of vegetation, the topsoil and subsoil will be removed as required and stored separately. Surfaced roads and paved areas that are subject to open trench crossings will be prepared by removing material only directly over the width of the pipe trench. This material will be kept separate from other stripped or excavated material.

Watercourse bank and bed material will be stored separately and will not be placed where flow or drainage will be obstructed.

The topsoil will be stripped across the working width by appropriate earth moving equipment and stored on the ROW. The topsoil stacks will not exceed 2m in height and will be kept free from disturbance to reduce the risk of physical damage and compaction. Generally, vehicle movements will be confined to the 'running track' on underlying subsoil.

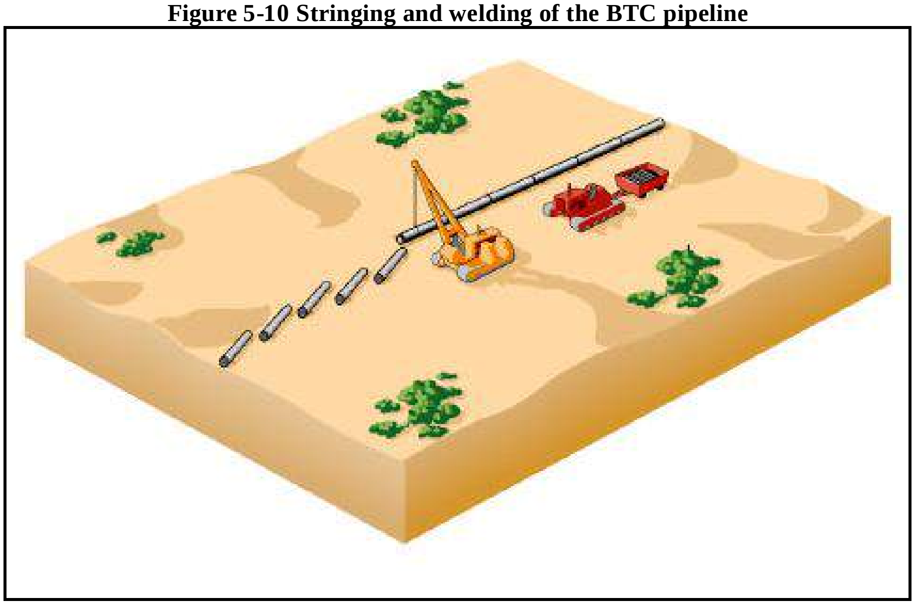
Following topsoil stripping, some areas of the working width may be benched or graded to enable safe working. In undulating areas this process will involve a cut and fill operation to bench or terrace the working width into a safe working profile. In areas of steep terrain, cut material may be removed to an approved spoil disposal location or put to a beneficial re-use; spoil will not be side-cast off-ROW, unless prior approvals have been received. Excess material excavated during grading will be segregated from topsoil.

Where necessary, measures will be taken to maintain the flow capacity of watercourses including ditches and drainage channels that cross the ROW, whilst ensuring a continuous running track for construction vehicles. The measures to be implemented (eg bridging, fluming, fording) will be selected by the construction contractors in consultation with the Project Management Team.

5.7.9 Pipe stringing and bending

Pipe sections will be transported to the ROW, and laid end to end along side the trenchline. The pipe will be strung in a manner to minimize joint overlap and accumulation of pipe and to leave gaps for crossings and for access where necessary to accommodate pedestrians, livestock and, as appropriate, wildlife activities. The pipe will not typically be strung on the ROW more than 5km in advance of the mainline welding. Figure 5-10 illustrates the stringing and welding process.

Figure 5-10 Stringing and welding of the BTC pipeline



Factory manufactured bends will be used for acute changes of pipe direction or elevation along the route. Where less severe bends are required these will be constructed using pipe-bending machines in the field. The quality of the bends will be controlled through the use of approved bending procedures, by witnessing trial field bends before production and by inspection of completed field bends.

5.7.10 Pipe welding and inspection

Following stringing and bending, the pipe sections will be elevated onto wooden blocks (eg skids) to the correct height to allow proper alignment of the sections and safe welding. Internal line-up clamps will be used to align pipe lengths.

Welded pipe will be inspected to ASME, ASTM, and British Standards. Non destructive testing inspectors will be suitably qualified (ie to level II of the relevant PCN standard or ASNT-TC-1A standard). Welds will be initially visually inspected, then subject to one or a combination of the following non-destructive testing techniques:

- Radiography
- Ultrasonic testing
- Magnetic particle Inspection (MPI)
- Dye penetrant inspection (DPI)

Rejected welds will be repaired and re-inspected or replaced, as necessary. To minimize the number of tie-in welds below ground level, the pipe will be welded into the longest practicable strings. These strings will take into account third party access requirements across the ROW.

5.7.11 Field coating

The BTC pipeline will be supplied with a factory-applied three-layer polyethylene coating. Field coating will be applied to all welds, fittings and areas where the factory coating has been damaged to provide a continuous coating along the BTC pipeline. Following welding, the joint area will be grit-blasted and a primer coat applied. The final polyurethane pipe coating will subsequently be applied.

The coating will be tested for continuity by means of spark testing, using commercially available high voltage equipment, the voltage of which is discharged via a spark gap.

5.7.12 Trenching

The first step of trenching is the staking and marking of the trench centreline. Where possible, existing third-party services (eg underground cables, pipelines, drainage systems) will also be located and marked prior to the commencement of excavation work. Warning posts and bunting will be erected for overhead cables and temporary crossing points will be indicated.

The trench will be dug to a depth that allows BTC pipeline installation with a minimum of 1m of cover from the top of the pipe to the pre-existing ground surface. The presence of sub-surface structures (such as other pipelines) and surface features (such as hills, rivers or irrigation channels) may lead to a requirement for deeper installation of the BTC pipeline in some areas.

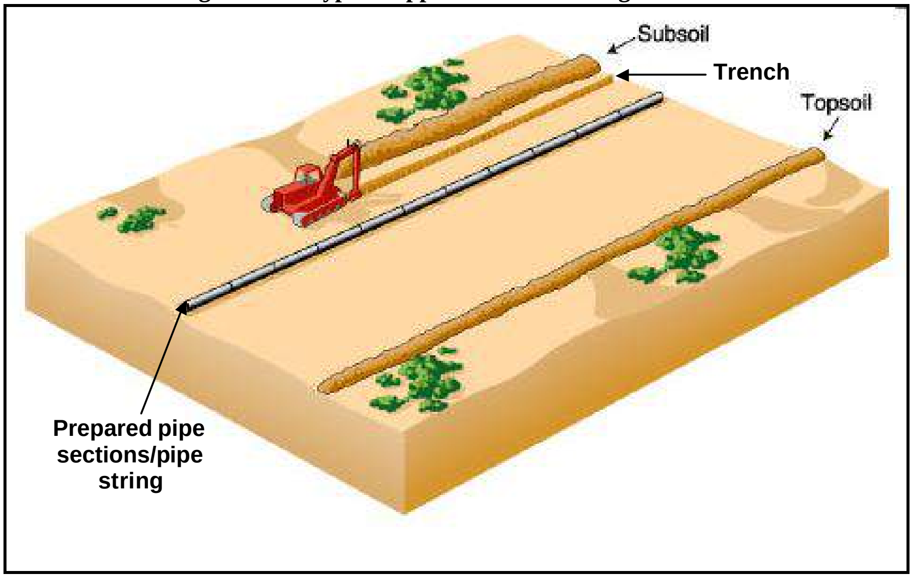
The trenching operation will be undertaken using methods to suit the local terrain and ground conditions. It is expected that trenching equipment will include backhoes and trenching machines. In confined areas, such as areas adjacent to existing pipes, a combination of backhoes and hand tools will be used to open and reinstate the trench.

Up to 15km of continuous trench may be open at any one time. Where the ROW is near settlements, measures will be taken to limit access by the public to the ROW or excavated trench.

Where ground conditions dictate, trench dewatering will be undertaken. When discharge velocities have the potential to create erosion, energy dissipaters will be used to establish sheet flow and the contractor will implement measures to create sheet flow. Trenches will be dewatered in such a manner that no heavily silt-laden water flows into any wetland or waterbody. All trench dewatering water will be discharged away from water bodies, and onto stable surfaces, in a non-erosive manner. In addition to implementing the erosion and sedimentation control measures for trench dewatering, the construction contractor will ensure that all other necessary measures are taken to prevent pollutants from reaching a wetland or waterbody. If no suitable location is available on the ROW (eg if no upland, stable, well vegetated areas are nearby) and discharging of trench water directly on the ROW would cause an unacceptable impact, a discharge location off-ROW may be selected, keeping as close as possible to the ROW. The area of discharge will be reinstated after use. The use of filter bags, detention pits, or similar method may be employed as and when appropriate.

A typical approach to the trenching process is illustrated in Figure 5-11.

Figure 5-11 Typical approach to trenching activities



At locations where it is necessary to provide public access across the trench, safe trench crossings will be constructed. Warning signs and barricades will be erected around the trench, and adequate warning lights will be provided and used during the hours of darkness.

5.7.13 Lowering-in and backfilling

Prior to lowering-in, the BTC pipeline trench will be prepared to accept the pipe. Rocks or debris that could damage the pipe coating will be removed from the trench. Where needed, imported materials, screened to remove rocks, will be placed in the bottom of the trench. Where excavated material is unsuitable for backfilling, suitable materials with the appropriate engineering characteristics may be sourced from commercial sources or ‘borrow pits’.

After pipe joint coating and testing, the section of BTC pipeline will be lowered into the trench. Sideboom tractors and backhoes will be used to lift the pipe and lower it into the prepared trench. Several sidebooms and backhoes are typically used simultaneously to accomplish the lowering-in procedure (as illustrated in Figure 5-12). Once lowered into the trench, each pipe section will be welded onto the preceding or adjacent sections.

Where the BTC pipeline crosses watercourses or the water table is high the BTC pipeline will be either concrete coated (to achieve negative buoyancy), or secured using ground anchors.

The trench will be backfilled with the material taken from the trench in the reverse order to which it was excavated. Screened soil or imported sand may be required as bedding material to protect the coating. The trench will then be backfilled with the remaining trench material, which will be consolidated by tamping or rolling. This process ensures that appropriate compaction of the material in the backfilled trench is achieved and reduces the risk of future settlement, washout and erosion. Care will be exercised to eliminate organic debris, such as branches and chips, from bedding, padding and backfill materials.

In sloping terrain (usually 15 degrees and above), trench breakers (eg bags filled with solid material, inert polyurethane foam, or similar material) will be installed across the width of the trench at suitable intervals and to within 100mm of the existing ground level. Trench breakers act as barriers to subsurface water flows that could channel through the pipe trench, washout the backfill material and potentially expose the pipeline.

Any surplus material from trench excavations will normally be spread within the ROW and within zones that exhibit similar subsoil types. The spreading work will be carried out in a manner that avoids the mixing of soil types to the greatest extent possible. Care will be taken to ensure that the trench spoil is spread beneath the topsoil and is not left on the surface. Where off-site disposal is necessary, it will be disposed of in compliance with project environmental requirements. Where necessary, land drains will be restored as part of the backfilling operation.

Figures 5-12 and 5-13 respectively illustrate the pipe lowering procedure and the backfilling process.

Figure 5-12 Lowering-in of the BTC pipeline

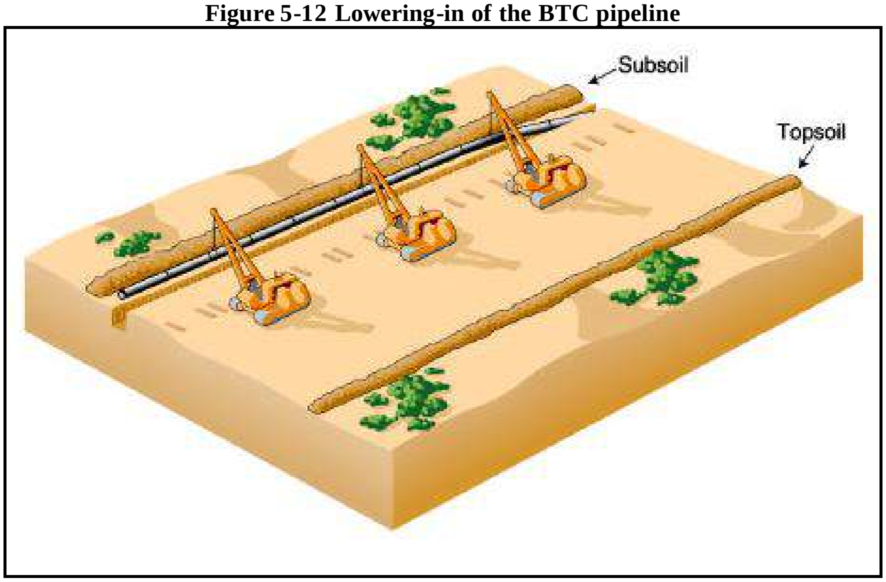
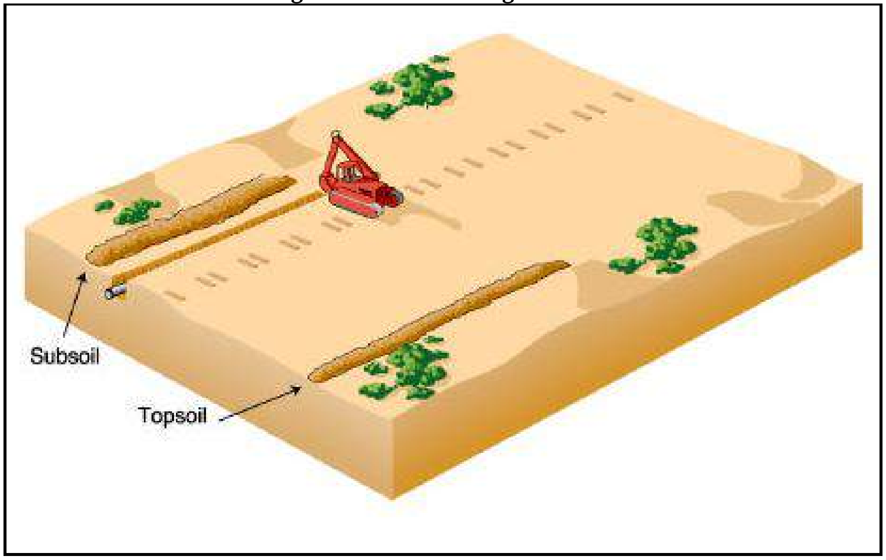


Figure 5-13 Backfilling activities



5.7.14 BTC pipeline crossings

Crossings are defined as the intersection between the proposed BTC pipeline route and pre-existing features such as:

- Rivers and other watercourses
- Public roads and tracks
- Rail tracks
- Underground services
- Geohazards (eg faults)

Crossing techniques for each of the above are discussed below.

5.7.14.1 Watercourse crossings

With respect to crossings, watercourses include canals, aqueducts, drainage ditches, and natural streams and rivers. Table 5-6 presents a summary of the main watercourse crossings along the pipeline route:

Table 5-6 Major river crossings schedule

River	KP
Mtkvari East [a]	29
Algeti River	53
Crossing	115
Ktsia River	137
Mtkvari West	220
Potskovi North	239
Potskovi South	243
[a] To be crossed by HDD. All other crossing open cut technique.	

In addition to measures for active watercourses, the construction contractor will be required to develop specific and approved methods for crossing any intermittent watercourses that may be dry at the time of the construction. These methods will be required to address the potential for the watercourse to become active during construction and also for the accommodation of high-energy events such as flash floods. Additionally, areas with marshes or high water tables may call for similar construction methodologies to those adopted for watercourses. If scouring of the watercourse bed is anticipated, the depth of burial and to the need for additional protective features will be determined through detailed hydrological analysis.

Special construction crews (eg tie-in crews) and equipment will typically be utilized for the installation of pipeline sections at watercourse crossings. A variety of techniques are available for the crossing of watercourses and it is likely that several of them will be employed for the BTC project in Georgia. A selection of common crossing methods is described in more detail below. On the basis of the current site survey work for the BTC pipeline route, it is anticipated that most crossings will be open-cut but that some watercourses will require Horizontal Directional Drilling (HDD).

It should be noted that all of the construction techniques described will be subject to suitable ground conditions, site investigation borehole surveys, the requirements of the consenting authority, an agreed method statement for each crossing, and the applicable environmental compliance requirements.

Open cut crossings

River and stream crossings will generally be constructed using the conventional open cut methodologies as outlined below. All methodologies assume flowing water, or the immediate potential for flowing water during construction. The open cut trench technique will be typically be used in conjunction with weighted (usually concrete coated) pipe. The purpose of the concrete coating is to ensure negative buoyancy of the pipeline and to provide additional mechanical protection. If concrete-coated pipe is not used, a concrete slab, or lean-mix concrete bags, may be buried in the pipeline trench above the BTC pipeline.

In order to avoid interruption of the flow of the watercourse, open cut crossings usually use wet-trenching or flumed water crossing techniques. Where appropriate and advantageous, seasonal constraints on construction activities may be implemented to ensure that crossings are established during low flow conditions.

Pipe to be installed in the crossing is welded, inspected and coated at a site near the crossing. When the complete pipe section has been successfully assembled and inspected, it is lowered into place. Trench breakers are then installed in the trench near to the watercourse banks to prevent subsurface flow.

For the BTC project, the disturbed portion of the watercourse bed and banks associated with any open cut crossings will be returned to pre-construction dimensions, where possible. The trenching of the watercourse banks and bed will normally be undertaken immediately prior to installing the pipeline section of pipeline and the trench will typically be back-filled as soon as possible following BTC pipeline installation. This will minimize environmental impacts to the watercourse. The material placed over the pipeline as backfill will be at least as erosion-resistant as the original bed material. In addition, where the riverbanks have been disturbed, these areas will generally be stabilized within two days of pipeline installation, and restored to their original condition and contours. Where this is not possible, site-specific plans will be developed to minimize environmental impacts. Erosion and sediment control measures will be installed and maintained until the area has stabilized and vegetation is sufficiently re-established (as discussed in Section 10 Potential Impacts and Mitigation). Sediment interception techniques may include the use of filter berms, silt fences and straw bale barriers.

Method 1 (Dry open-cut)

In this method, water flow is maintained using temporary "flume" pipes installed in the bed of the watercourse:

- The trenchline-only is prepared by stripping the topsoil from the watercourse banks and ramping them down to allow the safe installation of the pipeline
- Suitably sized flume pipes (eg flow does not exceed 80% of the flume pipe(s) capacity) are installed
- The upstream end of the crossing is then dammed, forcing the flow through the flume pipes
- The downstream end is then dammed to prevent backflow into the open trench
- Where appropriate, fish and other aquatic life caught between the dams are transferred downstream of the crossing
- The pipe trench is then excavated below the flume pipes. De-watering and/or trench supports may be used to facilitate safe excavation. If pumps are used, the discharge hose is typically directed to an upland area that is well vegetated or through a filtering medium to reduce silt loads, before the pumped water is allowed to percolate back into the watercourse
- The pipeline is installed in the trench and the trench is then backfilled, initially with subsoil and then with the stored river bed materials
- The riverbanks are then reformed and profiled in accordance with the project Reinstatement Plan and erosion control measures (eg silt fencing erosion control fabric) are installed
- The downstream dam, the upstream dam, and finally the flume pipe(s) are removed in that sequence

Method 2 (Dry open-cut)

This method is similar to that described under Method 1 above, except the water is pumped around the trench:

- The site will be prepared as for Method 1 and a dam constructed upstream of the crossing and within the approved ROW
- Pumps, intake hoses, and discharge hoses are installed to pump the water around to the downstream side of the pipe crossing. Pumps will be fitted with grills to prevent fish entering them where necessary and will be provided with secondary containment to prevent fuel spills into the watercourse
- Energy dissipaters are typically used to prevent erosion/scour at the downstream discharge point
- Once the pumps have been begun diverting water, a downstream dam is installed to prevent water from flowing back into the working area
- Where appropriate, fish and other aquatic life caught between the dams is transferred to a point downstream of the crossing
- The trench is then excavated in a manner similar to Method 1
- The pipe is installed, the trench backfilled and the whole area reinstated as for Method 1

Method 3 (Wet open-cut)

These are crossings using “wet” installation by means of an open-cut trench. It is anticipated that this method will only be used where ditches are either generally dry or very small. The typical procedure will be as follows:

- The site is prepared as for Method 1
- The river bed material is then excavated (potentially through the running water) and stored separately
- The pipe is installed and the trench is backfilled
- The pipe is protected and the whole reinstated as for Method 1

Trenchless crossings

Where the size and design of a watercourse is such that an open cut crossing is impractical, or will result in too much environmental disruption, trenchless techniques may be used. A range of techniques is available, as described below. It should be noted that many of these techniques, including auger bores and pipe jacks, require deep excavations on either side of the crossing to achieve the installation of the pipeline. De-watering, sheet piling and other techniques may be required to enable excavations and construction techniques to be carried out in accordance with health and safety regulations.

The applicability of non-open cut crossings is highly dependent on local geotechnical conditions and the techniques will typically require the utilization of an area of land wider than the normal ROW at either end of the boring. The principal advantage of the techniques over open cut excavations is that they can facilitate the crossing of sensitive or inaccessible features (eg gorges, rivers, railway lines, pipelines) with minimal disruption to those features.

Horizontal directional drill (HDD)

HDD is a large-scale operation that utilizes lubricated hollow drilling rods to tunnel under a feature. The first stage of HDD is to drill a pilot hole using a string of drilling rods. As the drilling proceeds, a drilling fluid, commonly known as ‘mud’, comprising of water and bentonite (a naturally occurring clay mineral) is pumped down the centre of the hollow drill rods to the drilling face. This lubricates the drilling rods and picks up cuttings before returning to the surface via the drill hole. The drill fluid is then filtered to remove the cuttings and returned to temporary storage tanks where it is held for reuse. The position and progress of the drill head is monitored and controlled from the surface using electromagnetic detection equipment.

It is possible that the drill may encounter groundwater as it progresses. The pressure under which the drilling fluid or mud is pumped down the borehole will be monitored to prevent migration into the groundwater and vice versa. Similarly, HDD may be affected by voids or solids within the substrate through which drilling is occurring. Drill fluid usage will be monitored at the surface to confirm no significant losses are occurring. As it is non-toxic, bentonite mud is normally used for drilling in areas where groundwater is likely to be encountered.

After the pilot hole is drilled, reaming devices are attached and pulled back through the borehole to enlarge it to the required diameter. A pre-prepared section of pipe will then be pulled through the borehole in one continuous action. This minimizes the risk of it becoming stuck during the pull. Bentonite is injected around the reamer to coat the borehole, and support the sides of the hole as the pipe is pulled through.

The plant associated with directional drilling typically includes an HDD rig, two power units mounted on skids, bentonite storage and mixing tanks, a filter for separating cuttings from the drilling mud and a control cab. The pipe is usually 'strung' on temporary roller supports for fabrication and then winched into position.

Drilling and pull back operations are typically continuous, 24-hour operations lasting for up to three weeks. Once the section has been completed, the drilling rig and associated plant are removed. The drilling mud is usually sampled, analysed and disposed of off-site to a licensed waste disposal facility.

Auger boring

A pit is excavated on one side of the crossing large enough to take the auger head and a full length of pipe, approximately 12m long. A smaller receiving pit is excavated on the opposite side of the crossing. A 'cutting head' is fixed to the auger drill at the front of the pipe. Power is transmitted to the auger drill via a power unit that is temporarily fastened to the top and to the rear of the pipe. This assembly is then lowered into the sending pit and is supported by cranes or side boom tractors. Engineers then line and level the pipe to ensure it is installed in the correct location and at the correct depth.

A combination of rotation of the auger drill within the pipe and a winch located on the front of the power unit installs the first pipe section with the excavated material being drawn from the cutting head, down the auger drill flutes before exiting from the rear of the pipe. Additional work areas are required on both sides of the crossing to accommodate the additional excavated material from the pits and the auger boring equipment.

Once the first section of pipe is augured into the ground, the second pipe length is lowered into the pit and welded to the first. The auger is then restarted. This process of lowering, welding and auguring is repeated until the crossing is complete.

Pipe jack (carrier pipe)

This construction method is generally used on large diameter pipes and involves the carrier pipe itself being installed behind a protective shield using a combination of normal mining techniques and hydraulic jacks to drive the pipe forward, with the excavated material being removed via the exposed end of the pipe. As each pipe progresses forward then another is welded on; by repeating this cycle the pipe is installed.

Microtunnelling

This method involves placing pre-cast concrete jacking pipes on the carrier pipe behind a microtunnelling machine with the excavated material being removed mechanically via the tunnel entrance.

The cutting head is lubricated with water and bentonite may also be used to reduce friction. The drill fluid is returned to the surface where it will be filtered to remove the cuttings and returned to temporary mud storage tanks for re-use.

Equipment associated with microtunnelling will include a power unit, one or two storage tanks for cuttings, separation plant and an operation board.

Used drilling fluids will be sampled, analyzed and recycled or disposed off-site to a suitable waste disposal facility.

Road and rail crossings

Minor road crossings are likely to be accomplished by open trenching of one-half of the road at a time, with steel plates used to maintain one lane of through traffic at all times. Smaller rural roads may be temporarily closed to through traffic if this is acceptable to local officials and residents. Temporary partial or complete closure of roads will require that appropriate signs and barricades, and other traffic management measures, are used to minimize road user inconvenience and promote safety. The pipe to be installed in the crossing will be welded, inspected, and coated nearby. The completed fabrication will be lowered into the BTC pipeline trench during a low traffic period, and one-half of the trench covered with steel plates to restore traffic. The trench will be backfilled one-half of the road at a time, using a lean-mix concrete or other readily compacted fill.

All rail crossings and most major road crossings are likely to be undertaken using trenchless techniques similar to those described above for watercourse crossings.

5.7.15 Block valve station construction

Following initial site grading activities, equipment foundations will be installed. Equipment will then be installed, which will involve the mechanical assembly and connection of the valve components, the CP, the telemetry repeater and facility piping and wiring. Site surfacing and fencing will then be completed.

5.7.16 Outline of facilities construction

The main pipeline facilities (eg intermediate pigging stations and pump station) will be constructed under a separate contract to the main pipeline/block valve construction. The work will be conducted sequentially at each facility, however it is likely that the contractors will choose to work on a number of separate facilities in parallel.

At each facility, the construction programme is likely follow the same typical sequence:

- Site surveying to determine the geotechnical, geophysical and topographical features of each proposed facility site
- Locating, marking and isolating pre-existing underground services
- Raising or diverting existing overhead services such as power and telephone lines
- Perimeter demarcation and setting out
- Establishment of temporary fences and gates
- Establishment of access roads and internal facility roads
- Site clearance and preliminary grading
- Establishment of construction facilities (eg materials stores, laydown areas, offices, etc)
- Completion of detailed geotechnical assessments as required to support the detailed design of foundations for plant and buildings
- Soil improvement and slope stabilization, if required

- Site excavation and placement to achieve the required cut and fill profile for the facility
- Installation of underground piping, drainage systems, utility lines and chambers
- Construction of retention ponds (as necessary)
- Installation of CP groundbeds
- Installation of building and equipment foundations
- Placement of ground slabs to support each building and key item of equipment
- Placement of equipment and construction of buildings
- Connection of the facility to the pipeline
- Installation of all above ground utilities and services (including security, lighting, fire fighting, process control and telecommunications systems)
- Installation of high security fencing and gates
- Installation of outer security wall and the provision of gates to suit
- Placing of granular surfacing to all unpaved plant areas
- Landscaping (as necessary) including the supply, planting and establishment trees and other appropriate plant species
- Reinstatement of temporary and permanent roads, paving, construction facilities, overhead services and other items that have been damaged as a consequence of the work

5.7.16.1 Generation, re-use of surplus subsoils and other material

As much as is practicably possible soil and rock will be returned to the areas of excavation. In all locations, however, there will be surplus subsoil or rock that cannot be returned owing to bulking of subsoils and rock, and material displaced by the pipeline volume. Such material will be disposed of both safely and in line with the project environmental requirements (see Section 6, Legal and Policy Framework).

Material remaining surplus after final reinstatement will be removed from the ROW. A number of options exist for the re-use or disposal of such material with various priorities:

ROW reuse (1st priority)

Where surplus soils and rock are suitable for use as a construction material it will be first considered for re-use on the ROW for (for example) project infrastructure works materials; stability, erosion control, worker camps, AGIs. Surplus rock material may require field crushing (in particular that generated from blasting).

ROW / project area disposal (2nd priority)

As a second priority such material will be used within the confines of the ROW and other project areas for (for example) hillside contour blending and localised increase in finished surface height of AGIs.

Off ROW re-use (3rd priority)

This would involve the transfer of surplus soils to an approved third party for re-use purposes as raw or semi- finished materials, for example crushed andesites that may be suitable for road construction materials or for rail ballast.

Off ROW disposal (4th priority)

Potential spoil disposal sites have been identified and are presented in the summary of potential spoil disposal sites and borrow areas (presented in Section 8, Environmental Baseline). The construction operator would select, develop, operate and reinstate those sites (or any other, which the construction contractor would wish to develop, following granting of suitable licences).

Sites for the disposal of surplus soil and rock shall, in general, comply with the requirements for inert waste disposal sites for the project. In summary, such sites would be operated with the following conditions:

- only completely natural materials are to be deposited; the following are excluded: contaminated soil; agricultural topsoil; worked stone (except natural stone that has been processed by crushing / screening); building materials; any other waste material
- vehicles used for transporting waste soil and rock shall not be used to transport any other type of waste
- the majority of waste soil and rock shall be characterized by a wide range of particle size from soil to boulders, and consequently the replaced spoil will be largely free-draining. Should this not be the case for any particular site, the construction contractor will propose mitigation measures in their Waste Management Plan (WMP)

Spoil will not be deposited:

- in environmentally sensitive areas without the approval of relevant authorities
- in watercourses or valley bottoms
- where such material will potentially interrupt concentrated overland flow
- in such a way as to cause a landscape (visual) impact
- on any open area for steep slopes

Borrow pits

Where excavated material is unsuitable for backfilling, material will be taken from approved 'borrow pits'. Borrow pits will be fully licensed and will be worked in accordance with all local and safety related regulations, including provision of safety barriers, notices, signs, security, etc.

The construction contractor will be fully responsible for the selection, opening, working and closing of the borrow pit. Final remediation of borrow pits will be undertaken in an environmentally sound manner to the approval of all local regulatory requirements.

Landfill sites

Landfill sites will also be required during the construction phase for wastes, which cannot be incinerated and are not hazardous. Wastes disposed of at an approved landfill site represent those, which would not be incinerated at waste disposal facilities (discussed later in this Section).

5.8 TESTING AND COMMISSIONING

5.8.1 Hydrostatic testing

5.8.1.1 Testing procedures

The entire pipeline will be subjected to hydrostatic pressure testing to prove the strength and integrity of the pipeline system, in accordance with the relevant standard (ASME B31.4). Hydrostatic testing of the BTC pipeline will involve filling sections with water and raising the pressure to a minimum of 1.25 times the maximum allowable operating pressure (equivalent to 90% of the specified minimum yield strength of the material). (Note: although the governing engineering standard ASME 31.4 calls for an eight-hour test period a more rigorous test period of up to 24 hours has been adopted for this project).

The pipeline will be tested in sections to:

- Limit the test volume
- Limit elevation changes to maintain the test pressure between the minimum required test pressure and maximum pressure which the pipeline will safely withstand
- Suit availability of water sources and the projects waste minimisation objectives
- Accommodate the maximum stress criteria for each wall thickness

Hydrostatic testing activities will be carried out in sequence and will include the following:

- Welding of certified test ends onto the each end of the pipeline test section
- Internal cleaning of pipeline sections using air or water-driven cleaning and gauging pigs to remove construction debris
- Gauging pig run to confirm the internal geometry is within specified limits
- Controlled line filling of pipeline sections with water for hydrostatic testing
- Temperature stabilization period to allow the water and line pipe steel temperature to stabilize
- Pressurization of the pipeline test section
- Test pressure hold period (eg commencement of 24 hour strength and leak test)
- De-pressurization of pipeline test section
- Controlled dewatering of pipeline test section
- Swabbing of pipeline test section to remove as much water as practicable
- Removal of test ends

Immediately following successful completion of the pressure test, the test section will be de-watered using swabbing pigs. The displaced hydrostatic test water may be transferred to another section of pipe or discharged at a suitable location. Filters and break tanks will be used to remove any solids and control the rate of discharge. Discharge locations and rates will be agreed in advance with the relevant authorities. If chemical additives have been used, the water will be tested and treated, as required, to ensure all discharges are in compliance with applicable environmental requirements. During discharging operations, samples for water quality analysis will be taken and stored for reference.

Following successful hydrostatic testing and dewatering of two consecutive test sections a tie-in closing weld will be carried out to link the two sections together.

5.8.2 Hydrotest water supply

Water for hydrostatic testing will be clean, contain the minimum achievable concentrations of contaminants (eg sediment, bacteria) and be non-corrosive. Water abstraction sources will be selected to suit the geographical location of the pipeline and of sufficient quantity and quality to facilitate filling of the pipeline test sections without any detrimental effect to the surrounding ecology and downstream consumers.

The number of hydrotest sections, their volume and the amount of water that can be re-used for more than one section will not be known until the completion of the construction contractors detailed plans for construction and commissioning.

Hydrotest water will be abstracted from surface water bodies located in close proximity to the BTC pipeline. The preferred source will be from one of the larger rivers crossed by the BTC pipeline such as the River Kura (KP223). Hydrotest water will only be taken from and disposed at pre-approved locations. It is likely that the testing programme will require continuous water abstraction for periods of several days at each abstraction point.

Prior to the commencement of the testing programme, the construction contractor will prepare, and submit for approval, a Pollution Prevention and Management Plan. The plan will detail methods to be used for water quality analysis, to fill/discharge to the BTC pipeline/facilities, and the environmental controls to be implemented to prevent or minimize the following potential impacts:

- Erosion at intake location (eg by using a buoy intake)
- Erosion /scour protection at the discharge location
- Fish entrainment into the pump (eg in identified fish habitats)
- Fuel spillage (eg secondary containment of pump)
- Inadequate reinstatement of disturbed lands

Potential hydrotest water abstraction points identified by the construction contractor(s) will be subject to an environmental review by the project team prior to their adoption. All necessary permits required for water abstraction and disposal will be obtained from the owner/occupier/local authorities and in accordance with project environmental requirements. The test water will be analyzed to check quality before and after use; the use of chemicals will be minimized but it may be necessary to add corrosion inhibitors, oxygen scavengers or biocides.

5.8.3 Pre-commissioning

Pre-commissioning of the pipeline will ensure the pipeline system has been constructed in accordance with the project design drawings and specifications. Unlike hydrostatic testing, pre-commissioning activities will be carried out over entire sections of the pipeline (eg from launching pig trap to receiving pig trap). All tie-in welds and mainline equipment will have been installed and the pipeline system will be mechanically complete.

For the pipeline, pre-commissioning activities will be carried out in sequence and will include the following activities:

- Final internal cleaning of pipeline using cleaning pigs
- Geometric survey using a specialist calliper pig to confirm the internal geometry of the pipeline
- Drying of the pipeline using dry air
- Dry lay up of the pipeline

Pre-commissioning of the pump stations, pigging stations and block valve stations will include the following activities:

- Internal cleaning of pipework by flushing with water
- Hydrostatic testing of pipework
- Internal inspection of pipework
- Drying of pipework using either vacuum drying or dry air

5.8.4 Pipeline lay-up

The project team will aim to minimize the period between introduction of hydrotest water and the commissioning/start-up (introduction of hydrocarbons) of the system. Where the period between the introduction of hydrotest water and commissioning exceeds 30 days then a lay-up procedure will be carried out as an integral part of the hydrotest and pre-commissioning procedures. The following Sections provide an outline of the potential lay up procedures that are likely to be used for the pipeline.

The system will be completely drained and free of all standing water. The system will be dried to a dew point of minus ten degrees centigrade or less at all exit points by blowing super dry air through the system and pushing foam pigs through the sections between pigging stations. The pig will be weighed at the beginning and end of the runs the weights will be graphed to demonstrate the rate of reduction of water content in the line. When the dew point of –10°C is reached at the exit points, the pigging process will cease. The system will then be shut-in for not less than 12 hours to allow it to come to equilibrium with the dry air. Exit dew points will then be measured and if found to be above -1°C, the drying procedure will be repeated. Once appropriate exit dew points have been reached then the pipeline system will be shut-in with a positive pressure until it is ready for commissioning and start-up.

5.8.5 Commissioning

Commissioning of the pipeline, block valves and associated above-ground installations will ensure that the pipeline system has been constructed in accordance with the design and that the system is ready for operation. Commissioning will also ensure that there are no defects in the pipeline system, which could cause problems during start-up (introduction of crude oil) or during operation.

Commissioning activities for the pipeline and block valves will be carried out in sequence and will include the following:

- Checking the opening, closing, sealing and operation of mainline block valves
- Operational checks on all instrumentation
- Operational checks on all ICSS and control equipment
- Operational checks on all metering
- Checking the operation of all pressure protection systems

- Checking the operation and settings of all pumping and associated equipment (eg block valves, filters, pre-heaters)
- Checking the operation of other facilities (eg generators)
- Checking the CP system to ensure that it is operating
- Undertaking integrity surveys to confirm continuity of pipeline coating

The minimum requirement for the commissioning of the BTC pipeline facilities will typically comprise the following:

- Start up and limited operation of permanent items of equipment and utilities by system (eg firewater, power generation, communications and control systems)
- Nitrogen and helium leak-testing integrity checks (including in-line critical valve leak testing) of hydrocarbon systems at the designated operating pressures of the plant
- Purging of plant systems prior to the introduction of hydrocarbons
- Closed-loop running of process plant and equipment utilizing appropriate test mediums to prove system integrity and correct functioning
- Plant performance trials conducted in accordance with specified performance criteria

The duration of performance trials and acceptance criteria will be based on the following considerations:

- Capacity of pipeline and facilities
- Methods to determine stock levels at start and finish
- Sample collection points
- Methods of measurement
- Adequacy of flow monitoring devices
- Consumption of raw materials
- Quality of finished product
- Reliability aspects
- Consumption of utilities
- Quantity and composition of effluent discharged
- Temperatures and pressures
- Flows and levels
- Product specification requirements
- Mass and energy balances

Following the successful completion of all required testing of the BTC pipeline and its associated facilities and the implementation of all necessary management/contingency plans, it will be brought into commission by filling with crude oil from Sangachal Terminal. All hydrocarbon vessels and pipelines associated with the facilities will be purged with nitrogen prior to plant start up.

5.9 REINSTATEMENT AND EROSION CONTROL

5.9.1 Introduction

Prior to the commencement of the construction programme the construction contractors will be required to develop a project-specific Reinstatement Plan based on the project Reinstatement Specification. The full width of the ROW and all other project areas will be reinstated in accordance with the Reinstatement Plan on completion of the works. The contractor will also be required to incorporate reinstatement measures in their method statements for each critical element of the construction programme (eg watercourse crossings, site clearance, re-grading). Additional details of the project reinstatement plans are provided in Reinstatement Plan (Appendix A).

The key areas that may require reinstatement are as follows:

- The ROW
- Worker camps
- Pipe and materials storage yards
- Maintenance areas
- Temporary roads and transport facilities
- Waste management and disposal sites

The following Sections provide a summary of the reinstatement works that will be required for the BTC pipeline and are based on a reinstatement specification being developed by the project team.

5.9.2 Reinstatement philosophy

The project reinstatement specification is based on the following principles:

- Disturbed areas will be reinstated to pre-construction conditions (eg contours) to the greatest practicable extent
- Disturbed areas will be stabilized to protect the integrity of the pipeline and minimize potential impacts associated with erosion, transportation and sedimentation of material originating from disturbed areas associated with the construction of the BTC pipeline (eg using temporary and permanent controls)
- Disturbed areas will be re-vegetated to achieve conditions similar to those that exist immediately adjacent off-ROW
- Regular monitoring of all reinstated areas will be undertaken until environmental requirements and goals are achieved

5.9.3 Erosion control

An erosion assessment of the route has been undertaken to identify areas of potential erosion and to support the development of appropriate erosion control measures for such areas. On the basis of the erosion assessment and the technical objectives of the project, the following goals have been set:

- No risk of the depth of cover above the BTC pipeline being reduced
- Very low risk of off-site pollution and sedimentation
- Low risk of damage to bio-restoration by erosion of soils containing seedbank resources, vegetative material and plants

5.9.4 Timing of reinstatement

Reinstatement of the ROW and facilities will be undertaken on a sequential basis dependent on the completion of construction and hydrostatic testing activities in each area. Where practicable, the ROW will be cleared of any residual construction debris, construction signs, and equipment prior to the successful completion of hydrostatic testing. Reinstatement of the construction corridor will then be started. Following successful hydrostatic testing, all other areas will be cleared and reinstatement will be commenced.

Should the proposed SCP construction follow directly from the BTC pipeline construction, full reinstatement will only be carried out as part of the BTC project on sections that will not be disturbed by SCP construction activities. Interim reinstatement and erosion control measures will be undertaken over the remaining portion of the ROW with final reinstatement of those areas being undertaken under the SCP project.

If there is a delay of more than 12 months between the completion of interim reinstatement and the start of construction of SCP for a route section subject to erosion control, then full erosion control measures and reinstatement will be performed over the whole of the disturbed area.

River crossings will typically be reinstated as soon as practicable given the BTC project constraints and regardless of the SCP construction schedule.

5.9.5 Site cleanup

Prior to demobilization of construction personnel and equipment, cleanup activities will be completed in accordance with environmental standards (eg housekeeping) and industry best practice. Cleanup activities will consist of the removal and/or disposal of temporary buildings, equipment, tools, and excess material brought onsite or generated during construction and commissioning programme.

5.9.6 Interim reinstatement

In areas that are expected to be disturbed within 12 months by the installation of the SCP, interim reinstatement measures will be implemented. The construction contractors will prepare a detailed method statement that identifies appropriate measures for each section of the pipeline according to the erosion potential of that section.

5.9.7 Permanent reinstatement

Permanent reinstatement will be undertaken on completion of the BTC pipeline hydrostatic testing in those areas that will not be subjected to disturbance by SCP-related activities and those deemed unsuitable for interim reinstatement. Elsewhere it will be undertaken after completion of installation and testing of the SCP.

The first stage of the reinstatement programme will comprise the regrading of all working areas to achieve a final surface that is sympathetic to the natural landform contours. Any required permanent erosion control measures (eg diversion berms) will also be installed at this time.

To facilitate natural re-vegetation of the ROW, where appropriate the separately stockpiled topsoil and vegetation debris will be spread over the surface of the ROW following completion of grading. The contractor will be required to comply with all requirements for the reinstatement of environmentally and ecologically sensitive areas, and will be required to submit a reinstatement schedule and methodology which at minimum complies with the project Reinstatement Specification and the ESIA requirements. In some instances, areas of sensitive natural habitats or high erosion potential may be seeded with a mixture of native plant species to facilitate re-vegetation. If deemed necessary by the Project Management Team, additional surface stabilization measures may be adopted in areas of high erosion potential.

The key reinstatement principles are summarised below:

- Minimize the deterioration of topsoil and subsoil quality and structure through predetermined stripping, handling and storage procedures
- Use of appropriate temporary erosion control measures (including erosion matting, sediment traps, silt fences, and filter berms)
- Use of permanent erosion control (including diverter berms, and trench breakers)
- Reinstate all damaged or relocated third party properties affected by project activities in accordance with pre-entry agreements
- Reinstate all redundant spoil and waste disposal sites. These will be closed, capped and landscaped in accordance with the relevant requirements of the project Reinstatement Specification and waste management strategy
- Reinstate certain locations such as environmentally sensitive areas, watercourses and in locations prone to erosion, as soon as practicable after installation of the pipeline. Any development (including roads, tracks, bridges, worker camps, etc) made to facilitate construction at these locations will also be reinstated to original condition as soon as practicable
- Undertake joint inspections of all reinstated areas (ie involving contractors reinstatement personnel and BTC Co representatives) to ensure that all necessary measures have been undertaken to ensure slope stability, recreate a surface profile similar to the pre-existing where practicable, ensure surface water drainage capabilities, and to ensure an appropriate level of soil compaction
- Complete reinstate of uncultivated areas to facilitate re-establishment of natural (pre-existing) vegetation communities (including, as appropriate, final grading, ripping, cultivating, reseeding and planting of trees and shrubs). Agricultural land will be tilled and left for re-seeding by the farmers
- A target minimum cover of pre-existing ground vegetation established within one year of final reinstatement will be set for each reinstated area on the basis of the floral composition and environmental sensitivity of the area
- An aftercare, monitoring and corrective action programme will be developed and implemented based on examining the bio-restoration process periodically after planting

Any fences, services, structures, roads, tracks, pavements or other facility affected by the works connected with BTC will be repaired or replaced to a condition that is at least as good as that found prior to construction.

5.9.8 River bank reinstatement

Upon completion of construction works at a crossing, the banks and a surrounding buffer area will be reinstated to a condition at least as good as that encountered prior to the construction works and in a manner that reflects the local environmental conditions. The construction contractor will produce method statements incorporating plans for erosion control, sediment control and reinstatement prior to the commencement of work at the crossings. At a minimum the method statements will include the following measures:

- Recording of the original channel width, depth and slope prior to disturbance and reinstatement as near to the original as is practicable
- Construction of stable platforms designed to prevent changes in channel shape where vehicles need to regularly cross the river
- Re-contouring of the bank will be undertaken to match surrounding slopes
- Environmental and engineering review of potential bank and bed stabilization methods
- Replacement of the channel substrate
- No soil deposition will be allowed within the channel after the crossing is complete, with excavated soil returned to the bank and contoured
- Replacement of the bank topsoil
- Reseeding of the banks

The contractor will be required to submit a contract-specific Soil Erosion and Sediment Control Procedure; at locations subject to washout. Measures to be used in such areas may include the provision of riprap, gabions or impervious membranes.

5.10 OPERATION, CONTROL AND MAINTENANCE

5.10.1 General

The pipeline system has been designed for minimal operational and maintenance intervention. The operating and maintenance requirements for the pipeline system have been developed to achieve the following objectives:

- Safety of operation for operations employees, customers and third parties
- Environmental compliance in accordance with HGAs, permits and authorisations, BP company policy, and project plans, specifications, and requirements
- Continuity of supply within design criteria
- Minimised operational expenditure consistent with meeting contractual obligations and sustaining the design life of the system
- Maintenance of the system's technical integrity and performance over its design life
- Full compliance with statutory and regulatory obligations
- Maintenance of the security of the system
- To demonstrate "fitness for purpose" of the BTC pipeline for the length of its design life allowing it to operate at optimum condition during this period
- Centralisation and integration of operations and maintenance activities

The Main Centre Control Room would be located within the Sangachal Terminal. As an emergency response centre, a high-level communication network (telephone/e-mail) would be established between the Sangachal Terminal and the existing Emergency Response Centre in BP's offices in Villa Petrolea (Baku).

The pipeline would be operated in accordance with international codes and standards. These codes place stringent requirements upon the operating company to ensure that the pipeline is:

- Operated safely

- Staff are appropriately trained
- Covered by a thorough programme of preventive maintenance
- Regularly surveyed

5.10.2 Operation and maintenance organisation

It is anticipated that the operation of the BTC pipeline will be managed by a dedicated team based across the three countries of operation. Wherever possible, the management structure will be integrated with other activities in the region, including the upstream projects (ACG and Shah Deniz), the Sangachal Terminal, the SCP and the WREP.

It is anticipated that maintenance resources will be based at remote locations along the BTC pipeline route and the existing terminals. Each facility will be responsible for a part of the BTC pipeline within its geographical area, including associated block valves, pumping and metering stations. The requirements for these facilities will be determined with regard to required maintenance frequencies, personnel mobility and safety, communications, required speed of response, etc.

The potential for sharing maintenance facilities with the SCP will be considered during detailed design.

5.10.3 Pipeline control

There will be a manned centralized control centre at the Sangachal Terminal Complex with remote control units at pumping and metering stations, intermediate pigging stations and block valves. The remote control units contain the field interface instrumentation equipment for control, monitoring, supervision, shutdown, fire detection, mechanical packages and supporting utilities.

The filling and emptying of the crude oil storage tanks at Sangachal will be controlled from the Sangachal Terminal. Selected information on the upstream supply infrastructure/plant status including tank levels and booster pump status will be provided to the BTC Crude Pipeline Operator by the terminal management system.

Under normal conditions pipeline throughput will be achieved by controlling the number and speed of the main oil line pumps at the pump station within Sangachal Terminal to achieve the required flow.

5.10.4 Pipeline maintenance

The pipeline system will be monitored and maintained to ensure that the system, as designed, constructed and tested, remains “fit for purpose” throughout the BTC pipeline’s design life. In general, BTC pipeline surveillance, function checks and condition monitoring will be used to anticipate system problems and allow them to be rectified in a timely manner. Planned maintenance management will be implemented through a combination of modern management techniques, information technology and innovative engineering technical analysis with the aim of minimizing any risks associated with long-term plant and equipment operations. The incorporation of planned maintenance has been a fundamental element of the project development to date and it will be implemented throughout the operation of the BTC system.

BTC pipeline inspection and maintenance activities during operation will include the following tasks:

- Pipeline monitoring
- Special crossing inspections
- Monitoring of population and third-party activities in close proximity to the BTC pipeline
- CP system monitoring
- Inventory monitoring surveys
- Functional operational checks and verification of plant and equipment
- Routine maintenance of plant and equipment at pre-defined intervals

It is intended that the maintenance procedural elements for the BTC facilities will be developed by BTC Co in consultation with specialist consultants, and scheduled accordingly utilizing a computerized maintenance management database. Maintenance procedures will provide the necessary instructions and technical information to support operational and maintenance activities that are necessary to satisfactorily maintain day to day plant operation, including:

- Stage by stage inspection, care and maintenance instructions
- Essential manufacturers maintenance instructions and references
- Isolation and permit to work requirements
- Previous historical reading/results, etc

5.10.5 Wax removal

Below a temperature of approximately of 38°C, waxes entrained in the crude oil start to solidify and form lumps within the fluid. Provided that the fluid does not stop flowing, these lumps will predominantly remain suspended in the crude and pass through the system.

Maintenance pigs will be used to remove or re-entrain wax that collects within the BTC pipeline or block valves. Following each pigging run the contents of the pig receiver will be drained to facilitate the removal of any residual wax collected by the pig. It is intended that collected wax will be pumped back into the BTC pipeline upstream of the mainline pumps. Alternatively, the oil may be warmed or pressurized to keep the wax entrained in the crude oil as it passes through the receiver. As a result of these measures, it is not anticipated that significant off-site disposal of waste waxes will be required in Georgia.

Final removal of the wax from the BTC pipeline system will be achieved at the Ceyhan Terminal where it will either be left in situ within the exported crude or removed and taken off-site for appropriate disposal.

5.10.6 Export system monitoring and pipeline surveillance

BTC pipeline surveillance will include the following activities:

- Patrolling
- Aerial survey
- Vantage point survey
- Leakage survey
- Liaison with owners/occupiers, tenants and authorities

- Coating defects survey
- CP system monitoring
- Online intelligent pigging

The surveillance programme will monitor the entire BTC pipeline length, however particular attention will be paid to sensitive locations including:

- Watercourse crossings
- Rail and road crossings
- Minor and major course deviations
- AGIs/facilities
- Aquifers
- Settlements – villages, etc

The design of the surveillance programme will also take into account experience gained through the operation of the NREP and WREP in Georgia.

In addition to the pipeline surveillance measures described above, closed circuit television (CCTV) and intruder alarm systems will be provided at each facility and ball valve site.

5.10.7 Training provision

During project development BTC Co will develop a comprehensive training programme for all BTC operation and maintenance personnel. The training programme will deliver operation, maintenance and safety training requirements as well as ongoing development of personnel skills.

Skills will be regularly assessed, and a system maintained for recording and ensuring that all personnel working on the BTC pipeline system are fully trained as well as competent to perform their assigned duties.

Similar standards of training and competency will also be required of all of the contractors' personnel who may be required to work within such facilities during operation.

5.10.8 Helicopters

Provision will be made for the use of helicopters to support normal operations. In particular they may be used to facilitate routine surveillance of the BTC pipeline corridor.

The strategic locations and the minimum requirements to facilitate helicopter services will be developed during the detailed design.

5.11 DECOMMISSIONING AND ABANDONMENT PLANS

5.11.1 Legal basis

The HGA continues to be effective for a primary term of forty years from the date of first shipment of oil. The BTC pipeline is therefore being built with an initial design life of 40 years. Some of the associated facilities, for example the pump stations, are being designed for an initial life of 20-30 years, maintainable for a longer operational period in line with the BTC pipeline design life.

Should the HGA be terminated for any reason during the period of BTC Co ownership of the line then BTC Co or its successor(s) are required to provide to the Georgian Government a written Abandonment Plan detailing:

- Removal of all surface installations
- Clearance of all equipment from waterways and marine areas that may pose a navigational hazard
- Drainage and disposal of any remaining oil in the facilities
- Disconnection of the pipelines from supply of oil, and abandonment in place or removal where abandonment causes a risk to the environment
- Filling all abandoned underwater pipelines with water or inert material and the sealing the ends
- Re-vegetation of the ROW consistent with the terrain features and other prevailing conditions

Within 30 days of termination of the agreement a plan must be prepared describing how this will be achieved. This Abandonment Plan will be subject to approval by the Government. An ESIA will be prepared prior to implementation of this plan, to assess and minimize potential environmental and social impacts arising from the abandonment operations. This abandonment ESIA will be submitted to the Government.

Upon completion of the abandonment operations an assessment of contaminated land will be prepared recording the final contamination status of the location of the project facilities. This assessment will be subject to governmental approval.

In the event of abandonment of the line during BTC Co ownership then BTC Co will carry out monitoring for a period of two years in order to identify (and if required remediate) any adverse environmental impacts related to pipeline activities, which may subsequently become evident.

5.11.2 Technical solutions for abandonment

As stated above, exact details of how facilities will be abandoned will be determined prior to abandonment, and agreed with the Government. Therefore it is not possible to determine at this stage exactly what techniques will be used. However, these will be in accordance with recognized international standards.

Possible abandonment techniques might include:

- Removal of all surface facilities and appropriate reinstatement
- De-oiling of the BTC pipeline, and disposal or re-use of any waste oil
- Filling the line with air or nitrogen to slightly over atmospheric pressure
- Maintaining a functional CP system to prevent corrosion, as corrosion could lead to subsidence
- Investigating any corrosion that does occur and excavating the BTC pipeline section if necessary
- In the event of a high risk of subsidence it may be necessary to fill sections of the BTC pipeline with concrete to prevent collapse

5.11.3 Handover of facilities

BTC is being designed and constructed as a "Build-Operate-Transfer" project. This means that 20 years after first export of oil ownership will transfer from BTC Co to GIOC. It is possible that the member companies of BTC Co will retain a small holding in the pipeline system after the transfer of ownership to GIOC.

Therefore whilst the design life of the BTC pipeline is 40 years the period of BTC Co ownership is 20 years prior to handover of ownership to GIOC.

5.11.4 Health, safety and environmental management

HSES management plans will be developed to ensure environmental compliance during the operational phase of the project. Wherever possible, the BTC HSES management system will be integrated with both the pre-existing upstream and WREP systems.

The HSES management procedures that will be adopted for the project are described in detail in Section 15, Management and Monitoring.

5.12 PROJECT RESOURCES, WASTES AND EMISSIONS

5.12.1 Labour

5.12.1.1 Construction

Although the size and make-up of the workforce would be at the discretion of the construction contractors, (subject to BTC Co approval), it is anticipated that construction would involve approximately 2,300 personnel. The workforce is likely to comprise approximately 1,600 personnel for the pipeline construction, 400 personnel for the facilities construction and 200 to 300 for the temporary facilities (eg worker camps and pipe yards).

5.12.1.2 Operation

It is expected that the pump stations would be permanently manned by up to 10 personnel and that approximately 20 to 30 further staff will be employed along the pipeline. The intermediate pigging station would not be permanently manned by technical staff, but would typically have a crew of five workers during a pigging run. It is anticipated that security personnel will be present at the pigging stations on a permanent basis. Block valve sites would not be staffed under normal operating conditions.

5.12.2 Construction equipment

The construction works will require the deployment of earth moving and specialist pipeline construction equipment. A summary of the estimated mobile and other related equipment required to accomplish pipe installation activities is presented in Table 5-7 below. It should be noted, however, that the precise type and number of equipment will be at the discretion of the construction contractors.

Table 5-7 Major mobile plant summary

Plant Type	Estimated Number
Off highway tractors	50-100
Motor graders	10-50
Cranes	10-50
Pick ups	50-100
Dozers	50-100
Excavators	< 10
Sideboom	10-50
Pumps <50hp	10-50
Air compressors <50hp	10-50
Welders <50hp	50-100
Rollers	< 10
Trenchers	< 10
Welding rigs	10-50
Cement mixers	10-50
Forklifts	< 10
Loaders/backhoes	50-100
Agricultural tractors	< 10
Dump trucks	50-100
Off highway trucks	50-100
Generators <50 hp (350W)	< 10
Ambulances	< 10
People cabs	10-50
Buses	50-100
Trailers	10-50

Major stationary plant anticipated for the construction phase is presented in Table 5-8 below.

Table 5-8 Major stationary plant associated with pipeline construction

Location	Plant	Function
Worker Camps (location and number to be decided by construction contractor)	Main power will be provided from diesel generators on site. Emergency diesel generator(s) would also be provided	Main power and emergency power generation for worker camps
	Sewage treatment system Potable water system	Sewage treatment and provision of potable water
	Waste Incinerators	Waste management during the construction period

Location	Plant	Function
Pipe storage yards (location and number to be decided by construction contractor)	Main power would be provided from diesel generators on site. Emergency diesel generator(s) would also be provided	Power generation and emergency power generation for pipe storage yards
	Sewage treatment system Potable water system	Sewage treatment and provision of potable water
	Waste Incinerators	Waste management during the construction period

5.12.3 Construction materials

Estimates for consumption construction material are presented in Table 5-9 below. Amounts are estimates only.

Table 5-9 Estimated resource requirements for construction

Resource Type	Estimated Amount	Units
Line pipe	134,200	Metric Tonnes
Aggregates (sand and gravel)	45,000	M^3
Concrete	25,000	M^3
	9,000	Metric Tonnes
Asphalt/Tarmac	60,000	M^2
Timber	3,700	M^3
Structural Steel	4,000	Metric Tonnes
Welding gas	54,000	M^3
Coating materials	925,000	M^2
Fibre optic cable	250,000	Metres

5.12.4 Energy

5.12.4.1 Construction fuel consumption

Diesel fuels will be required for the operation of all mobile and stationary plant as presented above. It is estimated that 104,000 tonnes of diesel (5 million GJ) will be required for the entire construction period. These figures do not include shipping and rail transportation fuel consumption. These figures assume all plant operates constantly during working hours for the full construction period, and therefore are likely to be over estimates of actual fuel consumption.

5.12.4.2 Operational fuel consumption

As noted earlier, combustion plant will operate on liquid fuels, predominately CTD. Consumption is estimated (for the programme of plant installation and operation as discussed earlier):

- 82,500 tonnes for year 1-2 of operation (4 million GJ)

- 82,300 tonnes for year 2-5 of operation (4 million GJ)
- 150,000 tonnes per annum for year 5 onward (7 million GJ per annum)

5.12.5 Water supplies for construction and operation

5.12.5.1 Construction

Raw water for sanitary and washing requirements at each of the worker camps and pipe yards will be sourced from one or more of the following:

- Purpose-designed and constructed boreholes
- Local civil or municipal supplies
- Springs
- Rivers
- Canals

These sources may also be used for potable water supplies if the water quality is shown to meet the World Health Organization (WHO) drinking water guidelines. Should the water supplies fail to meet the guidelines, the following options will be considered:

- Installation and operation of a dedicated water treatment plant
- Use of bottled water transported to the site

5.12.5.2 Operation

It is anticipated that water supplies for the pump stations will be sourced from a deep borehole. Located within the pump station site. Where necessary, water will be transported from pump stations to smaller facilities (eg IPSG1) by tanker truck as required. Water treatment will be undertaken at each facility with the aim of providing supplies suitable for potable water use and, if necessary, service water use. The type and extent of treatment will be dependent on the size and nature of the facility being supplied, and the quality of the water supply.

The water treatment plant for the pump station sites will be designed to operate with the minimum of operator input. The design and operation of the plant will incorporate measures to minimize the use of chemicals and the production of liquid and solid wastes. Raw water supply at the site will be provided from a borehole drilled to a nominal depth of 100m. If at the target depth of 100m no suitable water supply aquifer has been identified, the borehole will be progressed to greater depth or at a different location under the direction of a qualified hydrogeologist.

The borehole design will be prepared by the supervising hydrogeologist and will include features designed to minimize the potential for cross-contamination of aquifers and to avoid the migration of contaminants (including oil) from the surface to the aquifers.

The water treatment plant at the pump station will produce potable water that, at minimum, meets the WHO drinking water standards and BTC Co requirements.

The plant will be designed to produce an average of $1m^3/h$ of potable water. It is anticipated that the treatment plant/process will include the following:

- Preliminary disinfection using hypochlorite (or similar)
- Filtration to remove solids
- Free chlorine removal through carbon filters
- A reverse osmosis unit
- Treated water disinfection with hypochlorite
- An ultra-violet (UV) sterilisation unit capable of processing $10m^3/h$ of water. This plant may be located away from the main water treatment plant but will be directly linked with the potable water pumps
- Backwash accessories, tanks, pumps and reverse osmosis clean-in-place facilities

Each pigging station will be supplied with raw water by means of a water truck, or where necessary bottled potable water. An above ground service water storage tank will provide on-site water storage capacity. An anticipated peak flow water requirement of $5m^3$ per hour is expected for the pigging stations.

Each facility will be provided with a UV sterilization unit suitable for the treatment of up to $5m^3/h$. The sterilization unit will be designed and installed with the aim of ensuring that water is safe and free from bacterial or algal contamination at the point of use.

5.13 WASTES

5.13.1 Introduction

The construction project will generate inert, non-hazardous and hazardous wastes over a period of up to three years. Operation of the BTC pipeline will result in continued generation of small volumes of inert, non-hazardous and hazardous wastes for the remainder of the lifetime of the pipeline system.

5.13.2 Project waste management strategy

A waste management strategy has been developed for construction, testing, commissioning and operation. The strategy was designed to address the needs of both the BTC and SCP projects and takes account of proposals made for waste management by the other oil industry projects in the region. It also provides for synergistic development of waste management strategies for these projects.

Prior to the commencement of the construction programme the BTC team will prepare a Project Waste Management Plan (WMP). The WMP will:

- Propose a minimisation/collection/storage/treatment/re-use/disposal route for each waste stream; identify potential third party re-users; propose incinerator types, duties and locations
- Describe possible locations of landfills or long-term storage sites
- State the method to properly managing (eg training, storing, containerizing, labelling, transporting, disposing) wastes
- Describe the transition of control from the construction contractors to the operator, including arrangements for commissioning waste

Relevant aspects of the WMP will be prepared in conjunction with the construction contractor and will be reflected in their own management plans for construction wastes.

5.13.3 Project waste management principles

Standards

The BTC project will aim to adopt the standards specified in European Community (EC) directives and regulations on waste management.

Duty of care

The principles of "duty of care"(eg the responsibility of a generator or owner of waste to ensure that it is handled, transported and disposed of in an appropriate manner) for wastes and waste ownership by the waste generator will be adopted by the BTC project throughout the construction, commissioning and operation of the pipeline. During construction and commissioning the construction contractor(s) will share the duty of care for those wastes generated by construction activities with BTC Co. During operation the duty holder will be BTC Co or their successors. The BTC Company, as the top-level managers of the project activities, have the ultimate duty of care for overall waste management.

Waste inventories and classification

Waste inventories will be created to quantify and characterize waste streams at each stage of the project. Separate inventories will be developed for construction wastes and for commissioning/operational wastes. As a minimum, wastes will be classified into four types, as follows:

Inert	Waste as defined in Article 2 of the Landfill directive 1999/31/EEC – essentially non-degradable, non-leaching and non-reactive materials.
Hazardous Waste	Waste classified as hazardous according to Article 1(4) of Directive 91/689/EEC.
Non-Hazardous Waste	Waste that is neither inert, nor hazardous nor wastewater. It includes 'municipal waste' as defined in Article 2 of the Landfill Directive 1999/31/EEC.
Waste Water	Fresh water that is contaminated as a result of project activity.

Further subdivisions of these classifications may be developed and adopted on the basis of the treatment requirements (eg incineration) and ultimate disposal point (eg re-use, recycling, landfill) for each individual waste material.

The principal waste disposal options for each waste stream will be as follows:

Table 5-10 Waste disposal options

Waste Stream	Principal Disposal Options
Inert waste:	• Transfer to a third party for recycling or re-use • Processed and used for construction and reinstatement purposes • Burial in a landfill designed and operated in general accordance with the Landfill Directive (1999/31/EEC)

Waste Stream	Principal Disposal Options
Non-hazardous waste	• Transfer to a third party for recycling or re-use. A special case of this is to spread it on land for agricultural purposes. The waste, the land, and the spreading operation will be in general accordance with EC Directive 1986/278/EEC • Burial in a landfill designed and operated generally according to the Landfill Directive (1999/31/EEC)
Hazardous waste	• Transfer to a third party for re-use • Burial in a landfill designed and operated generally according to the Landfill Directive (1999/31/EEC)

The volumes of waste requiring ultimate disposal will be minimized both through the control of waste generation and through incineration. Inert and non-hazardous wastes that cannot be reused or recycled may be incinerated in an incinerator designed and operated in general accordance with EC Directive 89/369/EEC on Municipal Incinerators. Hazardous wastes may be incinerated in an incinerator designed and operated in general accordance with either EC Directive 1994/67/EC or EC Directive 89/369/EEC depending on the waste involved.

Hierarchy of waste management practices

Each waste stream will be managed according to the following hierarchy of techniques, in which the technique chosen should be the first in the hierarchy that is safe and practicable:

- Eliminate or minimize the waste stream by choice of procedure or technology
- Re-use as a material
- Re-use as a fuel
- Process and re-use as a material
- Process and re-use as a fuel
- Incinerate and re-use or landfill the ash
- Landfill (not applicable to waste water)
- Discharge to a receiving water course (applicable only to wastewater)

Transfer of waste to third parties

It is expected that there will be a wide variety of potential third parties that may receive wastes generated by the BTC project. These third parties will include commercial waste disposal contractors and entities (corporate or individual) that have the capacity to re-use or recycle individual waste materials.

In general, transfer of a waste to a third party for ultimate disposal will only be permitted if the part of their operation that is used for BTC project wastes meets specified EC standards. The disposal of waste timber and other reusable project wastes to the local population will, however, be permitted on the basis of a case-by-case review undertaken by the BTC Management Team.

Trans-boundary waste shipment

It is not anticipated that trans-boundary (international) shipment of wastes will be required for any element of the BTC project. Should the case arise where such shipments are found to be necessary, the shipments will comply with the relevant bilateral protocol and with the relevant requirements of the EC Regulation on the Supervision and Control of Shipments of Waste (Regulation 259/93).

5.13.4 Construction and commissioning waste management

The construction contractors will be responsible for the management and disposal of wastes they generate during the construction and commissioning phases of the project. The contractual terms set for the construction programme require all waste operations and waste facilities to meet the requirements of the relevant EC legislation and guidelines. The adoption of EC standards is consistent with the stated project aim of meeting international standards and with the commitments made in the HGA for Georgia.

Table 5-11 presents an indicative and approximate estimate of the wastes that will be generated by the BTC construction project in Georgia:

Table 5-11 Indicative construction waste breakdown

ITEM	Total (tonnes)
SOLIDS	
Activated Carbon	7
Bricks & building materials eg plaster	20
Cement (dust)	1
Clothing & PPE	15
Concrete – cured	60
Paper and card	330
Plastic bottles, cans, drums & packing	330
Plastic drums with pipe coating epoxy	50
Water inlet filters	3
Vehicle parts	1.1
Glass	390
Grease, Rags & Oil Adsorbents	40
Incinerator ash	460
Insulation	1
Light bulbs & tubes	0.2
Paint cans & brushes	0.05
Polystyrene products	15
Stone & rock	None
Tyres	15
Cleared trees & branches	850
Cleared undergrowth, shrubs, etc	80
Waste timber	Minor
Packing crates & similar	170
Concrete shuttering	40
Metals	
Welding rods	8
Aerosol cans	2
Aluminium	Minor
Cans	65
Sheeting	2
Exhaust catalysts	0.2
Copper (electrical wire, facilities services)	Minor
Plastic-coated cables	0.4
Pipe-end protectors	20
Steel (including stainless)	800

ITEM	Total (tonnes)
SLUDGES	
Inorganic	Minor
Organic	
- Grease	Minor
- Paint	1
- Pipeline coating materials	25
Sewage sludge	130
LIQUIDS	
Aqueous (Excluding Hydrotest Water)	
Blackwater (eg sewage liquids)	45,000
Drum cleaning waste	950
Greywater (eg oily water, wash water)	105,000
Greywater (eg oily water, wash water)	950
Washdown water (pipeyards and camps)	315,000
Oily	
Diesel Waste	15
Diesel generator – lube oil	35
Miscellaneous oils (incl. Hydraulic)	3
Vehicle & equip. maintenance – lube oil	15
MISCELLANEOUS WASTES	
Batteries and Electrical	
Dry batteries	1.4
Wet batteries	4
Misc. electrical or electronic	0.4
Bulk electrical (switchgear, fittings, etc)	0.4
Chemicals	
Acids	Minor
Adhesives	0.4
Bitumen	130
General chemicals	15
Fire fighting foam	1
Glycol	Minor
Solvents	1
Radioactive (eg testing sources)	Minor
Domestic	
Food	330
Clinical	0.7

There are currently no waste disposal facilities in Georgia that meet the minimum technical requirements set by the project. The principal waste disposal options available for the construction project are therefore:

- The creation of independent landfills and incinerators by the contractors specifically for project wastes
- Incorporation of the project needs into a regional waste facility development to cater for oil industry wastes from a number of sources including production and exploration activities in the Caspian Sea

Given the project schedule and the current availability of waste disposal facilities in Georgia, it is probable that the contractors will choose to establish at least one landfill facility and to employ at least two mobile/semi-mobile waste incinerators.

In order to achieve the timely establishment of a landfill, given the overall project schedule, it is likely that the construction contractor will prioritise siting studies and permitting approvals with the aim of initiating them very soon after the award of the contract. Some wastes (principally hazardous materials) may require secure storage for an extended period whilst the ultimate waste disposal point is chosen and a landfill is established. Waste storage areas will be designed, constructed and operated in general compliance with internationally recognised standards, including the relevant requirements of EC Directive 75/442/EEC and 91/156/EEC.

It is proposed that most combustible construction wastes will be compacted at the pipe storage yards and worker camps prior to incineration. Various wastes generated at the ROW and camps will also be transported to incinerator sites for disposal. At this stage of project development, it is not possible to present details of waste incineration units that may be applied, however the chosen system(s) will be operated in general compliance with EC directives 89/369/EEC; 94/67/EEC; 91/689/EEC and COM (97) 604.

During commissioning a considerable quantity of waste will arise, mainly owing to clean-up of construction wastes. It is planned that the construction landfill operators will be retained through commissioning until routine operation is established.

The contractors will be required to develop construction specific waste management plans prior to the start of the construction work. At the start of the construction contract, the contractors will undertake a waste minimization/treatment/disposal study, guided by the project waste management strategy. The study will identify and quantify the expected wastes and describe:

- Proposals for reduction, treatment processing
- Third parties to whom waste will be transferred for re-use
- The locations of landfills or waste storage sites to be adopted or developed for use by the project

The findings of the study will be used in the development of the construction waste management plans. At a minimum, these plans will include:

- A consolidated summary of the applicable regulations and restrictions governing the generation, handling, treatment and disposal of wastes generated during the construction/commissioning phases of the project
- Any permitting requirements for waste treatment or disposal
- Detailed method statements for each element of the waste management handling, treatment and disposal process
- Any third party agreements for waste handling, transfer or disposal

After construction of each section of the route is completed, the waste handling/disposal facilities established under the construction programme will either be:

- Closed
- Retained for long-term pipeline operation
- Retained for use by the BTC project
- Transferred to a local operator for general use by the community

If a waste handling/disposal facility is closed, the construction contractor will be required to ensure it is appropriately de-commissioned (eg including capping of any landfills), and the surface will be reinstated according to the project reinstatement strategy. If the facility is retained, it will be transferred to the operator or BTC contractor. Transfer to a local operator is most likely where the landfill is an extension of an existing site and it is not required for future BP use.

5.13.5 Construction waste and emissions inventories

5.13.5.1 Releases to the atmosphere

Atmospheric emissions associated with the construction activities were derived from the type and number of construction plant used and from the duration of each construction activity. These estimates are presented in Table 5-12, below.

It is anticipated that the most significant components of such emissions from the environmental and social standpoint will be combustion gases, specifically:

- Nitrogen oxides (NO_x)
- Carbon monoxide (CO)
- Carbon dioxide (CO_2)
- Sulphur dioxide (SO_2)
- Particulate matter (PM)
- Methane (CH_4)
- Volatile organic compounds (VOC)

Table 5-12 Assessment of combustion emissions arising from construction activities

Emission [a b]	Tonnes
Carbon dioxide	351,000
Carbon monoxide	2,739
Nitrogen oxides	668
Sulphur dioxide [c]	5,197
Particulate matter	119
Hydrocarbons	457

Notes:

[a] Road vehicle emission factors based upon low altitude heavy duty working truck, or light duty truck. Assumed to average 40mph over an 8hr working day, except for the ambulances (2hr working day at 60mph)

[b] Working day assumed to be 12 hour, throughout a 410 day construction period.

[c] Assumes 0.5% Sulphur content in the fuel, (in compliance with ASTM D975-01 for grade 2D diesel fuel.

The above emissions can be attributed to predominately to heavy mobile construction plant. Those emissions specifically associated with the incineration of certain construction waste are presented in Table 5-13, and reflect incineratable waste volumes estimated by the EPCM contractor.

Table 5-13 Atmospheric emissions associated with the incineration of waste (Tonnes) [a]

	Total Domestic Waste	Total Hazardous Waste	Combined Total Waste
SO_2	1.7	11.8	13.5
NO_X	1.6	2.4	4.0
CO	0.4	13	13.4
CO_2 [b]	495	18,205	18,700
PM_{10} [c]	1.2	0.0	1.2
HC [d]	0.0	1.6	1.6
N_2O	0.1	0.2	0.3
NH_3	<0.05	0.2	0.2
HCl	1.1	0.2	1.3

[a] Emission factors derived from CORINAIR Atmospheric Emission Inventory Guidebook 1999, assuming an air starved modular combustor incinerator (for example only).

[b] Derived from EPA AP-42 emission factors for domestic waste incineration

[c] Assumes that 71% of total suspended particulate is in the form of PM10 –ratio derived from large combustion engines (US EPA AP-42)

5.13.5.2 Aqueous wastes

Estimated aqueous wastes from construction activities are presented in Table 5-14. Please note that black water refers to sewage, and grey water reflects that from shower and washing facilities.

Table 5-14 Aqueous wastes associated with construction activities ($1000m^3$)

Hydrotest water [a]	350
Black water	126
Grey water	42
Putrescible Canteen Waste	3
Drum cleaning waste	1
Washdown water	263

[a] Value represents maximum value – hydrotest water re-use would reduce this value considerably

5.13.5.3 Hydrotest water disposal

The maximum theoretical volume of hydrotest water would be equal to the entire pipeline capacity in Georgia (ie approximately $350,000m^3$), however hydrotest water re-use will reduce this very considerably. Prior to the testing, the construction contractor will be responsible for the development of a hydrotest water supply, use and discharge strategy that incorporates measures to ensure efficient resource usage and ensures that abstraction and disposal of hydrotest water is appropriately managed.

Hydrotest water disposal procedures will be dependent on the quality of the water and the nature of any lay up (eg temporary mothballing) period that has been undertaken. The contractors Pollution Prevention and Management Plan will include detailed method statements for all water disposal activities. The following sections outline the general procedures that will be applied.

To the greatest extent possible, Hydrotest water will be discharged, via break tanks and additional filters as appropriate, into the next section of line to be tested. If necessary, additional water will be added to make-up any losses or differences in lengths of test section. If surplus water is encountered then it will be discharged at approved locations. Prior to the discharge of any hydrostatic testing waters to the environment, the water will be tested and the results known. Water will be discharged in a manner that prevents environmental impacts (eg scouring, erosion) to land surfaces and/or watercourses.

It should be noted that all water discharged from a pipeline following hydrotesting would be discoloured/stained. Although visible, the levels of concentration are normally very low and as such can be safely discharged to the environment (eg to vegetated ground and then indirectly to watercourse or directly to watercourses). The concentration of iron and other potential contaminants in the discharged water will be determined and if found to be above approved water quality parameters, one of several options for appropriate disposal will be adopted:

- The hydrotest water will be diluted prior to discharge or the discharge rate will be reduced
- The water will be held in an approved holding area and allowed to evaporate off, the remaining iron residue will either collected for proper disposal, or if concentrations are at or below acceptable limits, abandoned in place. Although this option will be retained for use should circumstances require, it should be noted that it is not currently anticipated that evaporation ponds will be used
- Chemicals (eg manganese dioxide) will be added to neutralise the environmental effects of the iron

Hydrotest water that does not meet the water quality standards for direct disposal will not be discharged directly to the environment. After dewatering and disposal activities are complete, disturbed areas will be restored to their pre-construction conditions.

5.14 WASTE MANAGEMENT DURING PIPELINE OPERATION

Upon completion of the commissioning phase, the project WMP will be re-formulated as an Operational WMP. This plan will set out all necessary waste management procedures for routine and exceptional activities associated with the operation of the BTC pipeline. The Operational WMP will be formulated with the aim of integrating the BTC waste management procedures into existing strategies and to maximize synergies with other projects in the region.

Given the limited range and extent of activities that will be undertaken on the BTC pipeline during operation, it is anticipated that the volume of waste produced will be very small, particularly during Phase 1 of the development (eg prior to the commissioning of pump stations).

It is expected that the operator will adopt some of the third party agreements made by the construction contractors as long-term disposal routes. It is also anticipated and that some or all of the waste handling/treatment/disposal facilities established during construction will be adopted for operational use.

5.14.1 Solid and non-aqueous waste

Solid and non–aqueous wastes for the operational phase of the project have been estimated by the engineering design team and are presented by waste type in Table 5-15.

Table 5-15 Annual production of non-aqueous and solid wastes for off-site disposal

Waste Type	Approximate Quantity
Spent Lube Oil	+++
Spent Synthetic Oil	++
Spent Hydraulic Oil	+++
Spent Heat Transfer Medium	++
Spent Detergent	+
Grease, Rags, and Oil Absorbents	+
Waste Diesel	++
Pigging Wax	+++++
Spent Filter Elements	++
Dry Waste from Filters & Pig Receivers	++
Inorganic Sludge	++
Sewage Sludge	++
Scrap Metals	+
Batteries	+
Non – Metallic Scrap	+++
Empty drums and other packing	++

+ <1 Tonne
++ <10 Tonnes
+++ 10-50 Tonnes
++++ 50-100 Tonnes
+++++ 100-500 Tonnes

5.14.2 Wastewater

5.14.2.1 General principles

Wastewater will be minimized by efficient use of raw water and water management schemes will be devised for both construction and operation. In order to minimize waste, the management schemes will aim to ensure that water is re-used whenever practicable prior to treatment and disposal.

All wastewater, except for uncontaminated rainwater, will be treated prior to discharge. The standard of treatment, (eg the limits in terms of concentration and/or flow of contaminants) will be location–specific and dependent on the conditions at the point of discharge to the environment. At a minimum, the relevant World Bank environmental performance guidelines will be complied with.

Run-off and dewatering from construction sites will be treated to remove suspended silt and other solid matter, as necessary. Other contaminated wastewater will be treated to the standards set out in the EC Directive on Urban Wastewater Treatment (1991/271/EEC). Where the Directive specifies different standards for different population ranges, the stricter standards will be chosen for the more sensitive receiving waters. Wastewater treatment facilities will be established at major worker camps and facilities. Other minor locations will use portable treatment equipment.

It is expected that water treatment plants will be established at the pumping station, the main worker camps and potentially at pigging facilities. These are likely to be capable of accepting a range of segregated waste waters. Short-term camps are likely to have simpler facilities, such as packaged sewage treatment units and tanks to receive waste from chemical toilets.

If any wastewater is transferred to a third-party for treatment, the requirements will be equivalent to those applying to third party landfill sites.

5.14.2.2 Operational wastewater streams and treatment

Estimated aqueous wastes from permanently manned facilities are presented in Table 5-16. Permanently manned facilities comprise pump stations and pigging stations.

Table 5-16 Estimated operation waste (tonnes per year)

Black water	1,200 m^3
Grey water	400 m^3
Putrescible Canteen Waste	30 m^3
Note: Assumes worker numbers remain constant for entire export period.	

A number of aqueous wastes would be generated at the proposed pump station sites, of several categories. Each would require different treatment schemes. The streams arising, and their outline treatment is presented in Table 5-17. Final design of wastewater treatment at pump station sites will achieve all project standards for water quality.

Table 5-17 Outline wastewater treatment

Wastewater Stream	Outline Treatment
Domestic waste water including sewage	Sewage Treatment Package (STP)
Operational waste water from workshop facilities, process area and equipment washing (clean)	Oil-water separator (OWS)
Operational waste water from workshop facilities, process area and equipment washing (contaminated)	Held in sumps for either: Waste tanker collection Trickle feed to STP On/off site incineration
Rainwater runoff from roofs and undeveloped areas	Discharge to the environmental without treatment
Rainwater runoff from process slabs and tank bunds where there is a risk of oil contamination	OWS and any supplemental treatment to achieve project water discharge standards
Rainwater runoff from clean areas	Discharged to the environment without treatment
Firewater runoff from an incident triggering the deluge system process and storage areas	Held in firewater detention pond (FDP) for assessment of suitable treatment and disposal (possibly OWS, STP or tanker collection – to be decided for each incident)
Backwashings from water treatment filters and plant	OWS
Drainage from raw water, potable water or firewater tanks	Discharged to the environment without treatment

The likely treatment methods for each type of wastewater are described in more detail in the following sections.

Domestic wastewater

Domestic wastewater from the major AGIs and worker camps will be passed to a sewage treatment package (STP), specifically designed for the site throughput, to reduce suspended solids, chemical oxygen demand (COD) and biological oxygen demand (BOD). The construction contractor will determine the details of the STP design as part of their detailed design responsibilities.

The outflow from the plant will then be passed for off-site discharge.

Operational wastewater (clean)

Where there is minimal risk of oil contamination, such as domestic sinks, operational wastewater will be treated as domestic wastewater.

Operational wastewater (potentially contaminated)

There are several categories of potentially contaminated wastewater:

- Wash water from hosing equipment, vehicles or process slabs. This is to be treated by oil-water separation (OWS) equipment to remove solids and suspended oil droplets. Surfactants will not be used in the washing areas as their presence could potentially compromise the performance of the OWS
- Drainage of equipment coolant systems containing glycols and additives such as anti-corrosion reagents; this stream is unsuitable for treatment by an OWS, so must be collected either in drums or a dedicated water sump tank for later removal by an approved waste contractor. As suitably equipped waste contractors may be difficult to locate in Azerbaijan or Georgia, there are two further treatment options for this wastewater stream – trickle-feed to the STP or incinerate using incinerators located within Georgia. These options are to be explored with equipment manufacturers
- Wash water from regular detergent washings of equipment. This stream is unsuitable for treatment by an OWS, so must be collected either in drums or a dedicated water sump tank for later removal by an approved waste contractor

Rainwater runoff (potentially oil contaminated)

Oil contaminated rainwater runoff could potentially arise from two main sources.

- Water collecting in tank bunds, such as the diesel storage tank, where there is likely to be oil contamination. Such water should be manually pumped out to the OWS (via the firewater detention pond (FDP)). Such bunds will not be permanently connected to the FDP/OWS as there is the risk of flooding the unit with oil in the event of a leak
- Rainwater falling on process areas that house equipment. The drains from these areas will be connected to the OWS. Likely areas to be connected in this way are those sited outside and having the risk of an oil spill, they include:

  - Incinerator/waste compactor areas
  - Pigging area
  - Diesel generator package
  - Firewater pumping area

Rainwater runoff (clean)

Clean rainwater runoff will arise from rainfall onto the gravelled areas of site and roofs of buildings. Since these areas are not expected to pick up any contamination, the water will be passed through site drainage to offsite discharge. In the event of an unexpected waste spill to the clean drains, the offsite outlet valve will be shut to allow a decision to be made on the treatment and disposal route. There will be the facility to sample and pump-out water held up in this way.

Firewater runoff

In the event of a fire in the pump station turbine house, the firewater deluge system will deliver up to large volumes of water at high flow rates. This water is potentially contaminated with oils, equipment coolants (glycols) and any chemicals stored within the building. In the event of a fire, process drainage from these buildings will be directed to an on site firewater retention pond. Any collected firewater runoff will be held in the pond until a treatment route is determined.

Back-washings from water treatment plant

In the train of water treatment equipment, there are water filters and potentially other plant items (sand filters or carbon adsorption units) that need cleaning or backwashing. It is likely that the liquid from backwashing would contain suspended solids that would be routed to the STP through the sewage drainage system.

Drainage from raw and firewater tanks

It is assumed that these tanks will need to be cleaned infrequently. The water should contain no contamination and may be safely routed to off-site discharge. When the firewater tank is cleaned, the off-site discharge valve will be closed to ensure that water is available should a fire arise during the cleaning process.

5.14.3 Atmospheric emissions

A range of atmospheric emissions will be generated by BTC project activities during operation. As indicated in Table 5-18, the atmospheric emissions associated with operational activities were derived from the fuel requirements for the major thermal plant. Values presented do not reflect the operation of the crude topping plant, however such emissions are anticipated to be relatively insignificant compared to those associated with gas turbine operation (Table 5-18). These values are summarised for worst case (in terms of operational emissions) operational activities in the first five years of operation, during which:

- From year 2004 to 2006, two turbine drivers would operate at each pump station site, and additional emissions would arise from truck transport of CTD to PSG2 from PSG1
- From year 2006 to 2009, where a second crude topping plant would begin to operate at PSG1, and truck transport would cease

The subject of atmospheric emissions is discussed in greater detail in Section 10 of this ESIA.

- From year 2009 onwards, where four turbine drivers would operate continuously at each pump station and both sites would produce CTD

Table 5-18 presents indicative estimates of the key operational emissions.

Table 5-18 Atmospheric emissions from construction activities (tonnes)

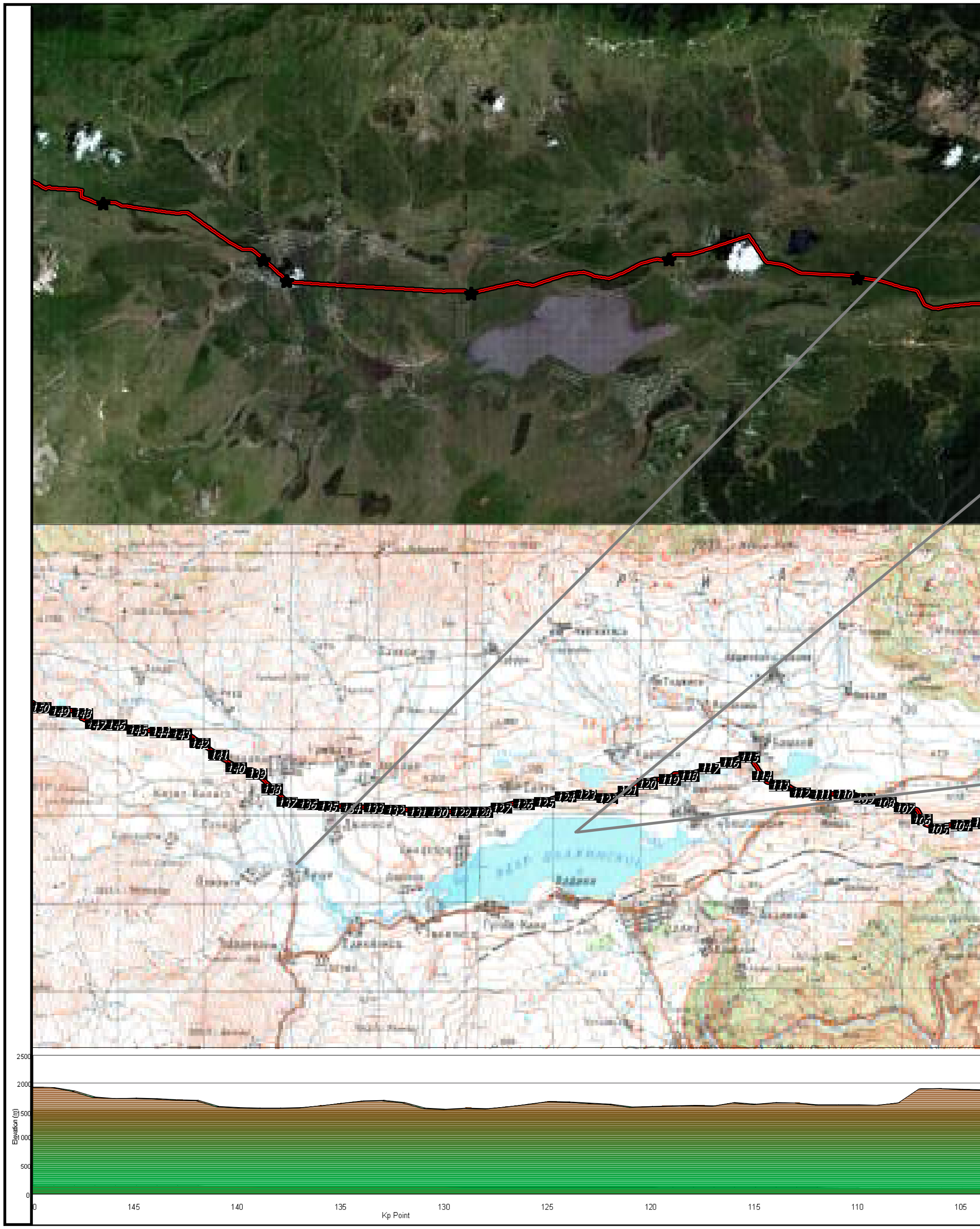
Emission [a b]	2004-2006	2006-2009	2009 onward through project lifetime
	(Tonnes / yr)	(Tonnes / yr)	(Tonnes / year)
Carbon dioxide	263,500	263,500	490,000
Carbon monoxide	185	180	299
Nitrogen oxides	2,050	2,050	3,330
Sulphur dioxide [c]	350	350	600
Particulate matter (PM_{10})	30	30	40

Notes:

[a] Assumes operation of all plant on of CTD and base case (representing worst case for emissions)

[b] Assumes 0.2% Sulphur content in the fuel, (in compliance with Project standard for CTD)

The above table also represents operational emissions associated with operation of all other AGIs.



River Ktsia near Kizil Kilisa

Black Stork on Lake Tsalka

Northern shore of Lake Tsalka

URS

NOTES

1. COORDINATE SYSTEM PARAMETERS:
ELLIPSOID: KRASSOVSKY (1940)
PROJECTION: GAUSS-KRUGER
GEODETIC DATUM PULKOVO (1942) ZONE 8
VERTICAL COORDINATE SYSTEM KRONSTADT (BALTIC SEA) DATUM

2. MAPPING IS BASED ON SCANNED 1:200,000 DATA.

KEY PLAN

LEGEND

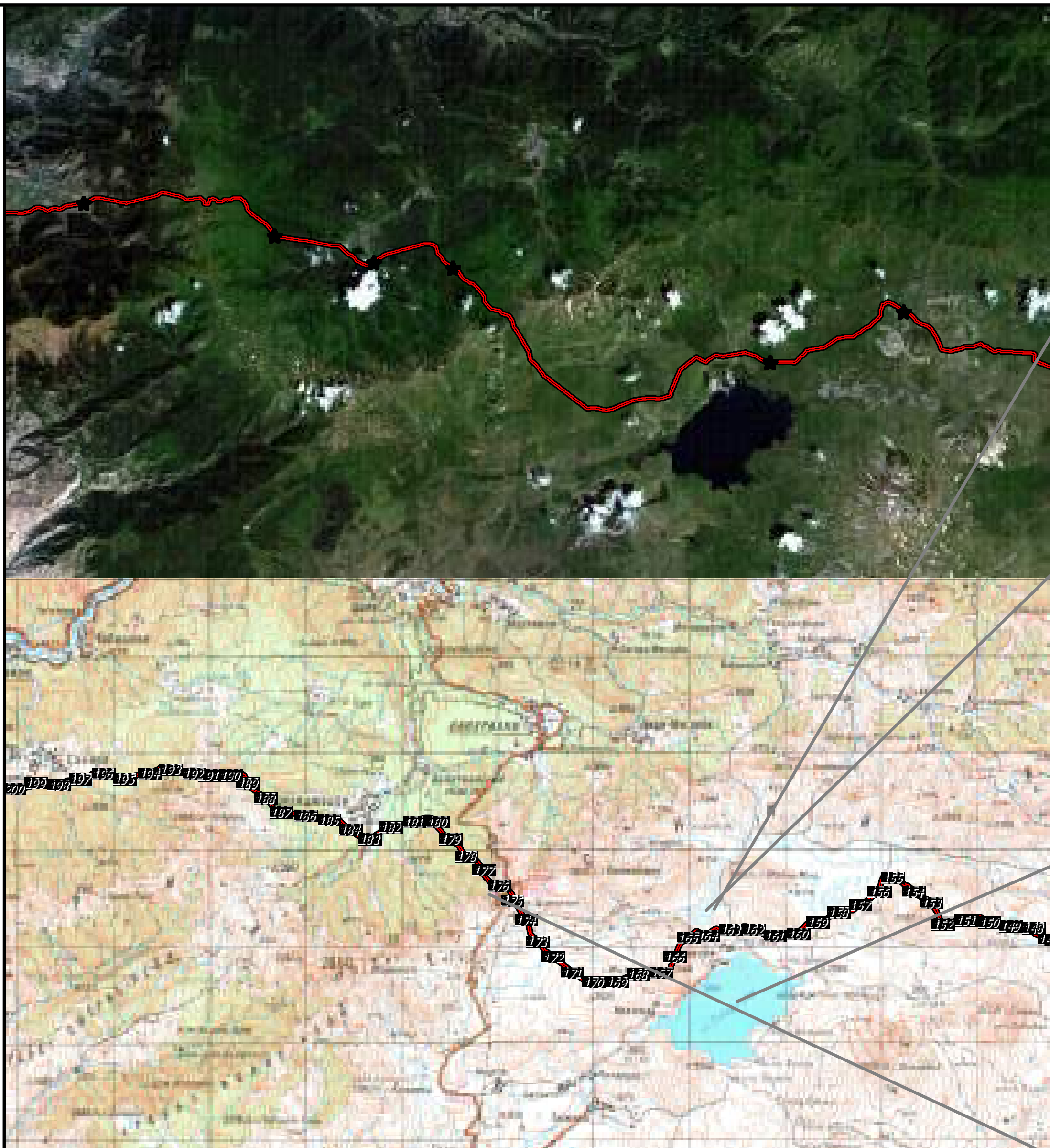
Current Route with KPs
Above Ground Installation

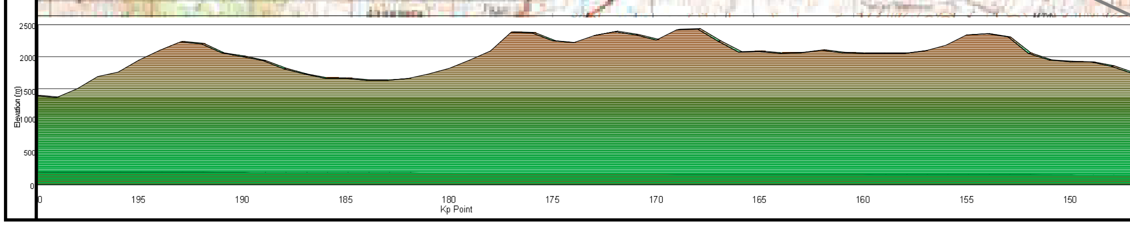
BTC ESIA

TITLE: Route Summary

SCALE (A3): 1:200,000

Figure: MAP 5.1c





Narianis Veli Wetland and Mount Taukvetili

Fox on subalpine meadow near Tabatskuri

Lake Tabatskuri

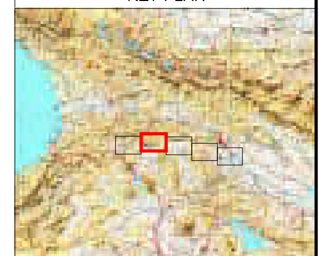
Tkhratskaro Pass

NOTES

1. COORDINATE SYSTEM PARAMETERS:
ELLIPSOID: KRASSOVSKY (1940)
PROJECTION: GAUSS-KRUGER
GEODETIC DATUM PULKOVO (1942) ZONE 8
VERTICAL COORDINATE SYSTEM KRONSTADT (BALTIC SEA) DATUM

2. MAPPING IS BASED ON SCANNED 1:200,000 DATA.

KEY PLAN



LEGEND

Current Route with KPs

Above Ground Installation

BTC ESIA

TITLE: Route Summary

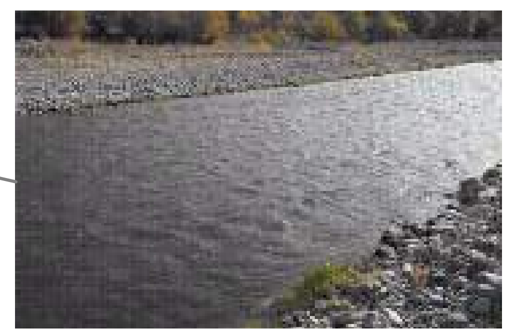
SCALE (A3): 1:200,000

Figure: MAP 5.1d

River Potshkovi

River Mtkvari

Riperian floodplain (River Mtkvari)



River Potshkovi

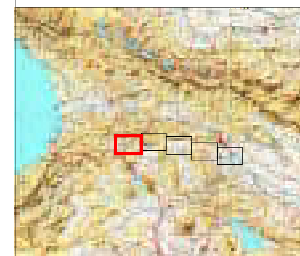
URS

NOTES

1. COORDINATE SYSTEM PARAMETERS:
ELLIPSOID: KRASSOVSKY (1940)
PROJECTION: GAUSS-KRUGER
GEODETIC DATUM PULKOVO (1942) ZONE 8
VERTICAL COORDINATE SYSTEM KRONSTADT (BALTIC SEA) DATUM

2. MAPPING IS BASED ON SCANNED 1:200,000 DATA

KEY PLAN



LEGEND

Current Route with KPs

Above Ground Installation

bp

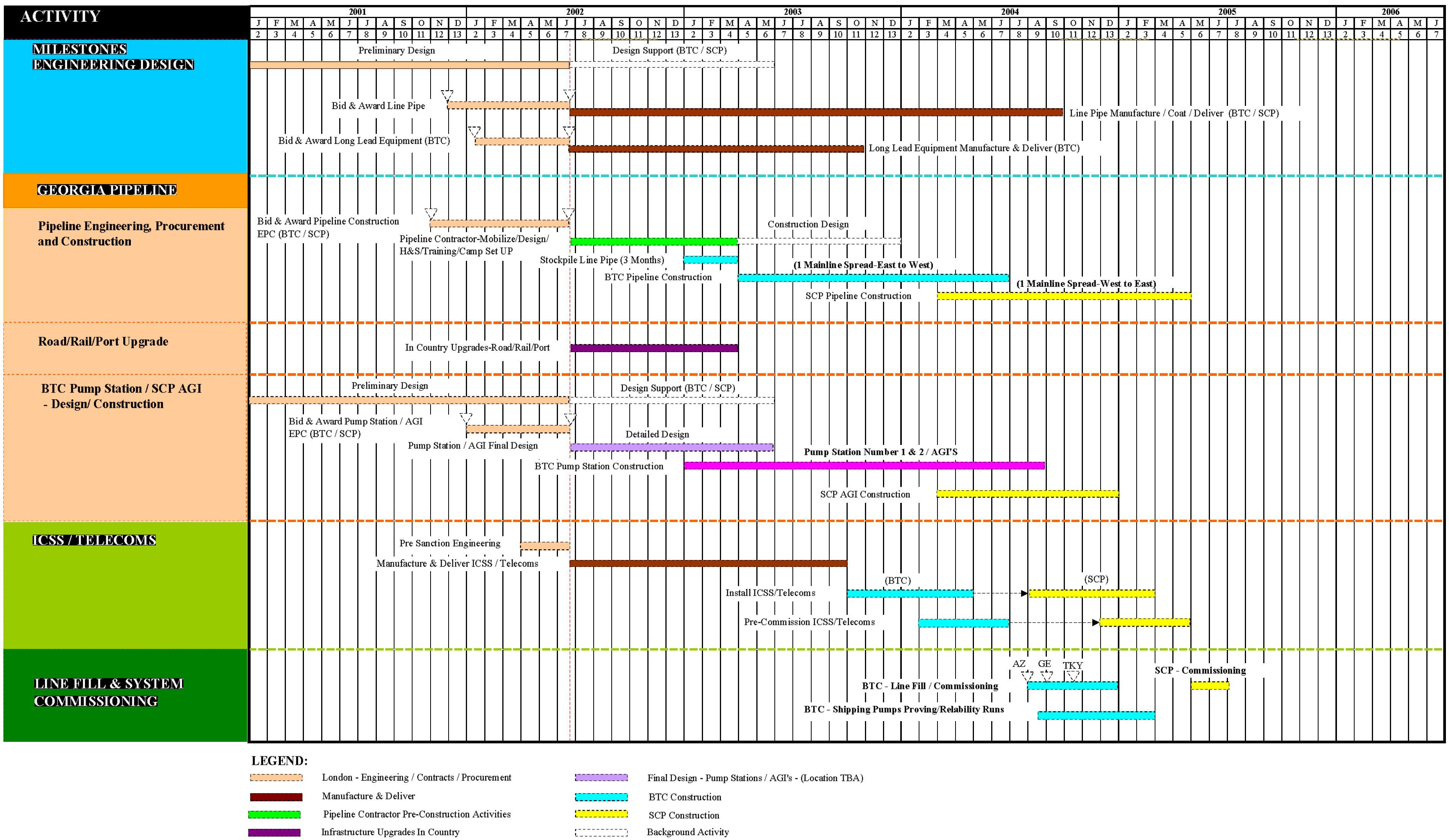
BTC ESIA

TITLE: Route Summary

SCALE (A3): 1:200,000

Figure: MAP 5.1e

FIGURE: 5.2 BTC / SCP OVERALL KEY EVENTS SCHEDULE



LEGISLATION AND POLICY FRAMEWORK

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6 LEGISLATION AND POLICY FRAMEWORK

This section of the ESIA outlines the legislation, standards and policies applicable to the BTC Project in Georgia in two sub-sections. The first sets out the environmental legislative and policy framework and the second sets out the social legislative and policy framework.

6.1 ENVIRONMENTAL LEGISLATION AND POLICY FRAMEWORK

6.1.1 Introduction

The BTC Project will be designed, built and operated in a manner intended to conform with a number of legislative and regulatory requirements and other guidelines and policies, the main categories of which are set forth below:

- National legislation (including the Intergovernmental Agreement and Host Government Agreement – the IGA and HGA, respectively – which form a prevailing legal regime under domestic law in Georgia)
- Specific environmental standards cited in the HGA (Dutch and Austrian)
- International Finance Institution (IFI) Policies
- International Conventions in force in Georgia
- BP Corporate Policies applied by it as Operator of the project

With the exception of the Constitution of Georgia, the Standards set forth in the IGA and the HGA override national legislation to the extent such national legislation is inconsistent. Accordingly, the complete range of standards applicable to the BTC Project in Georgia includes not only what is set forth in the IGA and the HGA, but also Georgian environmental legislation and applicable international standards and guidelines to the extent that they are not inconsistent with the IGA and HGA. Finally, while the applicable national legislative and regulatory requirements together establish the minimum standards of performance below which the conduct of BTC Project Activities must not fall as a matter of law, the BTC Project will also be implemented in accordance with standards; practices and guidelines requiring conduct that will in many instances exceed those legal requirements. These include BP's corporate Health, Safety and Environment (HSE) policies and the requirements of various IFIs with which BTC agrees to comply as part of the BTC Project financing.

This section of the ESIA discusses the relevance of each of these to the BTC project. The descriptions of the IGA, HGA and other laws and documents included below are summaries only and are qualified by reference to the full text of the actual laws or documents.

6.1.2 National environmental legislation

The national environmental legislation applicable to the BTC Project is comprised of the following sources of law listed hierarchically in accordance with the Constitution and other laws of Georgia:

- The Constitution of Georgia

- The IGA and the HGA
- The existing laws of Georgia on environmental protection, safety and emergency situations, to the extent they do not conflict with the IGA or HGA
- Other regulatory requirements as set forth in "sub-legislative" normative acts such as Presidential Decrees, Ministerial Orders, Instructions, Regulations, etc, to the extent they do not conflict with the IGA or HGA

The national environmental legislation applicable to the BTC Project, moreover, is covered by a covenant from the Government of Georgia to the BTC Participants to restore the initial Economic Equilibrium in case of any negative change to the national legislation in force as of the Effective Date (See Section 7.2(x) of the HGA). Obviously, the policies of both BP and the IFIs will be applied to the BTC Project as they exist from time to time regardless of this stability covenant.

Each of these pieces of legislation is reviewed below.

6.1.2.1 Constitution of Georgia

While the Constitution of Georgia does not directly address environmental matters, it does lay down the legal framework that guarantees public access to information and will form a vital component of the overall public consultation process with regard to environmental conditions. The sections of the Constitution given below define the fundamental principles ensuring appropriate public consultation.

Article 37, Part 3 states that "any person has the right to live in a healthy environment, use the natural and cultural environment. Any person is obliged to take care of the natural and cultural environment." Article 37, Part 5 states that "an individual has the right to obtain full, unbiased and timely information regarding his working and living environment."

Article 41, Part 1 states that "a citizen of Georgia is entitled to access information on such citizen as well as official documents available in State Institutions provided it does not contain confidential information of state, professional or commercial importance, in accordance with the applicable legal rules."

6.1.2.2 The Intergovernmental and Host Government Agreement Framework

The BTC Project is being implemented within the framework of an Intergovernmental Agreement (IGA) among the three transit countries (the Azerbaijan Republic, Georgia and the Republic of Turkey) and is comprised of a package of documents including the IGA itself, three unexecuted forms of the Host Government Agreements (HGAs) and, with respect to the Republic of Turkey, unexecuted forms of the Lump Sum Turnkey Agreement (LSTK) and the Government Guarantee. Together, the IGA document package constitutes the binding international law and the controlling domestic law of Georgia governing the BTC Project.

The foregoing IGA document package was ratified by each of the three Parliaments and, in accordance with its own terms, entered into force on September 10, 2000. In October 2000, the BTC Participants executed one HGA with each of the three transit countries and, with respect to the Republic of Turkey, the LSTK and the Government Guarantee. Table 6-1 depicts the Intergovernmental and Host Government Agreement Framework.

Table 6-1 IGA and HGA Agreement framework matrix

Agreement	Azerbaijan	Georgia	Turkey
IGA Signed and ratified by Governments together with unexecuted forms of the three HGAs, the LSTK and the Government Guarantee appended thereto	✓	✓	✓
HGA Signed by Government and the BTC Participants as private law contracts	✓	✓	✓
LSTK Signed by BOTAS and BTC Participants as a private law contract	n/a	n/a	✓
Government Guarantee Signed by Turkish Government and BTC Participants as a private law contract	n/a	n/a	✓

6.1.2.3 The IGA

In an effort to ensure more uniform application of environmental, health, safety and technical standards across the three jurisdictions in which the BTC Project will be constructed and operated, Article IV of the IGA states that "[such standards will be] in accordance with international standards and practices within the Petroleum pipeline industry (which shall in no event be less stringent than those generally applied in the European Union)." This more general statement is subsequently elaborated in the relevant provisions of the HGA as described below.

6.1.2.4 The HGA

In addition to its role as an integral component of the IGA, the HGA is also a contract entered into between the Government of Georgia and the BTC Participants. The HGA determines the following components of the legislative and regulatory framework for the conduct of BTC Project Activities:

- The overall regulatory framework within which the BTC Project will be constructed and subsequently operated including the technical and design standards
- The applicable foreign and international environmental standards and practices incorporated by reference into the national legislation by the HGA
- The regulatory requirements applicable to the BTC Project and the administrative responsibilities of different government departments for the BTC Project
- The liability of the BTC Participants to the State and to third parties for, *inter alia*, breaches of the national environmental legislation

Each of these components will be briefly summarised below.

The overall legislative framework

Article 12 and Appendix 3 of the HGA detail the environmental, health and safety standards and practices applicable to the project. The main principles of Article 12 include the following:

- The environmental, health and safety standards are set forth in Appendix 3 and are applicable notwithstanding conflicting national standards and practices (Section 12.1)
- If spillage or release of Petroleum occurs, the BTC Participants will take all necessary action as set forth in Appendix 3 (Section 12.1)
- The applicable social impact standards are set forth in Appendix 3 (Section 12.2)
- The BTC Participants are obligated to take all action to remedy harm and restore land and other harmed matters to their prior condition regardless of fault or causation (Section 12.3)

Article 12 is cited in full in Appendix B Annex I.

The following is a brief summary of the matters covered in Appendix 3 of the HGA:

- Order of priority for actions shall be protection of life, environment and property (Preamble to Appendix 3)
- Environmental standards to be conformed with (Clause 3.1)
- Procedures to be followed in the event of an emergency (Clause 3.2)
- Enactment or promulgation of future environmental standards and practices by regional or intergovernmental authorities shall not apply to the extent they are different from, in addition to, or more stringent than the Environmental Standards applicable as of the Effective Date (Clause 3.3)
- Scoping study and risk assessment requirements (Clause 3.4)
- Contaminated land baseline study requirements (Clause 3.5)
- Environmental Impact Assessment procedures and requirements (Clause 3.6)
- Spill Response Plan procedures and requirements (Clause 3.7)
- General principles to be followed in the preparation of the scoping study, risk assessment, Baseline Study, EIA and Spill Response Plan (collectively termed the “Environmental Strategy Product”) (Clauses 3.8 to 3.11)
- Procedures to be followed in the event of dispute as to the implementation of the Environmental Strategy Product (Clause 3.12)
- Liability for pre-existing environmental pollution, contamination or damage (Clause 3.13)
- Abandonment plan procedures and requirements (Clauses 3.14 to 3.16)

The general requirements described in Clauses 3.6 and 3.8 to 3.11 have formed the basis for the methodology and structure adopted in the environmental impact assessment for the project. For purposes of technical compliance, as well as for purposes of achieving compliance with the applicable environmental standards and practices, the HGA also sets forth the technical and design standards for the BTC Project. Appendix 3, Part 3 of the HGA is cited in full in Appendix B of this ESIA.

The applicable foreign and international standards and practices

Section 3.1 of Appendix 3 of the HGA states that the BTC Participants shall, in conducting all pipeline activities:

> Conform to the environmental standards and practices set forth in this Appendix 3 as well as those generally observed by the international community with respect to Petroleum pipeline projects comparable to the Project, but in no event shall such environmental standards and practices be less stringent than the relevant standards and practices applied in the Netherlands (and, with respect to mountainous and earthquake-prone terrain as well as whenever the Netherlands has no relevant standard or practice, the relevant standards or practices, if any, of Austria) in respect of comparable projects (the "Environmental Standards").

As member states of the European Community, environmental standards in The Netherlands and Austria are predominantly derived from Directives and Regulations issued by the European Commission. These standards cover, among other things, guidelines for air emissions, water, noise and waste.

In addition to the implementation of EU Directives and Regulations, both the Netherlands and Austria have a number of national laws relevant to the project. It should be noted that Guidelines, National (Standards Institutions) and ISO norms, policies and standards are not directly legally enforced in The Netherlands or Austria. However, when guidelines, norms, policies and standards are referred to in the construction permit and/or in the operational permit, they will gain a legal standard and will be enforceable under law.

HGA environmental, health and safety regulatory process

The HGA also specifies that, *inter alia*, all environmental, health and safety approvals shall be provided on a priority basis within thirty (30) days but in no event later than sixty (60) days (subject to the provisions of Appendix 3). Appendix 3 of the HGA also details the regulatory requirements associated with the preparation, submission and publication of various components of the environmental strategy product including a scoping study, risk assessment, an environmental Baseline Study, the Environmental Impact Assessment and the Spill Response Plan.

This framework is supplemented by Presidential Decree No. 151 on the "Realisation and co-ordination of projects for oil and gas transportation from the Caspian basin through the territory of Georgia via one common energy corridor and appointment of the Georgian International Oil Corporation as the authorised and plenipotentiary representative of Georgia in these projects."

Pursuant to Section 2.2 of the HGA, Decree No. 151 appoints the Georgian International Oil Corporation (GIOC) as the sole authorised representative of the Georgian state in all oil and gas transportation projects from the Caspian Sea including the BTC Project. The Decree states that GIOC is fully authorised to conduct all negotiations on behalf of the Georgian state with international oil and gas companies, including international financial investment, banking, trading, insurance, consulting and other organisations. In addition, GIOC has signing authority on behalf of the Georgian state (with the approval of the President of Georgia) with regard to all agreements, contracts and other documents related to implementation of oil and gas transportation projects.

Under the decree, GIOC has obligations to:

- Co-ordinate the interface between project investors and participants and the state entities and non-governmental organisations of Georgia
- Provide assistance to project investors and participants in acquiring relevant rights, certificates, licenses, visas, permits and approvals related to implementation of such projects in Georgia
- Facilitate the interface between project investors, participants, NGOs, the public and mass media to ensure that project implementation proceeds in an open and transparent manner

GIOC is further authorised to:

- Prepare and submit proposals to the President of Georgia related to the provision of security for such projects in conjunction with the National Security Council, Special State Security Service, Ministry of Defense, Ministry of State Security, Ministry of Internal Affairs, Ministry of Justice, State Intelligence Department and State Border Department, with participation of Georgian and foreign experts
- Submit proposals to the President of Georgia on necessary amendments and additions to the relevant legislative and normative acts of Georgia and other documents, which will be required to facilitate implementation of these projects

HGA principles on environmental and other liabilities

In addition to the obligation imposed on the BTC Participants by Section 12.3 of the HGA to take all action to remedy harm and restore land and other harmed matters to their prior condition regardless of fault or causation, Sections 10.1 and 10.2 further set forth the principles of liability applicable to the BTC Participants in the event of a breach by them of the national environmental legislation. The BTC Participants shall be liable to the State Authorities for loss or damage arising from any breach by them of the HGA or the national legislation of Georgia. Moreover, the BTC Participants shall be liable to third parties for any breach of the standards set forth in the HGA or the national legislation; provided, however, that the BTC Participants shall not be liable to the State Authorities for punitive or consequential damages.

6.1.3 Existing national administrative and legal framework – environmental

Georgia is divided into administrative units (districts). All central Government bodies are located in Tbilisi, the capital city. The Local Executive bodies perform the main administrative functions in each district. A full description of the administrative structure is given in Section 9, Socio-Economic Baseline.

Section 2.2 of the BTC HGA and Presidential Decree No. 151 (24th April 2001) together reference the Georgian Oil International Corporation (GIOC) as the government's MEP Representative, ie the BTC Participants' primary point of contact with government. There is also a government commission that oversees all Caspian Oil and Gas Transportation projects in Georgia, introduced by the Presidential Decree No. 43, which is chaired by the President of

Georgia. In addition to GIOC, a variety of other government departments also play a role in the BTC Project, including but not limited to:

- Ministry of Environment and Natural Resources Protection (MENRP)
- Ministry of Labour, Health and Social Affairs
- State Department of Land Management
- Ministry of Agriculture
- State Department of Forestry
- State Department on Protected Areas, Reserves and Hunting Farms
- Ministry of Urbanisation and Construction
- Ministry of Fuel and Energy
- State Department of Geology

Existing and forthcoming environmental legislation and guidelines relevant to the BTC Project (to the extent not pre-empted by the IGA and HGA) are listed in Table 6-2.

Table 6-2 Existing and forthcoming Environmental Laws, Sub-legislative Normative Acts and Guidelines

Year Adopted	Law/Normative Acts/Guidelines
Existing Laws, Normative Acts and Guidelines	
1994	On Soil Protection
1994	On Protection of Plants From Harmful Organisms
1995	On Creating Borjomi-Klaragauli National Park and Measures Facilitating Establishment of Protected Areas System
1996	On System of Protected Areas
1996	On Entrails
1996	On Environmental Permits
1996	On State Ecological Expertise
1996	On Protection of the Environment
1997	On Wildlife
1997	On Tourism and Resorts
1997	On Water
1998	On Sanitary Protection Zones of Resorts and Resort Areas
1998	On Hazardous Chemicals
1998	On Pesticides and Agrochemicals
1999	On State Complex Expertise and Approval of Construction Projects
1999	On Oil and Gas
1999	On Protection of Ambient Air
1999	Forestry Code of Georgia
1999	On Protection of Cultural Heritage
1999	On Compensation of Damage From Hazardous Substances
1999	On Licensing Design-Construction Activities
2000	On Regulating and Engineering Protection of Coastline and River Banks
2001	On Expansion of Borjomi-Kharagauli National Park

Year Adopted	Law/Normative Acts/Guidelines
Forthcoming Laws, Normative Acts and Guidelines	
Under Review	On Environmental Impact Assessment
Under Review	On Red List and Red Book
Under Review	Advice on Guidelines for Environmental Impact Assessment (first phase) of the BTC Main Export Oil Pipeline in Georgia
Under Review	Methodological Guidelines on Route Selection of Oil and Gas Pipelines in Georgia
Under Review	Georgian Law on Main Pipelines
Under Review	Law on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters

6.1.4 International agreements and conventions

The international agreements and conventions of relevance to the BTC Project to which Georgia is party are listed below:

- UN Framework Convention on Climate Change (acceded by the Resolution #302 of the Cabinet of Ministers of Georgia)
- Kyoto Protocol to UNFCCC (acceded by the Parliamentary Resolution #1995)
- Montreal Protocol on Substances That Deplete the Ozone Layer (and it's London, Copenhagen and Montreal Amendments) (acceded by Resolution #711 of the Cabinet of Ministers of Georgia, acceded to London, Copenhagen and Montreal amendments by Parliamentary Resolutions #376, 377, 378)
- Vienna Convention on the Protection of the Ozone Layer (acceded by the Resolution #711 of the Cabinet of Ministers of Georgia)
- Geneva Convention on Long-Range Transboundary Air Pollution (acceded by the Presidential Decree #8)
- Ramsar Convention on Wetlands of International Importance Especially as Wildfowl Habitat (acceded by the Parliamentary Resolution #201, as amended by the Parliamentary Resolution #1039)
- UN (Rio) Convention on Biological Diversity (ratified by Parliamentary Resolution)
- Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) (acceded by Presidential Decree #524)
- Convention on Migratory Species
- Paris Convention on the Protection of the World Cultural and Natural Heritage (acceded by Parliamentary Resolution)
- European Convention on the Protection of the Archaeological Heritage
- Convention for the Protection of the Architectural Heritage of Europe
- International Convention on Civil Liability for Oil Pollution Damage (and Amendments) (acceded by the Resolution # 805)
- International Convention on Oil Spill Preparedness, Response and Co-operation (acceded by Resolution #711 of the Cabinet of Ministers of Georgia)
- International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage & Protocol & Amendments (acceded by Parliamentary Resolution #207); (note: refers to London Convention)
- International Convention to Combat Desertification (acceded by Resolution #711 of Cabinet of Ministers of Georgia)

- Basel Protocol on Transboundary Movements of Hazardous Wastes and Their Disposal (acceded by the Presidential Decree #232)
- Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters

6.1.5 International finance institution policies and guidelines

The BTC Project is currently negotiating financing with a number of IFIs. In connection with any financing, IFIs such as the International Finance Corporation, part of the World Bank Group, the European Bank for Reconstruction and Development (EBRD) and export credit agencies require compliance with specified environmental and social policies during the term of any financing provided by them.

The BTC owners are also required by the provisions of the HGA to "conform to the environmental standards and practices … generally observed by the international community with respect to Petroleum pipeline projects comparable to the Project" (Article 3, HGA). Thus, to satisfy the HGA, potential international lending agencies and to ensure good practice, all ESIA work for the BTC project is being carried out with regard to World Bank Group and EBRD policies.

These policies will include environmental standards applicable to the project as well as guidelines covering resettlement and other actions involved in project development and operation. The policies that will apply to the project will be set out in an environmental action plan that will be included in the project loan documentation. Tables 6-3 - 6-5 indicate the policies that may be deemed applicable, and have been considered in developing this ESIA.

Table 6-3 Relevant World Bank Group and EBRD policies considered

Policy	Potential Relevance to the BTC Project	How Addressed by the BTC Project	ESIA Document Reference
IFC OP4.01 Environmental Assessment (October 1998)	Requirement for environmental assessment (EA) of projects proposed for financing. The BTC project has been classified as Category A. Projects are classified as Category A if they could potentially lead to significant environmental impacts that are sensitive, diverse, or unprecedented. The associated guidelines specify the stages of the ESIA process, discuss their objectives and list requirements for each stage, including: screening, scoping and development of terms of reference, preparing environmental assessment report, EA review and project appraisal, and project implementation. EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance	The present ESIA addresses issues and requirements relevant to Category A projects as set out in the policy	Through the development of this ESIA report. In particular Section 4 addresses project alternatives and Sections 10 and 11 environmental and social impacts and mitigation, respectively

Policy	Potential Relevance to the BTC Project	How Addressed by the BTC Project	ESIA Document Reference
World Bank / IFC OP4.04 Natural Habitats (November 1998)	OP4.04 embodies the "no net loss" principle, Paragraphs 4 and 5 state: "The IFC will not invest in projects that significantly convert or degrade critical natural habitats or in projects that otherwise affect habitats supporting threatened or endangered species. They will also not invest in projects that significantly convert or degrade other natural habitats unless careful and comprehensive review and analysis indicate that: 1, No feasible alternative exists for the project or its siting; 2. The projects overall benefits substantially outweigh its environmental costs; 3. Project plans include mitigation measures acceptable to IFC; and 4. Project sponsors have the ability to implement necessary conservation and mitigation measures or the project includes plans that are acceptable for developing this capacity	The BTC project, and BTC Co recognise the importance of protecting biological diversity, and in particular ensuring that protected natural habitats are avoided where at all possible through the route selection process. Where an overall project assessment indicates that this is unfeasible, and the overall benefits substantially outweigh the environmental costs, direct mitigation measures have been developed and will be implemented to minimise the impact. Where a residual impact remains, the project will implement compensation plans and environmental investment projects to offset this impact and ensure that there is no net loss to biological diversity	See Section 8, Baseline Description, and the Appendix C of this ESIA for a discussion of habitats and protected areas
OPN11.03 Cultural Property (September 1986)	The World Bank's general policy regarding cultural properties is to assist in their preservation, and to seek to avoid their elimination. OPN11.03 states that the Bank normally declines to finance projects that will significantly damage non-replicable cultural property.	The project has gathered detailed cultural heritage and archaeological information through literature searches and consultation with national and international experts. Extensive non-intrusive integrated baseline surveys involving teams of national and international experts have been completed and sites of potential importance avoided where possible through route selection. Remote sensing tools, including aerial photographs	See Section 8, Baseline Description, and Appendix C of this ESIA for a discussion of important cultural heritage features. A Cultural Heritage Management Plan is included in the Archaeology Section of Appendix C

Policy	Potential Relevance to the BTC Project	How Addressed by the BTC Project	ESIA Document Reference
	"Cultural Property" is defined as "sites having archaeological, palaeontological, historical, religious and unique natural values". Along the BTC pipeline route areas and sites have been identified that are important from an archaeological or cultural perspective. Appropriate actions are being taken at these sites to prevent significant damage	have been used to identify potential sites. Intrusive Phase 2 surveys will be undertaken to define the extent of any potential sites prior to construction, enabling further avoidance measures to be taken. Pre-excavation of sites will take place if no alternative route can be identified, and the overall project benefits outweigh any costs. Direct site protection measures will be implemented during the construction phase. Archaeologists will be present to monitor any late finds during construction. Plans are being developed to manage, record and preserve finds. The Cultural Heritage Management Plans will be subject to regular review and revision to ensure that the Project Plans remain appropriate and effective	
OD4.30 Involuntary Resettlement (June 1990)	The principal World Bank instrument governing project impacts resulting from land expropriation is World Bank OD 4:30 *Involuntary Resettlement* (There are presently two involuntary resettlement policies within the World Bank Group. The project has adopted OD 4:30 *Involuntary Resettlement* on the advice of the World Bank Group). World Bank OD 4:30 *Involuntary Resettlement* is invoked where the involuntary taking of land results in people experiencing economic or physical displacement through one or more of the following circumstances: (i) relocation or loss of shelter; (ii) loss of assets or access to assets; (iii) loss of income sources or means of livelihood, whether or not the persons must move to another location; and, (iv) loss of	Project land acquisition and associated livelihood impacts will be addressed in accordance with international good practice as embodied in the policies and guidelines of the IFC/World Bank Group. Requirements contained in Georgian legislation and the project HGA will also be complied with. The overarching goal of the BTC project is: ***To restore or enhance project affected peoples' living standards, income earning capacity and production to at least without-project levels*** In compliance with OD4.30, the BTC project is completing a Land Acquisition and	See Section 11, Socio-economic Impacts and Mitigation, of this ESIA for a discussion of the land acquisition process. This section outlines the principles that are being followed to address BTC land expropriation and associated physical and economic impacts on land owners, users and occupiers in Georgia, and outlines in more detail how the above key issues will be addressed and compliance achieved. A full Land Acquisition and Resettlement Action Plan is also

Policy	Potential Relevance to the BTC Project	How Addressed by the BTC Project	ESIA Document Reference
	access or restriction of access to communal resources and services. Projects entailing any of the foregoing impacts are required to prepare a Resettlement Action Plan. Through careful pipeline alignment and facilities siting, the BTC Georgia project will minimize impacts on housing and the need to physically relocate households. The project will also involve impacts on land, productive assets, and livelihood through (i) temporary use of land for construction purposes; (ii) permanent acquisition of land (or imposition of rights to construct and operate a pipeline under existing ownership) for the pipeline alignment and two permanent AGIs; and, (iii) imposition of restrictions on land use adjoining the pipeline. The project will impact privately owned land, municipal and state land, some of which is leased to private entities and individuals	Resettlement Action Plan (LARAP). This document is currently under preparation using international specialists experienced in World Bank Group Policies and national land procedures. The LARAP will be prepared through consultation with project-affected people and will be publicly disclosed. The LARAP will also address the following key issues: Grievance mechanisms Valuation of land and compensation determination Liaison with communities Negotiations Documentation of land use and/or ownership Eligibility for compensation Land reinstatement Monitoring and evaluation	being prepared for the project
Policy on Disclosure of Information (September 1998)	The World Bank Group requires consultation with project stakeholders including the potentially affected population, NGOs and other interested parties about the project's environmental and social aspects, and to take their views into account. The consultation should begin at an early stage of the project design. IFC's publication "Doing Better Business Through Effective Public Consultation and Disclosure – A Good Practice Guide" provides "step-by-step" practical guidance on how to prepare a	A Public Consultation and Disclosure Plan (PCDP) has been prepared for the BTC project in accordance with the World Bank Group policies. Public Consultation and Disclosure of information have been carried out through the design stages of the BTC project and will continue throughout construction and operations. A scoping report was completed in	The BTC project consultation process is discussed in more detail in Section 16, Consultation. The full Public Consultation And Disclosure Plan is Provided In Appendix F Annex I

Policy	Potential Relevance to the BTC Project	How Addressed by the BTC Project	ESIA Document Reference
	constructive public consultation programme and effectively disclose information. Under the World Bank Group policies, the BTC project must complete a Public Consultation and Disclosure Plan (PCDP)	consultation with NGOs, scientists, academic institutions, regulators and other interested stakeholders the early engineering design phase. The report was disclosed and comments taken into consideration during the execution of the ESIA baselines studies and impact assessment. Consultation continued during the ESIA preparation. The draft ESIAs will be disclosed in accordance with the HGA and World Bank Group requirements	
IFC Policy Statement on Child/Forced Labour (March 1998)	**NOTE** * Consideration of this policy is a requirement for all World Bank Group investments and does not pre-suppose that the Bank believes that the Project is involved in such practices	The BTC Project or its contactors will not employ Child or Forced Labour. The Invitations to Tender and Contracts contain appropriate clauses to address this	Employment issues are addressed in Section 11

Table 6-4 Relevant World Bank Group and EBRD guidelines considered

Guideline	Relevance to the BTC Project	Compliance by the BTC Project	ESIA Document Reference
World Bank PPAH - Guidelines for Oil and Gas Development (Onshore) (July 1998)	The Oil and Gas Development (Onshore) Guidelines included in the PPAH address onshore oil and gas exploration, drilling and production operations. These Guidelines set out the standards that must be achieved during the performance of onshore oil and gas operations. The standards have been used in the development of BTC project environmental standards	The BTC project has been designed taking into consideration these guidelines; in particular in the areas of air emissions, waste management and oil spill prevention	A framework Oil Spill Response Plan for construction and operation phases has been included in Appendix E Annex 6 of this report. Section 5, Project Description, outlines the project design and how these standards have been achieved. Section 10, Environmental Impacts and Mitigation, incorporates recommendations that ensure compliance with these requirements

Table 6-5 Relevant World Bank Group and EBRD procedures considered

Procedure	Relevance to the BTC Project	Compliance by the BTC Project	ESIA Document Reference
EBRD Environmental Procedures (1996)	EBRD Environmental Procedures detail the environmental appraisal process and standards required of projects sponsored by the Bank. An EIA is required for all Category "A" projects including large diameter oil and gas pipelines. It is the responsibility of the project developer to commission and conduct the necessary environmental investigations to the satisfaction of the Bank. EBRD operations are structured to meet national and existing European (EU) environmental standards. Where EU standards to no exist, national, World Bank standards and international agreements apply where relevant. EBRD encourages developers to comply with good international practice and standards. EBRD believes that effective public consultation is a way of improving the quality of operations. The EBRD requires project sponsors to ensure that national requirements for public consultation in the country of operation be met and that these in turn meet the procedures described in the "Banks Disclosure of Information Policy". For Category "A" projects the EBRD requires the project sponsors to provide the affected public and interested NGOs with notification	The BTC Owners have commissioned this ESIA to address the requirements of the EBRD's procedures. The Public Consultation and Disclosure Plan (PCDP) developed (discussed above) details the BTC project's consultation and disclosure programme	Environmental requirements have been addressed in the ESIA report as well as Appendix C Environmental Baseline and Appendix E Environmental Impact and Mitigation. Social requirements have been addressed in the ESIA report and in the PCDP document

Procedure	Relevance to the BTC Project	Compliance by the BTC Project	ESIA Document Reference
	about the nature of the operation. The EIA and Executive Summary should be available to the public in the local language, in accordance with relevant national legislation and allow sufficient time for public comment		

6.1.6 BP's corporate policy

6.1.6.1 Policy

BP corporate policy focuses on five areas: ethical conduct; employees; relationships; health, safety and environment; and control and finance. They apply equally to all BP activities worldwide. BP policy commitments are the foundation on which its business is built and carried out.

BP's corporate policy states that long-term relationships founded on trust and mutual advantage are vital to BP's business success. BP's commitment is to create mutual advantage in all relationships so that others will always prefer to do business with BP. This will be done by:

- Understanding the needs and aspirations of individuals, customers, contractors, suppliers, partners, communities, governments and non-government organizations
- Conducting activities in ways that bring benefits to all those with whom relationships are held
- Fulfilling obligations as a responsible member of the societies in which the company operates
- Demonstrating respect for human dignity and the rights of individuals

BP is committed to working to build long-term relationships founded upon:

- High performance standards
- Delivering on promises
- Openness and flexibility
- Learning from others
- Mutual interdependence
- Sharing success

The BTC Co-Owners have nominated BP HSE Policies as the basis on which the BTC Project is developed.

6.1.6.2 HSE policy commitment

BP's commitment to HSE performance in the Caspian region, and applicable to the BTC project is outlined in Figure 6-1 overleaf.

BP expects to apply its corporate policies above, and in particular on safety, health and the environment as long as it remains Operator of the project, and subject to the decisions made by Project Participants with respect to operation of the project. BP will apply these policies as in effect from time to time and the policies described in this ESIA are subject to change.

Figure 6-1 BP HSE Policy in the Caspian Region

Health Safety & Environmental Policy

bp

We fully endorse the BP Group Policy and are committed to our worldwide corporate goals: no accidents, no harm to people and no damage to the environment.
Getting HSE right is a fundamental part of our business in the Caspian Sea Region and BP through our operations in exploration, development, extraction and transporting of oil & gas fully supports its goals and requirements.
In meeting with this policy we will:

1. Expect all personnel to demonstrate commitment to, and leadership in, health, safety and environmental (HSE) protection, performance and compliance.
2. Manage HSE performance in compliance with the expectations in the BP "Getting HSE Right" management system.
3. Audit the environmental management system against ISO 14001.
4. Inform our employees, contractors, partners, stakeholders, government agencies and the public of relevant HSE aspects of our operations. Openly listen, consult and respond to their concerns.
5. Endeavour to continuously improve HSE performance.
6. Meet or exceed applicable HSE legislation, regulations and company requirements.
7. Ensure our employees and contractors are familiar with our HSE systems, and are competent and trained to carry out their work safely and with due regard for the environment.
8. Provide employees with a safe place to work.
9. Maintain a commitment to incident and pollution prevention, maintain emergency response plans and resources, and manage emergency situations resulting from our activities.
10. Set annual HSE objectives and targets and openly report our performance. Audit compliance with our policies and take corrective action where appropriate.

No task is so important that we cannot take time to plan and implement it in a safe and environmentally responsible manner.

David Woodward
Business Unit Leader BP Azerbaijan
September, 2001

6.1.6.3 HSE management

BP manages HSE through the application of a set of Corporate HSE Elements and Expectations embodied in the BP document ***"Getting HSE Right"*** or GHSER. All aspects of environmental management are addressed including the requirements for risk assessment; environmental impact assessment; emergency preparedness and response; community relations, and reporting and disclosure of information.

The policy expectations under the BP HSE Management System Framework state that, in all activities and operations, BP will:

- Comply fully with all legal requirements and meet or exceed our HSE Expectations wherever we operate in the world
- Provide a secure working environment by protecting ourselves, our assets and our operations against risk of injury, loss or damage resulting from criminal or hostile acts
- Ensure that all BP employees, contractors and others are well informed, well trained, engaged in and committed to the HSE improvement process; we recognize that safe operations depend not only on technically sound plant and equipment but also on competent people and an active HSE culture, and that no activity is so important that it cannot be done safely
- Regularly provide assurance that the processes in place are working effectively; while all BP employees and contractors are responsible for HSE performance, line management is accountable for understanding and managing HSE risks
- Fully participate in hazard identification and risk assessments, Assurance Management System Assessments and reporting of HSE results
- Maintain public confidence in the integrity of our operations; we will openly report our performance and consult with people outside the company to improve our understanding of external and internal HSE issues associated with our operations
- Expect that all parties working on BP's behalf recognize that they can impact our operations and reputation, and must operate to our standards. We will assure ourselves that our contractors' and others' management systems are compatible with our Commitment to HSE Performance

6.1.6.4 Environmental performance guidelines

Furthermore, BP has developed a set of environmental guidelines applicable to the development of new projects. The BP "***Upstream Environmental Performance Guidelines for New Projects and Developments"*** apply to all new developments and major modifications undertaken by BP, including BTC. They link the environmental assurance process with the engineering, commercial and business development processes. The guidelines require projects to use a zero damage philosophy as the starting point for project design and development. Any variations away from this basis must be evaluated against the following criteria:

- Technical feasibility
- Safety
- Legal compliance
- Good engineering practice
- Environmental damage costs
- Expert professional judgment
- Remediation & mitigation options

- Reputation

The Environmental Performance Guidelines require the establishment of a set of project environmental goals, based on the concept of zero damage. These goals serve as the aspirational drivers for the project. Targets are set in line with these goals against which the environmental performance of the project design and implementation are measured.

The environmental goals established for the BTC project are:

- No combustion emissions
- No loading and offloading emissions
- Zero discharge to land or surface waters (eg oil, chemicals, wastes)
- Maximise efficiency of net energy exported
- Restoration of habitat and hydrogeological regime after construction of pipeline
- No permanent disruption to livelihood of local population
- No resettlement of inhabitants of local population
- No loss of containment of product
- No third-party damage to the pipeline
- No damage to protected ecological areas or archaeological sites
- No creation of access routes to otherwise inaccessible areas

6.1.6.5 Corporate focus areas

BP has three publicly stated corporate environmental focus areas:

- Biodiversity
- Green House Gas Emissions Reduction
- ISO 14001 Environmental Management System Accreditation

Biodiversity

The BTC project recognises that it has the potential to have real and measurable impacts on biodiversity, both positive and negative as reflected by the Project Environmental Goals.

In his speech in 2000 at the BP Conservation Awards ceremony, Lord John Browne formalised BP's ongoing practical commitment to biodiversity through making specific external commitments to take action on biodiversity issues:

"We can have a real, measurable and positive impact on the biodiversity of the world. That is a high aspiration - but like our other aspirations we're determined to show that we can deliver."

And that BP were committed to achieve this by:

- "Working to understand the impact of our current activities….
- Ensuring that key staff monitor and manage conservation and biodiversity issues in their area of responsibility - as part of their performance contracts….
- Expanding the area we manage for conservation….
- Integrating biodiversity considerations into our operating practices….
- Working with others - local communities, partners and contractors - so that our effort is part of a wider drive in the right direction….

- Undertaking a series of specific initiatives in the countries and areas where we operate….
- Measuring, reporting and auditing performance….
- Setting targets to drive the right behaviours, publish results and have them independently verified….
- Sharing our ecological data with the World Conservation Monitoring Centre (WCMC)"

BP has a strategy in place that sets out 5 elements for action:

- Responsible Operations - understand impacts on biodiversity and demonstrate continual improvement in performance
- Public Policy - contribute constructively to the public policy on biodiversity
- External Relations - understand what is important to people; forming partnerships to develop solutions to biodiversity issues
- Conservation Projects - create collaborative partnerships, fund and contribute to conservation activities aligned with local, national, regional and global priorities
- Research, Education and Awareness - make a positive contribution to biodiversity research and education; raise awareness and understanding of employees, people BP works with and customers

At the BTC project implementation level, the BP Corporate Biodiversity Strategy is translated into:

- The need to comply with the commitments and spirit of International Treaties and Conventions to which Azerbaijan, Georgia and Turkey are signatories
- Integration of project plans with national and regional biodiversity action plans
- A robust route selection process including evaluation of biodiversity impact, resulting in the pipeline construction corridor that avoids the most sensitive areas, including IUCN Category I to IV sites
- An open and thorough public consultation process to identify sensitive areas, possible mitigation measures and achieve buy in and consensus on solutions
- Development of direct mitigation measures such as re-routes; reduced working width; seasonal constraints, etc
- Incorporation of direct mitigation measures into pipeline construction Invitation to Tender (ITT) documents
- Evaluation of possible indirect mitigation measures, such as offset projects resulting in overall enhanced biodiversity or environmental additionality
- Identification of potential partners for implementation of offset projects
- Provision of baseline data to the World Conservation Monitoring Centre (WCMC) to enhance its worldwide ecological database, thus assisting with biodiversity planning

Greenhouse gas emissions reduction

BP is committed to maintaining brand distinction compared to market competitors through continued leadership on greenhouse gas (GHG) emissions reductions. To achieve this BP will look to continue to influence public policy on climate change. BP is well positioned to take advantage of the growing market for lower carbon energy and to build on value already created through energy savings, which have resulted from earlier initiatives. It is recognised that Carbon has already become, and will increase in importance as a real business issue / cost.

BP supports the view of the Intergovernmental Panel on Climate Change that:

- The global average surface temperature has increased during the 20th century by about 0.6°C
- About three-quarters of the anthropogenic emissions of CO_2 to the atmosphere during the past 20 years is owing to fossil fuel burning
- There is now new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities
- Future changes in atmospheric composition and climate are inevitable with increases in temperature and some extreme events, and regional increases and decreases in precipitation, leading to an increased risks of floods and droughts

In 1998, BP targeted a 10% reduction in internal GHG emissions from a 1990 baseline (90MT) by 2010. This target was achieved in 2001 with emissions of 80.5MT (9.5MT reduction). However, meeting the target is not the end of BP's commitment to tackling climate change.

Therefore BP has identified a number of further steps to address the climate change issue. These recognise the need for stabilisation of GHGs in the atmosphere, and include:

- Improved energy efficiency
- Use of lower carbon fuels
- CO_2 capture and storage in the medium term.

Through application of skills, technology and business processes BP has set an internal target to hold our net emissions at 10% below 1990, through 2012, by a combination of:

- 10 – 15% improvement in operational energy efficiency by 2012
- Use of flexible mechanisms such as GHG emissions trading and carbon credits

This will be achieved by:

- Sharing knowledge and expertise on energy efficiency
- Producing and selling products with a lower carbon content
- Shifting the balance of our business in favour of lower carbon energy sources
- Working with others (eg Auto makers) to develop more energy efficient technologies
- Continuing our focus on growing our renewable energy portfolio

BP has established a pioneering internal emissions trading scheme, which will be used to help meet GHG emissions targets. Through making and selling lower carbon products, BP will be helping to create "carbon credits", which can be created when a change is made to a more efficient or lower carbon form of energy. BP is committed to working with others to advance emissions trading and emissions credits. We will work with others to quantify credits and apportion ownership.

BP is continuing to lead in the commercialisation of renewable energy technologies, and has one of the fastest growing renewable energy businesses in the world, BP Solar for example is expected to grow by 40% this year.

At the BTC project implementation level, the BP Corporate commitment to GHG emissions reduction is reflected in the developing emissions profile for the project.

ISO 14001 Accreditaton

To progress towards the BP Environmental Expectation that material activities and operations be managed in line with a recognised international Environmental Management System (EMS), specifically ISO 14001, the following target was established:

- By the end of 2001 (2002 for Arco heritage) all major facilities will have their EMSs certified to ISO 14001, and be producing regular verified site environment reports, available on the Internet

The BP Caspian Sea Business Unit achieved certification of its EMS in the year 2000, covering all existing operational units.

At the BTC project implementation level, the BP Corporate commitment to ISO 14001 certification is reflected in the requirement to achieve certification within 9 months of operations commencing. To aid this certification process this ESIA has been developed to be in line with the requirements of ISO 14001, including development of registers of legislation, aspects and impacts registers and monitoring and management plans. An EMS will be developed to manage activities during the construction phase, with certification to be achieved within 9 months of operations commencing.

6.2 SOCIAL LEGISLATION AND POLICY FRAMEWORK

6.2.1 Introduction

As with the environmental requirements, the social standards set forth in the IGA and the HGA override national legislation to the extent such national legislation is inconsistent. Therefore, the BTC Project social legislation and regulatory framework in Georgia includes not only what is set forth in the IGA and HGA, but also includes the Georgian national legislation to the extent that it is not inconsistent with the IGA and HGA. Additionally, the BTC Project will be implemented in accordance with applicable international conventions in force in Georgia, IFI standards with which BTC agrees to comply as part of the BTC Project financing and BP project specific policies which in many instances exceed the above mentioned legal requirements.

The descriptions of the IGA, HGA and other laws and documents included below are summaries only and are qualified by reference to the full text of the actual laws or documents.

6.2.2 Host Government Agreement (HGA)

Many of the requirements applicable to social assessment are set out in Article 12 of the Georgian HGA. Article 12 references Appendix 3, which outlines the standards and principles for social impact assessment (SIA). The key requirements are:

- Use best endeavours to minimise potential disturbances to surrounding communities and the property of the inhabitants thereof (Clause 5.1 of Appendix 3)

- Complete a general review of social conditions in the general location of the pipeline and associated infrastructure, consisting of a scoping study and a risk assessment. These will together form the basis of the content and structure for a social impact assessment of project activities and associated operations, to be conducted by the BTC Participants (Clause 5.3 of Appendix 3)

- During the course of project activities, from time to time, to confer with the State Authorities as to the impact of ongoing project activities in light of the SIA (Clause 5.4 of Appendix 3)

- To take all action necessary to remedy any loss or damage to land and other property that results from an adverse environmental, health or safety event and to restore them, as far as possible, to their prior condition. In doing this, the BTC Participants will incur all associated expenses. If it is not possible to restore land/property, the BTC Participants shall pay full, adequate and fair compensation (Section 12.3 of the HGA)

In addition to Article 12 and Appendix 3, Article 4.1 references Appendix 2, which further governs the social impact of the BTC Project. The key requirements are:

- The BTC Participants "shall be responsible for compensating all landowners and occupiers of such lands which are part of the Construction Corridor or become part of the Permanent Land in accordance with such grant and applicable Georgian Law" (Clause 1.3 of Appendix 2)

- Maintain means of access and construct temporary crossings that may be reasonably required by affected landowners and occupiers. Following construction, private roads and footpaths will be reinstated to their original condition, and made available to landowners (subject to maintaining the security of project facilities) (Clause 7.4 of Appendix 2)

Finally, Article 18 of the Georgian HGA details certain employment and procurement practices. The key aspects include:

- The BTC Participants and any contractor may select and determine the number of employees to be hired in connection with the project. All citizens of the State hired in respect of the project shall be hired under written employment contracts that specify the hours of work required of the employees and the compensation and benefits to be paid. All employment practices applicable to citizens of the State working on the project in Georgia must be at least as stringent as the requirements provided for in Georgian labour legislation. These requirements include hours of work, leave, remuneration, fringe benefits and occupational health and safety standards (Section 18.2)

- For procurement of services, equipment, materials, machinery and tools, vehicles, spare parts, goods and supplies necessary for the proper conduct and achievement of Project Activities, the BTC Participants and any Contractor (including any Operating Company) shall give preference to Georgian suppliers in those cases in which such Georgian suppliers are in all material respects competitive in price, quality and availability with those available from other sources (Section 18.3)

6.2.3 Existing national legal and administrative framework - social

The government administrative framework is outlined in Section 6.1.1.5 above. Specific detail on land, public participation and labour issues is provided below.

6.2.3.1 Land legislation

The overall framework for the granting of Rights to Land by the Government to the BTC Participants is set forth in Articles 4 and 7 and Appendix 2 of the HGA. Section 4.1 of the HGA grants to the BTC Participants:

- The absolute and unrestricted Rights to Land in respect of State Land
- Subject to private arrangements entered into by the BTC Participants, the exclusive and unrestricted property right to use, possess, control and construct upon Non-State Land
- The status and powers of expropriating Rights to Land in respect of Non-State Land

Section 7.2 of the HGA grants the BTC Participants the right to exercise the above mentioned Rights to Land by providing that the State Authorities shall:

- Exercise powers of taking, compulsory acquisition, eminent domain or other similar sovereign powers to allow the BTC Participants to receive and exercise the Right to Land in respect of the State Land
- Assist the BTC Participants in respect of their exercise of the powers of taking, compulsory acquisition, eminent domain or other similar powers of the State in respect of Non-State Land necessary for the Project

Appendix 2, which is appended to the HGA by Section 4.1(iii), further governs the BTC Participants Rights to Land by providing that:

- Subject to any private arrangements entered into by the BTC Participants, the Rights to Land granted to or obtained by the BTC Participants shall be enforceable by the BTC Participants against all State Authorities and against all third parties
- Except for State Land, the BTC Participants shall exercise their powers to obtain the Construction Corridor and to obtain and maintain the Permanent Land and shall compensate all landowners and occupiers of such lands which are a part of the Construction Corridor or become part of the Permanent Land in accordance with such grant and applicable Georgian Law
- The BTC Participants shall have no obligation to pay to the State Authorities any compensation, other than reimbursements of actual verifiable costs, in respect of any land or Rights to Land. However, the BTC Participants shall compensate the State for any State Land that was used for agricultural purposes and is disabled from use for agricultural purposes because it is made a part of the Construction Corridor and/or Permanent Land. Any such payment shall be governed by the Law of Georgia "On Compensation of Compensatory Land Cultivation Costs and Sustained Damages in Case of Allocation of Agricultural Land for Non-agricultural Purposes."

Besides the HGA, there are several land laws in Georgia that have direct implications for the social aspects of the BTC project. The two key items of legislation are:

- The Law of Georgia On the Rule for Expropriation of Ownership for Imminent Public Necessity, 23rd July 1999. The State of Georgia has the constitutional power to seize any property by means of expropriation, for projects of imminent public necessity including oil pipelines. The decision is made only through a Regional Court(preceded by a Presidential Decree justifying the imminent nature of the public necessity) and includes a description of the property to be expropriated and an instruction on the necessity to pay due compensation. The expropriator shall make every reasonable effort to acquire property by negotiation and is required to value the property in accordance with the fair market value before negotiations (and at its own expense)

- The Law on Compensation of Compensatory Land Cultivation Costs and Sustained Damages in Case of Allocation of Agricultural Land for Non-agricultural Purposes, 2nd October 1997. This law specifies requirements for compensating the government (a land replacement fee, which is fixed and variable according to location and quality of land) and affected private landowners and users (for factually suffered property loss plus lost profits) by the beneficiary of an allocation of agricultural land for nonagricultural purposes.. In the event that agricultural land is taken out of agricultural use, the law requires that a land replacement fee be paid to cover costs of cultivating a compensatory parcel of agricultural land of equivalent size and quality, and that the owner/user of such land be fully compensated for damages

6.2.3.2 Public participation

There are two environment focused items of relevant legislation relating to public participation in project development:

- The Law of Georgia On Environmental Permits, 15th October, 1996. The law establishes requirements for consultation and access to information during environmental permitting. This is conducted in the form of public discussion of the activity with the participation of the investor, the Ministry of Environment and Natural Resources Protection of Georgia, and local administrative bodies

- The Law of Georgia On Water, 25th November 1997, as amended, provides for participation of public organisations, labour teams and individuals in implementation of measures aimed at rational use and protection of water

6.2.3.3 Labour legislation

Several items of Georgian legislation are relevant to the BTC Project. The most pertinent is:

- the Labour Code of Georgia, 28th June 1973, as amended, which regulates labour relations between all workers and employees working in Georgia in all enterprises, institutions and organisations, regardless of their ownership and organisational form. It supports the realisation of human rights and freedoms through fair reimbursement and the creation of safe and healthy working conditions. Several provisions are stipulated in the law, including employment guarantees, working time, health and safety conditions, government social insurance, benefits and pensions

In general, foreign citizens and stateless persons living in Georgia have the rights and obligations equal to the rights and obligations of citizens of Georgia.

Employment policy

In addition to the relevant HGA terms, employment policy is governed by the:

- Law of Georgia On Employment, 28th September 2001, which includes the economic, social, organisational and legal fundamentals for protecting the unemployed. The law extends to all the citizens of Georgia and stateless persons who are deemed to be on equal footing with citizens of foreign states in obtaining jobs in Georgia. Under the law, the State Authorities are to establish employment programs (special, local, regional and national), which give priority to "less competitive human resources" (including the unemployed, large families and single parents). The law sets forth policy on the free choice of work regardless of colour, race, sex, religion, political and social status, etc

6.2.4 International agreements and conventions

The key international agreements and conventions of relevance to social issues are outlined in Section 6.1.2 above.

6.2.5 International finance institutions policies

The key international finance institution policies and guidelines of relevance to social issues are outlined in Section 6.1.5 above.

6.2.6 BP corporate policies

Relevant BP corporate social policies will be applied to the project. These are outlined in full in the BP booklet, "What We Stand For". Contractors will be required to comply with these policies, and appropriate clauses are included in the Invitations to Tender and Contracts. Key aspects of BP Business Policies on social issues are highlighted below. BP will also apply the project Statement of Social Objectives, as provided in Section 11.

The following extracts from the BP booklet "What We Stand For" are of particular relevance:

6.2.6.1 Ethical conduct

"We will pursue our business with integrity, respecting the different cultures and the dignity and rights of individuals in all the countries where we operate. BP supports the belief that human rights are universal. They are enshrined in the United Nations Declaration of Human Rights (UNDHR), which we support".

6.2.6.2 Employees

"We respect the rights and dignity of all employees. Everyone who works for BP contributes to our success and to creating a distinctive company. Working together, drawing from our diverse talents and perspectives, we will stimulate new and creative opportunities for our business. Collectively we will generate a more exciting and rewarding environment for work in which every individual feels responsible for the performance and reputation of our company".

6.2.6.3 Relationships

"We believe that long-term relationships founded on trust and mutual advantage are vital to BP's business success. Our commitment is to create mutual advantage in all our relationships so that others will always prefer to do business with BP".

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT METHODOLOGY

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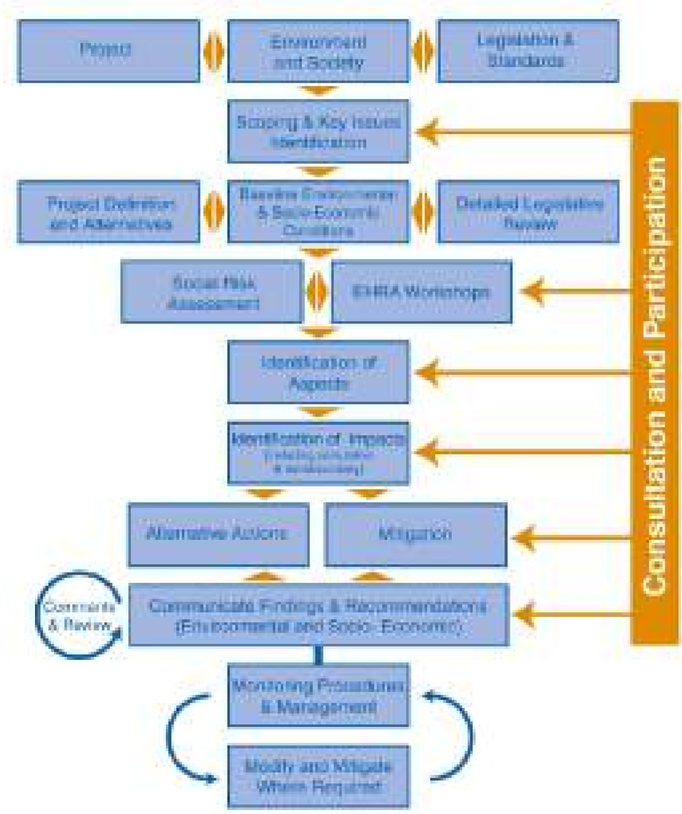
7.1 INTRODUCTION

The ESIA process incorporates a number of key steps as illustrated in Figure 7-1. The assessment process constitutes a systematic approach to the evaluation of the proposed project in the context of the natural, socio-economic and regulatory environments in which development is proposed.

Figure 7-1 The ESIA process



Each of the steps in the ESIA process is described in turn in the following sections.

7.2 CONSULTATION, PARTICIPATION AND DISCLOSURE

7.2.1 Overview

The process of stakeholder disclosure and consultation is an ongoing overarching requirement that applies to the entire ESIA process. The consultation was of critical importance in gaining insights into the key environmental and social issues, concerns of communities and other stakeholders, and in aiding the development of potential strategies for addressing these impacts.

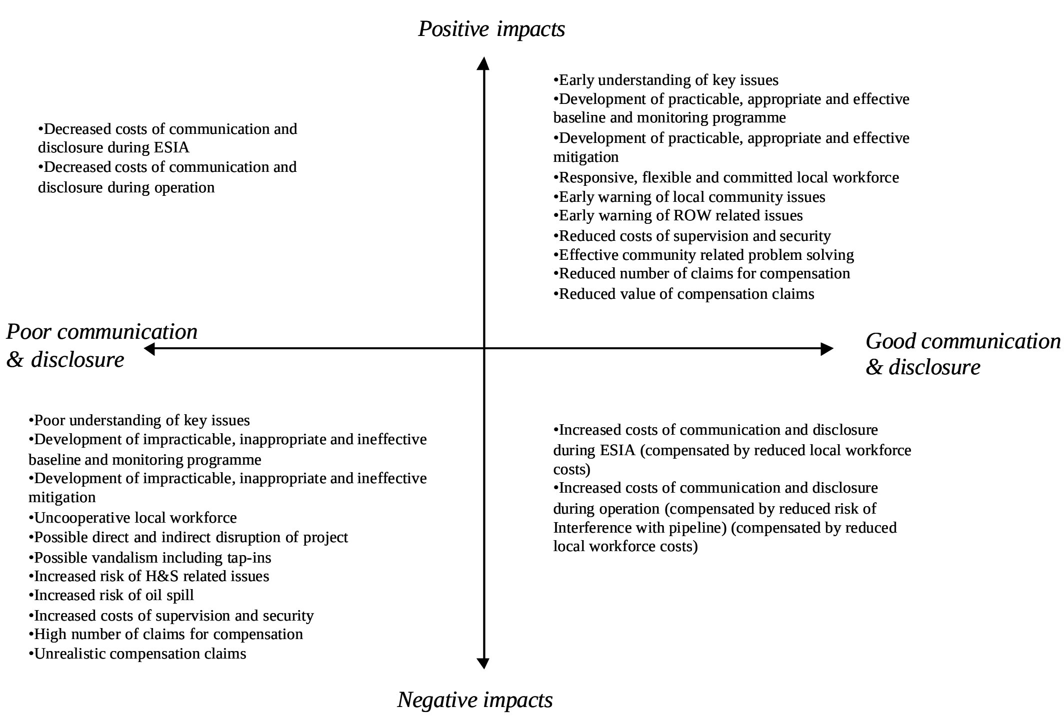
BTC Co recognizes the importance of stakeholder consultation, participation and disclosure during the life of the BTC project.

- Effective consultation with stakeholders is:
  - Key to understanding the concerns and requirements of affected communities and ensuring their participation in the formulation and refinement of the project design
  - A prerequisite for sustainable development along the pipeline route

Effective disclosure through the release of timely, accurate and comprehensive information to stakeholders is essential to ensure; that the likely impacts (both positive and negative) are understood by stakeholders and to allow the stakeholders to provide feedback to the project.

These benefits are illustrated in Figure 7-2.

Figure 7-2 Benefits of effective consultation and participation



Methodologies for disclosure and consultation are discussed in more detail in the following sections:

- Section 16, Consultation gives a full outline of the consultation which has taken place to date
- Appendix F, the PCDP, includes further information on the methodology used for data collection, consultation and lists of stakeholders consulted at each point
- Section 9, Socio-economic Baseline outlines many of the social and economic issues raised by stakeholders during the consultation process

7.2.2 Stakeholder identification

The BTC Owners and the local and international ESIA consultants worked together to identify the key stakeholders who should be consulted at various stages of the project. This was done using a combination of previous project experience, knowledge of Georgia and the NGO community, and consultation with authorities, NGOs, academics, etc. This has ensured that all people who may be affected by or have an interest in the proposed project have had an opportunity to obtain information about the project and express their opinions and concerns.

Stakeholders were drawn from the following groups:

- ***Authorities*** comprising national, regional and local government bodies, of primary political importance to the project and to the ESIA process, including regulators
- ***International, national and local NGOs***, organizations which have a direct interest in the project, and which may have useful data or insight into the local and national challenges faced by the project
- ***Interest groups*** including, for example, media, academics, institutions, foundations and community groups
- ***Residents, landowners and land users*** of the towns and villages in what are known as the pipeline affected communities, those within a 2km corridor either side of the pipeline or pipeyard, or within 5km of a worker camp, or large AGI
- **IFIs**
- **BTC owners and project partners**

A full list of the stakeholders consulted can be found in the PCDP.

7.2.3 Tracking consultation

Documentation of public consultation is important in ensuring that inputs are captured and fed into the project planning process and to maintain a record of issues raised by consultees. A database was established to log all meetings with stakeholders at national, regional and local levels to ensure effective tracking of the consultation process throughout the ESIA and later the land acquisition process. This contains the date of the meetings, minutes, issues raised, persons involved and agreed actions and responsibilities including:

- Records of meetings with government departments, scientists and conservancy bodies
- Record of meetings with local communities
- Records of meetings with NGOs

It was decided that data relating to consultation with individual households should be recorded separately to protect the anonymity of individual respondents. This is in line with international practices and helps to ensure that the responses are truthful and more accurately reflect the opinions of the householders. The database is also used as a tool to ensure that actions are followed up and completed.

A clear representation of consultations carried out is discussed in Section 16. All relevant stakeholders were identified using the most recent and accurate information available. This has ensured that all people who may be affected by or have an interest in the proposed project have had an opportunity to express their opinions and concerns. Views have been sought at a local, regional and national level.

7.3 THE SCOPING PHASE

Having decided that an ESIA was required for the BTC project, a scoping process was undertaken to identify key issues and develop the terms of reference for the ESIA. At this stage, it was considered essential to identify the likely environmental and social impacts more precisely and to define the project's area of influence. As part of this process, information about the project and its likely effects was disseminated to local affected communities, national scientists, academic institutions, and NGOs, in addition to the authorities and regulatory bodies. This was followed by consultations with representatives of these groups. The main purpose of these consultations was to focus the ESIA on issues of concern at the local level. The scoping led to a focused ESIA of a manageable number of important issues.

It was important for the successful completion of the ESIA that the scoping process was undertaken early and in an open manner.

7.3.1 Objectives

The key objectives of the scoping exercise were to:

- Define the project in sufficient detail to allow the scoping exercise to effectively and efficiently shape the environmental and social impact assessment
- Review relevant policy, legal and administrative frameworks including corporate environmental policy and management system, relevant national and international legislation and guidelines
- Identify key issues
- Identify and confirm the stakeholders
- Initiate consultation, participation and disclosure with the stakeholders, identify and document their key concerns and obtain their agreement on the key issues to be addressed
- Identify data gaps and agree any necessary fieldwork to fill these gaps with stakeholders
- Where appropriate, to identify potential mitigation measures for further analysis
- Establish the work plan and Terms of Reference for the remainder of the ESIA process, including a continuing programme of stakeholder disclosure and consultation

7.3.2 Scoping workshops and report

A series of scoping workshops and meetings were held with the following stakeholders:

- Local Communities
- National Regulators
- Scientific Community
- Regional and National Government
- NGOs
- IFIs

The results of the scoping exercise were presented in a Scoping Report made available to the following organizations:

- Key stakeholders in Georgia including Government, regulators, the scientific community and NGOs
- Key international stakeholders including the IFIs
- BP and other partners of the BTC Group
- The engineering design teams (John Brown Hydrocarbons Limited, Bechtel and Fluor Daniel)

The workshops set out to inform key stakeholders on the project scope, the ESIA activities, and the schedule. They also solicited feedback on key issues to be addressed during the on-going consultation process. Details of the consultation process are provided in Section 16; a record of who was consulted and the issues that were raised is provided with the project PCDP in Appendix F.

7.4 CONSIDERATION OF PROJECT ALTERNATIVES

Prior to agreeing the pipeline route and other aspects of project design, viable alternatives were identified so that a realistic base-case design could be developed. However, design development is an iterative process and the design is modified continuously to take account of new information as and when it has become available, including information from the ESIA process.

A full discussion of the alternative options that were assessed during the scoping and project development are discussed in detail in Section 4, including the social and environmental implications of a ‘no development option’.

7.5 DETAILED LEGISLATIVE REVIEW

The Policy and Legal Framework review for this project is described in Section 6. This review addressed social and environmental policies and requirements at the following levels:

- National legislation
- International legislation and guidelines relevant to the project
- BP corporate policy and management systems
- HGA

The definition of relevant national and international standards and requirements has ensured that the project development has been assessed against all relevant existing environmental and social regulations and guidelines as well as the project proponent company's environmental, social, ethical and business policies and standards.

7.6 ESTABLISHING BASELINE INFORMATION

7.6.1 Overview

The Scoping Report identified a number of key issues and associated information gaps. In order to be able to understand the potential impacts of the proposed pipeline on these issues it is necessary to have a good understanding of the pre-project, or baseline, conditions. The key issues relate to a range of environmental and socio-economic attributes including:

- Noise
- Air
- Traffic
- Ecology
- Soils
- Cultural Heritage
- Contamination of land
- Landscape
- Water Resources
- Employment
- Energy
- Land acquisition
- Infrastructure and resources
- Safety
- Community Relations

A good understanding of the baseline for these attributes has been achieved through two activities:

- Detailed review of all secondary resources (ie existing documentation and literature)
- Undertaking primary field studies to collect required supplementary data

7.6.2 Environmental baseline information

Following a detailed literature review a preliminary field survey was carried out in the Summer and Autumn of 2000 by a team of Georgian and international scientists. The survey consisted of a walk over of an approximate route corridor and resulted in a preliminary baseline report. The specialist survey team included a botanist, zoologist, geologist and an archaeologist. Its main objective was the identification of environmentally sensitive issues along the proposed corridor.

Based on the findings of the preliminary corridor walk over, a number of detailed field surveys were planned and undertaken during the Winter, Spring and Summer of 2001. The surveys covered various subjects including Flora, Fauna, Archaeology, Air Quality, Noise, Landscape, Seismic Analysis, Geology, Geotechnical Engineering, Traffic and Infrastructure, and Soil. The surveys were carried out partly by the ESIA team and partly by specialist technical teams.

Botanical and faunal survey: these were carried out at a general level throughout the proposed pipeline corridor and subsequently, based on the identification of sensitive habitats at a number of key locations as listed in Section 8 Environmental Baseline.

Archaeological surveys: a number of archaeological surveys have been carried out along the route to evaluate the significance of findings known through the literature reviews or through aerial photograph interpretation. Additional archaeological surveys were carried out whenever a new route was examined and at proposed AGI locations.

Air quality assessment: air quality was sampled at three locations along the pipeline route to record pre-construction quality. Two locations were selected with regard to the future installations associated with the pipeline whilst one remote location on the pipeline route was selected to gather background data.

Noise assessment: this was carried out at the proposed pump station sites and at all sites where temporary facilities may be developed during the construction period.

Landscape assessment to evaluate the aesthetic and amenity value of the landscapes along the route: this task was carried out by a Georgian landscape architect of international reputation and consisted of an evaluation of the current quality of the landscape along the pipeline corridor, of the area of visual influence of the pipeline construction and operation activities and of the potential impacts associated with the pipeline construction activities.

Seismic assessment of the proposed route: a detailed seismic assessment of the proposed route was carried out by a specialist team of quaternary geologists, seismic geomorphologists and a Georgian seismologist to evaluate the degree of neotectonic activity along the proposed pipeline route, identify active faults and assist in the design of the faults crossings.

Geotechnical investigation along the whole route: a geotechnical investigation was carried out along the entire route and on the segments of corridor that were re-routed owing to environmental or engineering requirements. The objectives of the geotechnical assessment were the definition of the construction requirements along the route, the evaluation of areas of ground instability and the identification of the construction techniques required to avoid geohazards.

Contaminated land investigation: a baseline contamination walk over and survey has been undertaken to document any potential contamination existing prior to the proposed pipeline construction and operation and to document background soil quality when no contamination had been detected.

Traffic and infrastructure study: this task consisted of a specialist assessment of the conditions of the existing roads and tracks that would be affected by the proposed construction activities and of the intensity and distribution of traffic prior to the commencement of the project.

Soils: this task consisted of a detailed soil survey along the proposed route to enable the determination of the erosion risk and to assess the adequate rehabilitation measures required to stabilize and reinstate each section of the proposed route after construction.

7.6.3 Socio-economic baseline information

A socio-economic survey was undertaken in all the 'pipeline affected communities', defined as communities within 2km of the pipeline or a pipeyard, and within 5km of a worker camp, or major AGI such as a pump or metering station. This zone of influence of construction and operation was determined by the consultants on the basis of previous pipeline experience and confirmed as appropriate by the local consultants in relation to Georgia. As sections of the pipeline have been rerouted from time to time in response, in part, to ESIA results, the 'surveyed communities' no longer correspond 100% to the pipeline affected communities, ie there are a few communities which have been included in the survey which no longer strictly fit the above definition as they are now outside the 4km corridor. However, there are no communities now considered to be pipeline affected which have not been included.

Data were collected by a team of trained local consultants supported by international consultants using standard methodologies for the collection of qualitative and quantitative information. Questionnaires were developed and tested on local interviewers experienced in data collection in rural Georgia. These were then adapted for local use and a team of local interviewers speaking the local languages was trained to ensure that local cultural sensitivities in the different communities would be recognized and interview approaches adapted accordingly.

Five different questionnaires were used in total:

- Household questionnaire seeking mainly quantitative information, focused on local villagers and their livelihoods
- Questionnaire to guide a series of in-depth interviews with villagers who have significant standing in the community, or facing specific impacts, seeking to gain both qualitative and some quantitative information
- Qualitative questionnaire or guide for a semi-structured interview with village leaders aimed at gaining information about the villages from the village leaders perspective and their attitudes to the pipelines
- Qualitative questionnaire for use in villages (villagers and village leaders) to gain specific to information relating to attitudes and concerns arising from the potential proximity of worker camps, pipe yards and large AGIs
- Qualitative questionnaire for interviewing villagers and village leaders to check on attitudes towards the building of an oil as opposed to a gas pipeline, and towards the cumulative impacts of both pipelines

Prior to undertaking the above surveys villages that may be affected by potential impacts were identified to ensure that a representative sample of the population of pipeline-affected communities were included. Factors taken into consideration included ethnic groups, geographical spread, size of community, gender and age distribution of respondents.

The data was collected in a format that could be easily transferred to a database and GIS for later analysis using SPSS[1], and mapping of attitudes and impacts. They covered the following main topics:

- Population and demographics
- Labour and livelihoods

[1] Standard specialist software designed to assist in the analysis of data gathered through interviews and questionnaires

- Infrastructure, resources and services
- Culture, local administration, decision-making and planning
- Attitudes and perceptions

In addition to village level data, the consultants also collected socio-economic data from Government officials in the regional centres and towns, census data and economic data from international sources.

The project sought information in each and every community along the pipeline route. Interviewees for the household level data were chosen through a random selection process and the numbers interviewed in each settlement were statistically proportional to the population of that settlement. Hence the numbers of household interviews undertaken in each community ranged from six to over 25, while the number of in depth interviews ranged from one to eight. The in depth interviews were largely held with the authorities in the villages, starting with the Head of Local Authorities (Gamgebeli), and including teachers, doctors or nurses, etc, in larger settlements. However, some in depth interviews were held with groups thought to be potentially impacted by the project in a more substantial way, including shepherds and a representative sample of landowners (farmers). In total 706 household and 138 in depth interviews were carried out in the 71 communities along the route.

In addition to the village level consultation, a focus group for the district leaders and five in-depth interviews with government representatives were held in Poti Port. The aim of this was to help understand some of the possible benefits, which might accrue from the construction of the pipeline in addition to some of the potential challenges that might be faced in that area.

7.7 ENVIRONMENTAL AND SOCIAL HAZARD AND RISK ASSESSMENT

Environmental Hazard and Risk Assessment (EHRA) and Social Risk Assessment (SRA) are processes whereby the ESIA team can:

- Confirm its understanding of the project with the design engineers
- Identify to the design engineers areas of potential environmental or social concern
- Jointly develop alternatives so that potential impacts can be avoided where possible, or mitigated

EHRA/SRA meetings were conducted with key project engineers and HSE advisors and facilitated by members of the ESIA team. They provided an opportunity to gather additional information on the project where necessary. Each meeting allowed input from all participants in the identification of potential environmental and social hazards associated with the project activities. In addition, possible alternatives and options were evaluated.

The process considered each activity that will, or may, occur during the project including:

- Planned routine activities
- Planned but non-routine activities
- Unplanned or accidental activities

This process culminated in the development of a list of activities and the identification of hazards that may affect the environment or local communities. It is important to note that existing mitigation measures designed into the project were considered during these meetings.

7.8 IDENTIFICATION OF ENVIRONMENTAL ASPECTS AND IMPACTS

Once baseline information had been collated, predictions and modeling of potential changes resulting from the proposed BTC project development were conducted. This was undertaken through identification of the projects aspects and impacts resulting from each activity during construction and operation.

7.8.1 Environmental aspect identification

The ISO's standard for Environmental Management Systems (EMS), ISO 14001 defines an environmental aspect as:

"An element of an organization's activities, products or services that can interact with the environment."

This definition has been used in the identification of the proposed project's environmental, legal and socio-economic aspects. To identify project aspects, all proposed activities, have been considered in terms of their direct or indirect potential to:

- Breach relevant policy, legal and administrative frameworks including HGA and national legislation, relevant international legislation, standards and guidelines, and corporate environmental policy and management systems
- Interact with the existing natural environment including its physical and biological elements
- Interact with the existing socio-economic environment

Activities assessed during site preparation, construction, reinstatement, operation and decommissioning include:

- Planned routine activities
- Planned but non-routine activities
- Unplanned or accidental events

7.9 ENVIRONMENTAL IMPACT ASSESSMENT

7.9.1 Overview – environment

ISO 14001 defines an environmental impact as:

"Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services."

An impact may result from any of the identified project aspects. The following table illustrates the links between activity, aspect and impact.

Table 7-1 Links between activities, aspects and impacts

Activity	Aspect	Impact
Handling hazardous materials	Potential for accidental spillage	Contamination of soil or water
		Mortality to flora and fauna
Use of vehicles	Exhaust emissions	Contribution to global warming and ground level ozone
	Fuel oil leaks	Contamination of soil or water
	Noise	Disturbance to surrounding environment/dwellings

The aspects and impacts of each activity of the BTC project have been identified for each activity and are summarized in Section 10, Environmental Impacts and Mitigation.

Impacts may be direct or indirect. Indirect impacts are often produced away from the project as the result of a complex pathway, for example the interruption to groundwater flow may result in reduced vegetation and damage at a remote wetland. In addition impacts may be further divided into residual, cumulative and trans-boundary. These types of impact are discussed below. During the impact appraisal process all types of potential impact have been addressed (see Section 10).

The ROW encounters not only significantly different terrains in Georgia but also varying climatic conditions, vegetation and landscape. In view of these changing factors along the route the ROW has been separated into units (linear or point), each of which have common characteristics with regard to the following three factors:

- Project activities (that could result in impacts)
- Biotope (similar physical and biological environments, eg mountainous coniferous forest)
- Environmental sensitivity

Archaeologically sensitive sites or river crossings are units of limited geographic extent (point units) whilst forest habitats or faunal sanctuaries may have a broader geographic extent (linear units).

Not all the project will follow the linear distribution of the pipeline ROW, for example, construction traffic, camps and construction yards are activities off the ROW and therefore are discussed independently from the ROW units.

7.9.2 Social impact assessment

The evaluation of socio-economic impacts involves the assessment of both quantitative and qualitative data and the use of professional judgment. Quantitative data collected through national sources or local level interviews is assessed and analysed by traditional economic or sociological techniques. However, qualitative data collected using the same methodology is more open to interpretation. In addition, what is a major impact to one person, one household or one community may be a minor impact to another according to specific personal circumstances. Hence, the results do not lend themselves easily to being ranked or assessed in exactly the same way as environmental data. As a result, the application of assessment language in the evaluation of results tends to be more qualitative in relation to the socio-economic impacts than in the equivalent environmental sections.

Another difference is that to evaluate elements of the project, which may require the development of mitigation measures from a socio-economic perspective, a distinction is made between the concept of issues and impacts. Issues can be broadly defined as an element requiring consideration and assessment for which a policy or a specific mitigation strategy may need to be defined. Impacts are elements with a potential direct or indirect impact on a specific household, community or sector of a community. In this sense, the overall management of community relations is an issue, where the need to compensate a farmer for the removal of his fence would be described as an impact.

In assessing the scale of the issues and impacts, the following factors are taken into consideration:

- The likelihood of the impact
- Changes to the assets that households depend upon for their livelihoods
- The duration of this change: short-term disturbance (eg during construction only), long-term (eg during operation period) or permanent
- The manageability of the change and potential for it to lead to further changes beyond the control of the project
- The ability of the affected people to adapt to changes and thus maintain livelihoods over the long term
- The magnitude of the impact is then viewed from the perspective of those affected, by taking into account the perceived importance of the impact or perceived impacts in the eyes of communities

Field survey data has been used to help identify specific communities in which a particular aspect of the project, or potential impact, is likely to be particularly important or to have a particularly acute, or chronic, effect. Where these impacts are quantifiable statistical data have been provided.

7.9.3 Impacted groups

Socio-economic impacts apply and are assessed at the household, community and project levels. Different households will often be affected in different ways by the same impact. It is therefore necessary to assess variation in impacts between different households. For example, a poor household dependent upon natural resources over which it has no legal rights may not have access to compensation or may be ill equipped to use compensation money in an appropriate way. However, since most of the communities within the pipeline corridor have a similar economic profile, many of the impacts can be assessed at the community level in order to develop further specific community level mitigation measures where appropriate.

Impacts are also assessed at a more macro level where appropriate in order to assess cumulative impacts caused by the whole project as well as its individual parts. Other social and socio-economic issues that are regional in nature as opposed to route specific are being examined within another study entitled "Environmental, Social and Economic review of the ACG Full Field Development and Export in the Regional Context" This addresses broader issues such as revenue management, access to energy, economic linkages, conflict and human rights. Other social and socio-economic issues that are regional in nature as opposed to route specific are being examined within another study entitled "Environmental, Social and Economic review of the ACG Full Field Development and Export in the Regional Context" This addresses broader issues such as revenue management, access to energy, economic linkages, conflict and human rights.

7.10 MITIGATION OF POTENTIAL IMPACTS

Mitigation has been an integral part of the BTC project development, from conceptual design through to construction, operation and decommissioning. Mitigation measures are generally identified to avoid, minimize or remedy the adverse effects of impacts. They may also be used to enhance the positive benefits of the project, especially in relation to social issues. They are developed using professional judgment and experience within the legal, technical, political and economic constraints of the project and may involve policy changes, technical solutions, or various forms of compensation. The project team, community and other stakeholders have been consulted to ensure that the mitigation measures are both practical and appropriate. Mitigation measures either already implemented or proposed for the BTC project are discussed in Sections 10, 11 and 12 and include:

- Routing of pipeline to avoid areas of high sensitivity
- Measures in the original project design (eg ensuring the pipeline goes around and not through people's houses)
- Engineering design solutions during the ESIA process (eg moving a site for spoil, increasing pipe thickness)
- Alternative solutions to processes and methods to achieving objectives (eg methods of transporting materials, or recruitment of unskilled workers)
- Operational control procedures (eg fines for damage outside the ROW)
- Conservation management
- Management systems (eg reporting mechanisms for Community Liaison Officers (CLOs) and Key Performance Indicators (KPIs)/targets for contractors)
- Development of policies and procedures (eg Statement of Social Objectives for the project, compensation plans for land/livelihoods)
- Timing restrictions (eg construction activities near villages and schools)

For environmental impacts, a suite of standard mitigation measures has been developed and applied, as appropriate, to all potential impacts during site preparation, construction, reinstatement, operation and decommissioning of the BTC pipeline (see Section 10). These mitigation measures will fully mitigate a number of the predicted potential impacts. Each mitigation measure is numbered to allow easy identification.

Consultation on the mitigation measures proposed has included:

- A presentation of initial ideas to Government, NGOs and other interest groups during meetings in Tbilisi and Akhaltsikhe in October 2000
- Presentation of developed mitigation measures to government and NGOs during one to one meetings in December /January 2001/2 in Tbilisi
- Presentation of developed measures to six pipeline affected communities[2] in January 2002

[2] Akhaltsikhe, Tsikhisjvari, Bashkoi, Tetritskaro, Didi-Dumuki and Kesalo

These communities were chosen as representative of the pipeline-affected communities in terms of ethnic groups, size and potential locations close to worker camps and AGIs. Locations were also chosen on the basis of accessibility to ensure participation by individuals from other communities and local NGOs wherever possible; hence there was a combination of local communities and major district centres. All comments from the meetings have been taken into consideration in the development of final mitigation measures (including in relation to the potential siting of worker camps) as presented in the ESIA.

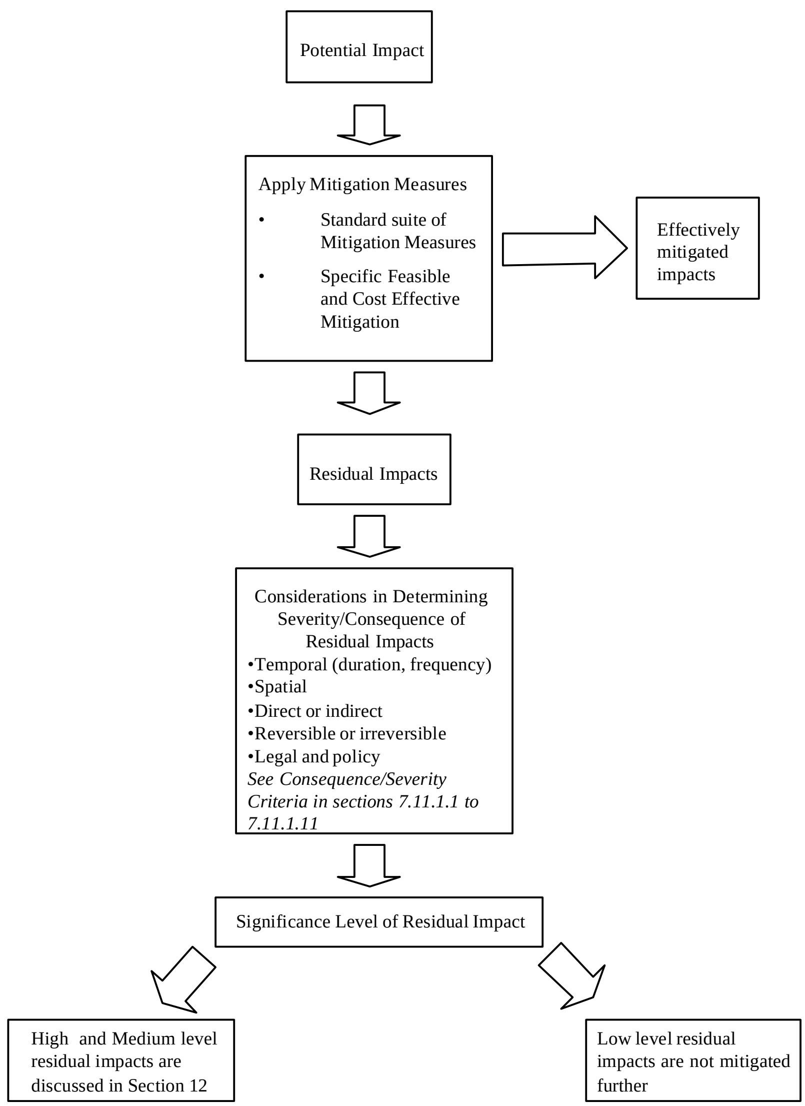
The full suite of mitigation measures is presented in Sections 10 and 11.

Following assignment of mitigation measures, any impact that remains is termed a **residual impact**. Assessment of residual impacts is discussed in the following section.

7.11 RESIDUAL IMPACTS

The flow diagram below illustrates the process of addressing potential and residual impacts (Figure 7-3).

Figure 7-3 Flow diagram illustrating the application of mitigation and assigning level of significance to residual impacts



The key to understanding the process applied to minimizing the impact of this project has been the development of a standard suite of mitigation measures. These are applied as appropriate to all potential impacts identified. If the potential impact is not fully mitigated by this standard suite, then specific, feasible and cost effective mitigation measures are also applied. Any impacts that remain after the application of these mitigation measures are considered residual impacts.

Any impacts remaining after mitigation measures have been applied are considered residual impacts. The significance level of the residual impact is assessed on the basis of:

- The severity/consequence of an **impact**
- The **likelihood** that the impact will occur

The significance level is ranked on four levels: High, Medium and Low, or Beneficial. These rankings are used for both environmental and social residual impacts. Evaluating the level of residual impact is discussed further in Section 7.11.3.

7.11.1 Consequence/severity of residual environmental impacts

As shown in Figure 7-3, residual environmental impacts have their consequence/severity determined, on a one to five tiered scale, using Impact Consequence Criteria. These Criteria have been developed for key issues listed as dot points below, and are contained in Sections 7.11.1.1 to 7.11.1.11. There are a number of considerations that have been built into these Impact Consequence Criteria including temporal, spatial, impact reversibility, direct and indirect impacts, and relevant legal or policy constraints.

- Noise
- Air quality
- Traffic
- Ecology
- Soils
- Archaeology
- Social
- Contamination of land
- Landscape
- Water resources

It should be noted that it is often difficult to compare residual impacts consistently across different natural and socio-economic environments. Scientific evidence as well as predictions based on observation of similar activities has been used in the impact assessment process. Where this is not possible qualitative judgment has been used to ascribe impact based on the project and ESIA team's extensive experience and knowledge.

7.11.1.1 Noise (for human receptors)

Table 7-2 Ranking of noise consequence/severity

Category	Very Low	Low	Medium	High	Very High
Ranking	1	2	3	4	5
Construct-ion	Ambient noise level raised by <3dBA (not perceptible by most people) and less than $L_{Aeq\ 5\ minutes}$ 70/75 dB(A)[1] outside dwellings between agreed daytime working hours and limit of $L_{eq\ (1\text{-}hour)}$ 45 dB(A)[2] at night (to avoid sleep disturbance)	Ambient noise level raised by 3-5dBA and less than $L_{Aeq\ 5\ minutes}$ 70/75 dB(A) outside dwellings between agreed daytime working hours and limit of $L_{eq\ (1\text{-}hour)}$ 45 dB(A) at night	Ambient noise levels at sensitive receptors raised by 6-10dB (A) and less than $L_{Aeq\ 5\ minutes}$ 70/75 dB(A) outside dwellings between agreed daytime working hours and limit of $L_{eq\ (1\text{-}hour)}$ 45 dB(A) at night	Ambient noise levels at sensitive receptors raised by >10dB (A); or exceedance of $L_{Aeq\ 5\ minutes}$ 70/75 dB(A) outside dwellings between agreed daytime working hours and limit of $L_{eq\ (1\text{-}hour)}$ 45 dB(A) at night	As for Level 4 and either tonal or impulsive noise present
Continuous operational noise in residential areas	$L_{eq\ (1\text{-}hour)}$ <45 dB(A)[3] at night and $L_{eq\ (1\text{-}hour)}$ <55 dB(A)[3] during the day	$L_{eq\ (1\text{-}hour)}$ <45 dB(A) at night and $L_{eq\ (1\text{-}hour)}$ <55 dB(A) during the day but ambient noise level raised by no more than 3dBA	$L_{eq\ (1\text{-}hour)}$ <45 dB(A) at night and $L_{eq\ (1\text{-}hour)}$ <55 dB(A) during the day but ambient noise levels at sensitive receptors raised by 3-6dB (A)	Exceeding $L_{eq\ (1\text{-}hour)}$ <45 dB(A) or $L_{eq\ (1\text{-}hour)}$ <55 dB(A) during the day	Exceeding of $L_{eq\ (1\text{-}hour)}$ <45 dB(A) or $L_{eq\ (1\text{-}hour)}$ <55 dB(A) during the day and tonal or impulsive noise present
Continuous operational noise in industrial/ commercial areas	$L_{eq\ (1\text{-}hour)}$ <70 dB(A)[3]	$L_{eq\ (1\text{-}hour)}$ <70 dB(A) and ambient noise level raised by no more than 3dBA	$L_{eq\ (1\text{-}hour)}$ <70 dB(A) ambient noise levels at sensitive receptors raised by 3-6dB (A)	Exceedance of $L_{eq\ (1\text{-}hour)}$ 70 dB(A)	Exceedance of $L_{eq\ (1\text{-}hour)}$ 70 dB(A) or $L_{eq\ (1\text{-}hour)}$ and tonal or impulsive noise present

1 World Bank Group "Pollution Prevention Abatement Handbook – General Environmental Guidelines". Recommended level for Industrial installations

2 WHO "Guidelines for Community Noise" (1999)

3 World Bank Group "Pollution Prevention Abatement Handbook – General Environmental Guidelines". For a residential area, the World Bank recommend that daytime limits do not exceed LAeq 55dB daytime, and LAeq 45dB night-time, or a maximum 3dBA increase than the existing noise level should the existing ambient noise level already exceed 45dBA

4 World Bank Group "Pollution Prevention Abatement Handbook – General Environmental Guidelines"

5 Should any of the above noted increased in noise levels be predicted to occur for more than two weeks duration, the next consequence/severity level up will be used
6 Only receptors within 1km of the activity where assigned a ranking

7.11.1.2 Air quality (for human receptors)

Table 7-3 Ranking of air quality consequence/severity

Category	Very Low	Low	Medium	High	Very High
Ranking	1	2	3	4	5
Short term (<24 hours) concen-trations	Process concentrations that are not discernible	Process concentrations that are <75% of the EU standards	Process concentrations that are 75-100% of the EU standards	Process concentrations that are 100-149% of the EU standards	Process concentra-tions that are >150% of the EU standards
Long term (>24 hours) concen-trations	Maximum process and baseline concentrations are <10% of the EU standards	Maximum process and baseline concentrations are 10-20% of the EU standards	Maximum process and baseline concentrations are 20-50% of the EU standards	Maximum process and baseline concentrations are 50-100% of the EU standards	Maximum process and baseline concentra-tions are >100% of the EU standards

Notes:

- Only receptors within 200m of the activity where assigned a ranking
- These standards are for the protection of human health and do not reflect industrial emissions
- The details for the various standards are included at Section 6
- The EU standards include consideration of duration. Any exceedance is considered to be of the same level of impact irrespective of its geographic extent, or location
- Nuisance takes account of duration by the inherent assumption that in order to cause a nuisance the impact must last for a reasonable duration (eg greater than one week or repeated impacts)

7.11.1.3 Dust (For human receptors)

The dust criteria are qualitative in nature and requires professional judgment in order to assign the appropriate ranking. Nuisance takes account of duration by the inherent assumption that in order to cause a nuisance the impact must last for a reasonable duration (eg greater than one week or repeated impacts).

Table 7-4 Ranking of air quality consequence/severity

Category	Very Low	Low	Medium	High	Very High
Ranking[1]	1	2	3	4	5
Dust	No measurable or notable increase	Measurable and notable increase in dust levels	Nuisance to people but no adverse health effects or on crops/property	Significant nuisance to people or with sensitive individuals affected, or minor property or crop damage	Very significant nuisance to people with measurable health effects, or significant damage to property or crops

Note: only receptors within 200m of the activity where assigned a ranking

7.11.1.4 Traffic impact

The approach for determining impact for traffic impacts relates to changes in traffic flow and the presence of receptors, as well as the duration of the impact. Impacts upon the road system itself will be limited by upgrading of the roads required to the standards required to enable project activities, such as heavy vehicle movement.

The presence of receptors (eg built-up areas, villages, schools, pedestrians, etc) is a necessary prerequisite in order for impacts to occur. The next consideration is the percentage increase in traffic flow, with the following rankings assigned:

- Not measurable – Very Low
- <5% increase – Low
- 6-10% increase – Medium
- 11-20% increase – High
- >20% increase – Very High

The final consideration in determination on the consequence/severity level is that the duration of the impact. Should any of the above noted increased traffic flows be predicted to occur for more than two weeks duration, the next consequence/severity level up will be used.

7.11.1.5 Ecology

The consequence/severity of ecological impact has been evaluated taking account of the following factors:

- The magnitude of the impact, as determined by its intensity, its extent in space and time and the likelihood of it occurring
- The vulnerability of the habitat or species to the change caused by the impact
- The ability of that species or habitat to recover
- The value, in nature conservation and ecological terms of affected receptors including species, populations, communities, habitats, landscapes and ecosystems

Any contravention of legislation relating to conservation is considered to be High (4)

Table 7-5 Ranking of ecological consequence/severity

Category	Very Low	Low	Medium	High	Very High
Ranking	1	2	3	4	5
Habitat integrity	Impact on the habitat integrity[1] largely not discernible	Loss of habitat integrity not measurable using standard techniques	Reduction in integrity of regionally (in the country context) important habitat using standard techniques	Reduction in integrity of nationally important habitat using standard techniques	Reduction in integrity of internationally important habitat using standard techniques
Species behaviour and interactions	No discernible effect owing to disruption[2] on behaviour or species interactions	Disruption of behaviour or species interactions discernible using standard techniques	Disruption of behaviour or species interactions of regionally (in the country context) important species discernible using standard techniques	Disruption of behaviour or interactions of nationally important species discernible using standard techniques	Disruption of behaviour or interactions of internationally important species discernible using standard techniques
Habitat/ species recovery	Immediate return to baseline conditions[3] on completion of reinstatement activities	Return to baseline conditions[3] within 2 years on completion of reinstatement activities	Return to baseline conditions[3] within 2-5 years on completion of reinstatement activities	Return to baseline conditions[3] after 5-10 years on completion of reinstatement activities	Return to baseline conditions[3] after >10 years on completion of reinstatement activities
Protected Habitat	Not impacting an area affected by national laws, international conventions, company policies or IFI Policies	Activities may temporarily disturb protected areas but not lead to any long-term effects on the ecological integrity of the protected area	Potential to contravene the very high (5) category; assuming reinstatement likely within three years	Potential to contravene the provisions or intent of national laws, international conventions, company policies or IFI Policies after mitigation, assuming full reinstatement to pre-disturbance condition within five years	Contravenes the provisions or intent of national laws, international conventions, company policies or IFI Policies

Notes
1 Ecological integrity includes issues such as loss of habitat, fragmentation of habitat, disruption and loss of wildlife corridors, ecological carrying capacity
2 Disruption to behaviour owing to physical changes, noise, visual intrusion and air emissions, for eg breeding, nesting, mating/spawning, diurnal and seasonal migration, hibernation, territorial activities, predator-prey relationships and ultimately mortality
3 Applies only to areas that are temporarily disturbed ie not permanent facilities

7.11.1.6 Soils

The magnitude of impacts on soils has been evaluated by taking account of the following factors:

- The magnitude of the impact, as determined by its intensity and extent in space and time
- The vulnerability of the soils to the change caused by the impact
- The ability of the soils to recover from the impact

Table 7-6 Ranking of consequence/severity on soil

Category	Very Low	Low	Medium	High	Very High
Ranking	1	2	3	4	5
Soil erosion	Soil erosion generally not discernible	Soil erosion predicted to occur at approximately the same rate as soil formation	Soil erosion predicted to be visibly active but no rill and gully formation evident	Rill and gully formation predicted to be evident	Rill and gully formation predicted to be extensive
Reduced soil productivity	Productivity losses generally not discernible	Productivity losses are discernible and predicted to last less than three months after construction	Limited productivity losses predicted to last less than one year after construction but more than three months	Moderate areal extent of productivity losses predicted to last more between one and five years after construction	Productivity losses are predicted to be extensive last more than five years after construction
Waterlogged soils	Water logging generally not discernible	Water predicted to remain in surface depressions less than three months after construction	Water predicted to remain in surface depressions less than one year after construction but more than three months	Water predicted to remain in surface depressions for between one and five years after construction	Water predicted to remain in surface depressions permanently (this altered state could be beneficial ,eg wildlife)
Sediment transport to water courses	Visible Sediments generally not discernible	Visible sediment predicted in watercourses for less than three weeks after construction and no obscuration of	Visible sediment predicted in watercourses for longer than three weeks after construction but no obscuration	Visible sediment predicted in watercourses for longer than three weeks after construction and obscuration	Permanent features in watercourses

Category	Very Low	Low	Medium	High	Very High
Ranking	1	2	3	4	5
		the bed	of bed	of the bed	

7.11.1.7 Cultural heritage

Information on archaeological features normally only becomes available during the construction phase of the project owing to the intrusive nature of the process. Therefore, the assignment of accurate consequence/severity prior to the construction phase is often not possible. Nonetheless, there are a number of factors to be taken into account in assigning the consequence/severity of a potential impact on archaeology.

A matrix has been employed in order to be able to determine the consequence/severity of the impact by taking account of the protected status and the potential for destruction of archaeological remains.

Table 7-7 Ranking of consequence/severity on cultural heritage

Category	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Ranking	**1**	**2**	**3**	**4**	**5**
Potential for Destruction	Deposits will not be affected, because of distance from the pipeline, or method of construction	A small (1-10%) proportion of the surviving deposits damaged or destroyed	A moderate (10-25%) proportion of the surviving deposits damaged or destroyed	A large (25-50%) proportion of the surviving deposits damaged or destroyed	Most (50-100%) of the surviving deposits damaged or destroyed
Protected Status	Resources whose importance is unknown, sites of uncertain date or character	Resources which have little or no archaeological or historical value, or where remains may have been previously destroyed	Locally important resources of low or minor importance	Regionally important resources of a reasonably defined extent, nature and date and significant examples in a regional context	Internationally and nationally important resources, legally protected remains of national importance

A 1 to 5 score is assigned for both "Potential for Disturbance" and "Protected Status" using the above table. These scores are entered into the matrix below and the final consequence/severity score determined by multiplying the Potential for Destruction score by the Protected Status score, and dividing by five.

Table 7-8 Consequence/severity scores on cultural heritage

Potential for Destruction					
5	**5**	**10**	**15**	**20**	**25**
4	**4**	**8**	**12**	**16**	**20**
3	**3**	**6**	**9**	**12**	**15**
2	**2**	**4**	**6**	**8**	**10**
1	**1**	**2**	**3**	**4**	**5**
	1	2	3	4	5

Protected Status

7.11.1.8 Contamination of land owing to project activities

Table 7-9 Ranking of contamination of land consequence/severity

Category	**Very Low**	**Low**	**Medium**	**High**	**Very High**
Ranking	1	2	3	4	5
Description	Concentrations below DIV[1]	DIV concentrations exceeded by <25% in project area and can affect receptors	DIV concentrations exceeded by 25-50% in project area and can affect receptors	DIV concentrations exceeded by 50-100% in project area and can affect receptors	DIV concentrations exceeded by >100% in project area and can affect receptors

1 DIV refers to Dutch Intervention values used internationally as screening criteria. The DIV are levels at which intervention to clean up is recommended. Their use here is to provide a measure of impact rather than as a trigger level for intervention during construction should any contamination be exposed.

7.11.1.9 Landscape

Assessing the consequence/severity of landscape and visual impact is a qualitative process, which relies upon subjectivity and reasoned judgment, supported where possible by evidence.

Table 7-10 Ranking of consequence/severity on visual receptors and landscape

Category	Very Low	Low	Medium	High	Very High
Ranking	1	2	3	4	5
Impact on Visual Receptors (resident and transitory)	Change in viewpoint not discernible	Few viewpoints affected/minor change in view	Many viewpoints affected/moderate changes in view	Majority of viewpoints affected / major changes in view	All of viewpoints affected
Duration and extent of change in landscape / Quality and value of landscape	No noticeable change in landscape / or landscape is low quality	Virtually imperceptible change in the landscape; or Reinstatement within 1-2 years	Changes in the natural landscape in a localized area; or Reinstatement in 2-5 years	Change in natural or high value landscape over an extensive area; or Reinstatement in 5-10 years	Change in natural or high value landscape over an extensive area; and Reinstatement not possible

7.11.1.10 Groundwater – quality and quantity

Table 7-11 Ranking of groundwater consequence/severity

Category	Very Low	Low	Medium	High	Very High
Ranking	1	2	3	4	5
For ground-water used, or may be used, as a resource, being of sufficient quantity and quality	No discernible change in ground-water baseline conditions, no discernible change in ground-water resource quantity and no effect on use	Change of <25% in any parameter from the DIV[1] criteria *or* depletion of resource that does not recover within 6 months post construction (within 10% of original elevation) and having a temporary effect on use	Change of 25-50% in any parameter from the DIV[1] criteria *or* depletion of resource that does not recover within 6-12 months post construction (within 10% of original elevation) and having a short term but reversible effect on use	Change of 50-100% in any parameter from the DIV[1] criteria *or* depletion of resource that does not recover within 1-2 years post construction (within 10% of original elevation) and having a long term effect on use	Change of >100% in any parameter from the DIV[1] criteria *or* depletion of resource that does not recover after 2 years post construction (within 10% of original elevation) and having an irreversible effect on use

1 DIV refers to Dutch Intervention values. The DIV are levels at which intervention to clean up is recommended. Their use here is to provide a measure of impact rather than as a trigger level for intervention should contaminated groundwater be encountered during construction.

7.11.1.11 Surface water – quality and quantity

Table 7-12 Ranking of surface water consequence/severity

Category	Very Low	Low	Medium	High	Very High
Ranking	1	2	3	4	5
For surface water used, or may be used, as a resource, being of sufficient quantity and quality	No discernible change in surface water baseline conditions, no discernible change in downstream river discharge and no effect on use	Change of <25% in any parameter from the DIV[1]; or visible sediment observed for less than 3 weeks; or <15% decrease of downstream river discharge for no more than 1 day and having a temporary effect on use	Change of 25-50% in any parameter from the DIV[1];or visible sediment observed for more than 3 weeks; or 15-40% decrease of downstream river discharge for 1-2 days and having a short term but reversible effect on use	Change of 50-100% in any parameter from the DIV[1]; or Visible sediment observed for more than 3 weeks; or >40% decrease of downstream river discharge for 2-3 days and having a long-term effect on use	Change of >100% in any parameter from the DIV[1]; or visible sediment observed for more than 3 weeks; or >40% decrease of downstream river discharge for >3 days and having an irreversible effect on use

1 DIV refers to Dutch Intervention values. The DIV are levels at which intervention to clean up is recommended. Their use here is to provide a measure of impact rather than as a trigger level for intervention.

7.11.2 Likelihood

To assign likelihood of residual impact, five criteria were defined and ranked. This five-tiered likelihood ranking of criteria is in line with international practices (eg Australian/New Zealand Risk management Standard AS/NZS: 4360). The criteria for likelihood are shown in Table 7-12.

Table 7-13 Likelihood categories and rankings natural and socio-economic impacts

Ranking	Definition
5	The impact will occur under normal operating conditions
4	The impact is very likely to occur under normal operational conditions
3	The impact is likely to occur at some time under normal operating conditions
2	The impact is unlikely to but may occur at some time under normal operating conditions
1	The impact is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances

7.11.3 Evaluating level of residual environmental impact

The residual environmental impacts are assigned a level of significance based on the likelihood of the impact and the consequence of that impact. For each residual impact a consequence/severity ranking between 1 and 5 has been assigned using the impact criteria tables above. The likelihood is assigned using Table 7-13. The significance level of residual environmental impact is then determined using the matrix below where L denotes a Low-level of impact, M a Medium-level and H a High-level.

Table 7-14 Significance level of residual environmental impact

LIKELIHOOD					
5	L	M	M	H	H
4	L	L	M	M	H
3	L	L	M	M	M
2	L	L	L	L	M
1	L	L	L	L	M[1]
	1	2	3	4	5
	CONSEQUENCE/ SEVERITY				

Note 1. A residual impact of Medium is ascribed to a level 5 impact for a likelihood of 1, even though it is very unlikely to occur.

7.11.4 Residual social impacts

As for environmental impacts, residual social impacts are any potential impacts remaining once mitigation measures have been implemented. However, in the case of socio-economic impacts, these may not be directly related to the aspects of the project, but may arise from unmet expectations or difficulties in communication (eg access to energy in relation to employment opportunities).

Once identified, these residual impacts are assessed according to their significance for individuals or communities, according to the table below. Note that the same ranking system is used as for residual environmental impacts, ie High, Medium, Low and Beneficial. A comment on the likelihood of the impact occurring is also provided.

Table 7-15 Assessment of residual impacts

Impact Category	Social
Beneficial	Improvement in line with Government policy and in the eyes of the community and individuals within it Improvement in the ability of household or settlement to maintain or improve its livelihood / store of assets Enhancement in quality or availability of resource leading to improvement in quality of life. For example: • Enhancement in physical capital including availability of infrastructure • Enhancement in social capital, including skills for future employment • Enhancement of relationship between BTC Co/construction contractor and communities • Enhancement in health and safety of local population
Low	Neutral short or long-term effect in terms of Government policy or in the eyes of the community and individuals within it Possible short term decrease in availability of resource or access to infrastructure not affecting livelihood Possible short-term decrease in quality of life of household or settlement not affecting long-term outcomes No effect on human health No discernable long-term effect on the local economy Impacts which are long lasting but to which the community is able to adapt, such as increased access to information / possible slow cultural change / changes in economic structure
Medium	Temporarily contrary to Government Policy but compensated by Social Investment opportunities Potential effect or perceived effect on ability of household to maintain livelihood / store of assets in short term Potential reduction in quality of life in short term Potential disruption to lifestyle in short term Perception of missed opportunity to improve Possible decrease or perceived decrease in access to infrastructure to which community is unable to adapt in the short term Quality of life Negative effect on human health which can be contained and is therefore short term with no increased mortality Impacts which may result in high levels of complaint in the short term
High	Key corporate / partner goals / targets on specific activities beyond statutory targets Contrary to Government Policy, and counterproductive in eyes of communities or individuals within them Negative effect on safety of humans or animals Negative effect on human health which can not be contained or results in increased mortality Effect or perceived effect on ability of household to maintain livelihood / store of assets to an extent not acceptable to affected people Permanent or perceived permanent reduction in quality of life Permanent cultural change to which the communities are unable to adapt Widespread perception of missed opportunity to improve quality of life, resulting in frustration and disappointment Result in tensions with communities which lead to sabotage to pipeline construction or operation by local communities, or outbreaks of violence between workers and communities

7.11.5 Addressing residual environmental and social impacts

The following approach is applied to addressing environmental and social residual impacts.

High (H)

- Check that the residual impact has been subject to feasible and cost effective mitigation where possible
- Where no further reduction in impact levels can be made, it remains a high-level impact and which may therefore be subject to compensation or offsets

Medium (M)

- Check that the residual impact has been subject to feasible and cost effective mitigation and where no further measures are practicable

Low (L)

- Not mitigated further

7.12 CUMULATIVE IMPACTS

Cumulative impacts are those impacts resulting from the combined effects of past, present or reasonably foreseeable actions owing to the project aspects and activities outside the project. An example of a cumulative impact might be the recurring loss of habitat in areas that are disturbed and then re-disturbed or, on the positive side, effect of repeated employment opportunities in local communities. Cumulative impacts expected to be considered in this ESIA relate to impacts owing to BTC and:

- The potential development of the SCP project
- Potential developments in local industry and associated projects
- Potential catastrophic failure of the SCP

The project also considers the cumulative impacts of BTC on the WREP in those locations where the corridor, and therefore the pipeline-affected communities, are the same. Cumulative impacts have been assessed for the BTC ESIA and the results are presented in Section 13.

7.13 TRANS-BOUNDARY IMPACTS

Trans-boundary impacts are those impacts that affect neighbouring countries as a result of the project. Examples might include air emissions and oil spills. Consultation on the oil spill response plan will take place during 2003 when oil spill related trans-boundary effects will be addressed.

Trans-boundary impacts have been addressed in Section 13.

7.14 REGULATORY APPROVAL PROCESS

On completion of the ESIA it will be submitted to the Georgian Ministry of Environment. The review period of the submitted documents is three months. Within this period, the ministry must contact state ecological expertise, verify compliance with the national legislation and environmental standards and develop a list of measures required to reduce impacts of the project implementation on the environment. An environmental permit is issued based on a conclusion of the state ecological expertise taking into account public opinion.

7.15 MANAGEMENT AND MONITORING

Monitoring during construction and operational phases of the project, through the audit of impact predictions and mitigation measures ensures that:

- Mitigation measures are implemented effectively
- Compliance with international standards, guidelines and best practice, and BP corporate policies, and international best practice
- Assessment of cumulative and residual impacts
- Continuation of the ESIA as an iterative process

Monitoring provides a means of validation of the implementation and effectiveness of the mitigation measures incorporated into the project design and developed during the ESIA process, whilst allowing assessment of the residual impacts predicted in the ESIA in Section 14. This information can be used to allow the refinement of the existing mitigation and, if necessary, the design of additional mitigation.

To assist in the implementation of mitigation and monitoring, Environmental and Social Management Plans will be developed and adopted by the contractor. Management and Monitoring plans to assist this process have been included in the ESIA. They describe possible mitigation and monitoring strategies and present generic procedures for their implementation. They also identify the roles and responsibilities for ensuring that monitoring is undertaken and that the results are analysed and any necessary amendments to practices are identified and implemented in a timely manner.

ENVIRONMENTAL BASELINE

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8 ENVIRONMENTAL BASELINE

8.1 INTRODUCTION

The environmental baseline is a comprehensive description of the physical and biological characteristics of the environment along the pipeline route prior to the proposed construction and operational activities. The purpose of the environmental baseline characterisation is to document the condition of the environment, evaluate the sensitive issues and enable the evaluation of the potential impacts and assist the engineering design team in the definition of mitigation measures that would minimise or eliminate the environmental impacts. In some instances the findings of the baseline characterisation work have highlighted critical issues that have induced the project team to implement re-routes to avoid unacceptable impacts.

The description of the physical and biological characteristics of the environment contained in this section reflect the condition of the environment at the time field surveys were undertaken. During construction of the pipeline it is recognised that there is potential for the condition of the environment to be altered. Potential impacts on the environment and respective mitigation measures are detailed in Section 10 *Environmental Impacts and Mitigation* and are further discussed in Section 12 *Residual Impacts* and Section 13 *Cumulative Impacts*.

The baseline characterisation of the pipeline route has been carried out through the following tasks:

- Review of available literature
- Multidisciplinary field surveys
- Focused scientific surveys of sensitive areas

8.1.1 Literature reviews

This task consisted of the review of publicly available information on the subjects listed below; leading Georgian scientists and academics carried out this task.

- Air Quality
- Protected Areas
- Archaeology and Monuments
- Soils
- Landscapes
- Geomorphology and Geology
- Hydrology
- Hydrogeology
- Fish and Fisheries
- Fauna
- Flora

The literature reviews are summarised in the following sections of this section.

8.1.2 Corridor field surveys

In addition to the literature reviews, a preliminary field survey was carried out in the Summer and Autumn of 2000 by a team of Georgian and international scientists. The survey consisted of a walk over of an approximate route corridor and resulted in a preliminary baseline report. The baseline study corridor was typically 200m wide. In addition, a number of sites off the pipeline ROW were surveyed (*Section 8.13*).

The survey team included a botanist, a zoologist, a geologist and an archaeologist. Its main objective was the identification of environmentally sensitive issues along the proposed corridor, thus enabling the input of environmental information into the route selection process. The identification of key issues also facilitated the definition of the detailed scope of work of the Environmental Impact Assessment and the selection of the team of professionals required to undertake the work.

8.1.3 Detailed scientific surveys

Based on the findings of the preliminary corridor walk over, a number of detailed field surveys were planned and undertaken during the Winter, Spring and Summer of 2001. The surveys covered various subjects including Flora, Fauna, Archaeology, Air Quality, Noise, Landscape, Seismic Analysis, Geology, Geotechnical Engineering, Traffic and Infrastructure, and Soil. The surveys were carried out partly by the EIA team and partly by specialist technical teams hired directly by the project proponent, BP.

The objectives of the surveys were to collect additional baseline data not available in the literature, to assist in the evaluation of the potential impacts along the route and in some cases to support the engineering design of the proposed pipeline and associated Above Ground Installations (AGIs). Whether directly related to the Environmental Assessment work or not, all studies undertaken on specialist subjects of environmental relevance were reviewed and their findings are summarised in the following sections of this report.

The detailed scientific surveys included the following:

- *Botanical and faunal surveys*

These were carried out at a general level throughout the proposed pipeline corridor and subsequently, based on the identification of sensitive habitats at the key locations listed below:

- *River Kovu marshes:* no longer part of the current route – see *Section 4 - Project Alternatives*
- *Tetritskaro* forested areas: three botanical surveys and one faunal survey – three routes were discarded on the basis of the botanical survey results
- *Bedeni Ridge and Tsalka area:* one faunal study and also multidisciplinary survey to assist route selection process
- *Ktsia Tabatskuri area*: two botanical surveys and two faunal surveys – a potential route was discarded on the basis of the combined survey results

- *Tkhratskharo – Tiseli forests:* two botanical surveys and one faunal survey – two potential routes were discarded on the basis of the botanical survey results

- *Sakire – Potskhovi riparian forests*: two botanical surveys and one faunal survey to evaluate mitigation measures required in the area

- *Archaeological surveys*

A number of archaeological surveys have been carried out along the route to evaluate the significance of findings known through the literature reviews or through aerial photograph interpretation. Additional archaeological surveys were carried out whenever a new route was examined and at proposed AGI locations.

- *Air quality assessment*

Air quality was sampled at three locations along the pipeline route to record pre-construction quality. Two locations were selected with regard to the future installations associated with the pipeline whilst one remote location on the pipeline route was selected to gather background data.

- *Noise assessment*

This was carried out at the proposed pump station sites and at all sites where temporary facilities may be developed during the construction period.

- *Landscape assessment to evaluate the aesthetic and amenity value of the landscapes along the route*

This task was carried out by a Georgian landscape architect of international reputation and consisted of an evaluation of the current quality of the landscape along the pipeline corridor, of the area of visual influence of the pipeline construction and operation activities and of the potential impacts associated with the pipeline construction activities.

- *Seismic assessment of the proposed route*

A detailed seismic assessment of the proposed route was carried out by a specialist team of quaternary geologists, seismic geomorphologists and a Georgian seismologist to evaluate the degree of neotectonic activity along the proposed pipeline route, identify active faults and assist in the design of the faults crossings.

- *Geotechnical investigation along the whole route*

A geotechnical investigation was carried out along the entire route and on the segments of corridor that were re-routed owing to environmental or engineering requirements. The objectives of the geotechnical assessment were the definition of the construction requirements along the route, the evaluation of areas of ground instability and the identification of the construction techniques required to avoid geohazards.

- *Contaminated land investigation*

A baseline contamination walk over and survey has been undertaken to document any potential contamination existing prior to the proposed pipeline construction and operation and to document background soil quality when no contamination had been detected.

- *Traffic and infrastructure study*

This task consisted of a specialist assessment of the conditions of the existing roads and tracks that would be affected by the proposed construction activities and of the intensity and distribution of traffic prior to the commencement of the project.

- *Soils*

This task consisted of a detailed soil survey along the proposed route to enable the determination of the erosion risk and to assess the adequate rehabilitation measures required to stabilise and reinstate each section of the proposed route after construction.

8.2 METEOROLOGY AND CLIMATE

8.2.1 Introduction

This section of the report describes the climatic characteristics for the Georgian section of the proposed pipeline route. The meteorological data were provided by Tbilisi Airport for the whole section of the route and included data from meteorological stations located primarily in Eastern Georgia. Other sources of data include a climatic study carried out by Kvaerner in 2001 to support the preliminary engineering design of the SCP gas export system, a Literature Review of Environmental Conditions along the Early Oil Pipeline Route Corridor (1996), the EIA for The Western Route Export Pipeline (1996), and any other existing literature.

The climate along the proposed pipeline route was characterised in terms of wind speed and wind direction, relative humidity, ambient air temperature, ground temperature, and atmospheric pressure.

Generally, Georgia is known for its favourable climate, with the Greater Caucasus Range serving as a barrier to the cold air from the north, producing a high thermal regime and a small number of extreme meteorological events. As a whole, the country can be divided into two distinctive climatic zones: humid subtropical in the west of the country, and dry subtropical in the east, naturally separated by the Surami range (Kordzakhia, 1961).

The climate along the pipeline route is largely a product of the Surami Mountain Range, located in western Georgia, and the dry plains of Azerbaijan to the east. The predominantly west-to-east transfer of air masses over the region, along with orographic lifting of the air associated with the mountain ranges, produce a damp climate in the western parts of Georgia, with almost uniform precipitation throughout the year. Consequently, the eastern side of the mountain ranges experience lower relative humidity, resulting in a dry-subtropical climate.

The pipeline route lies within the subtropical climatic zone, characterised by moderate precipitation, pronounced seasonal variations in climatic parameters, and a high level of solar radiation. The route comprises four sub-climatic regions along the pipeline, mainly owing to the differing relief and proximity to the Black Sea. They are described as follows:

- Dry-subtropical climate with warm summers (>22°C) and mild winters (approximately 0-8 °C) at the Azerbaijan-Georgia border. Characterised by a notably warmer and drier climate compared to the rest of the pipeline route. The climate becomes increasingly humid as the pipeline route approaches the Bedeni Plateau

- A transitional climate between the dry-subtropical in the east, and the humid-subtropical mountainous steppe climate to the west, located in the area spreading from the Bedeni Plateau to the feet of the Trialeti range. Altitude gradually increases by approximately 800 metres over a distance of around 42km, causing air temperature to decrease, and wind speeds to rise. Generally, the region experiences cold and occasionally snowy winters and long, but mild, summers. Precipitation increases westward with proximity to the Trialeti range

- The humid-subtropical mountainous climate with cold winter (<-5°C) and cool summer (< 20°C), located in the Trialeti and Samsari Mountain ranges. The altitude, approximately 2,500 metres, largely explains the lower temperatures in this region

- A humid subtropical mountainous climate with cool winters and mild summers, characteristically similar to the transient climatic zone, but located between the Trialeti and Samsari Mountain ranges and the Turkey-Georgia border

Climatic Zones are detailed in Figure: Map 8-1.

8.2.2 Sunshine and solar radiation

Owing to its latitudinal location, the pipeline route receives significant solar radiation. Calculations show that the total rate of radiation input, considering both direct and diffused (scattered and reflected) radiation, would amount to approximately 115-140kcal/cm^2 between sea level and an altitude of 500m. This figure would be slightly elevated for regions of greater altitude.

Sunshine duration in the eastern side of the study area averages approximately 2,350 hours annually, or 6.4 hours daily. In Gardabani, near the Azerbaijan-Georgia border, the daily mean is 6.9 hours and represents the greatest level of sunshine duration in the area of interest. Both the intensity and duration of incoming solar radiation is significantly reduced by the presence of cloud cover, typical for this region. Data concerning the solar radiation specific to the other climatic regions along the proposed pipeline was not available at the time of writing this report. It could be reasonably assumed, however, that despite the greater radiation input, the average hours of sunshine may decline with altitude and the associated cloud cover.

8.2.3 Air temperature

The weather description for the Azerbaijan-Georgian border and Bedeni plateau is based upon data obtained from Gardabani, Tbilisi, Vaziani and Telavi meteorological stations, as well as further meteorological stations located within neighbouring countries. The eastern part of the pipeline route, owing to its relatively low elevation (280m at the Azerbaijan-Georgia border, rising to 650m) and influence from the Azerbaijan dry plains, experiences generally warmer temperatures throughout the year compared to the western part of the country. Average air temperature in the warmest and the coldest month of the year range from 24.5°C in July to 3.2°C in February, with a mean monthly air temperature of 13.5°C for the year. In Tbilisi, the winter temperatures are slightly higher, resulting in a mean annual air temperature of 14.0°C. The first frosts of the year tend to arrive in early-to-mid November, with the usual winter extending until the beginning of April. The number of frost-free days exceeds 220.

The next zone, extending from the Bedeni Plateau to the eastern slope of the Javaketi and Samsari range, gradually rises to approximately 2,300m, west of Kizil Kilisa. This area presents a transition zone between the humid-subtropical climate in the east and a cold mountainous climate to the west. It has been estimated that the mean air temperature for this central section of the pipeline route would be 11.7°C, with a maximum monthly average of 21.8°C in August, and a minimum monthly average of 1.6°C in January.

Further west, the proposed pipeline route enters the high-mountain region of the Javaketi, Samsari and Trialeti Range, with the highest point (2,500m) along the route situated in the

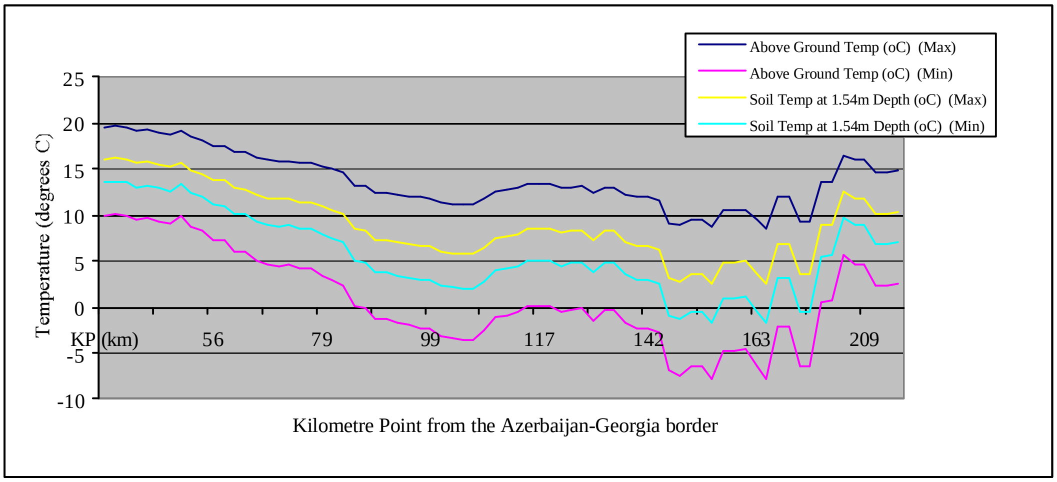
Trialeti range, to the West of Bakuriani. The high-mountain profile of the area accounts for its near extreme climatic conditions. The estimated mean annual temperature for the area is 9.5°C, with an estimated average of –1.4°C in January and 19.5°C in July.

West of the mountain ranges, toward the Turkey-Georgia border, temperatures gradually increase, owing to decreasing altitude and increasing proximity to the Black Sea. Temperatures are estimated to be similar to those experienced in the transitional climate zone, with mean annual air temperatures of approximately 12°C.

Absolute minimum air temperatures of –16.5°C have been estimated for the western and central sections of the pipeline route, with –11.8°C recorded for its eastern section. Extreme temperatures of –25°C are considered to be one-in-twenty or thirty year occurrences in the lowlands of Gardabani. Annual absolute maximum temperatures vary from 35.9°C in the west, to 40.7°C in the east of the route.

Chart 8-1 presents temperature data along the proposed Georgian pipeline route. Although approximate, it illustrates, to a certain extent, the basic temperature profile explained above.

Chart 8-1 Monthly average temperature profile along the proposed pipeline route



8.2.4 Ground surface and soil temperature

According to Kvaerner (2001), the annual average ground surface temperature at the Azerbaijan-Georgia border is 15°C, whilst the mean summer temperature is 32°C. The same study reports that the maximum ground surface temperature in this region is reported to be 70°C, whilst the middle and western zones are estimated to be 70°C and 65.2°C, respectively. The WREP EIA (1996) reported absolute minimum ground surface temperatures in Gardabani (Azerbaijan-Georgia border) to be –27°C.

For the transitional section of the pipeline route, where the area between the Bedeni plateau and the Javaketi Range lies, the annual mean ground surface temperature is 13.2°C. The estimated annual mean ground surface temperature in the third climatic region is 11.3°C, owing to generally cooler air temperatures in these climatic regions.

Soil temperature at a depth of 2m is the main parameter that characterises the thermal influences upon the pipeline. Estimations of the 2m soil temperature occur in the Kvaerner study (2001), and were reported to range between 8°C in winter to 18°C in summer, with the highest temperatures in the east of the pipeline route. Near the Azerbaijan-Georgia border, estimated mean annual ground temperature at the 2m depth fluctuates between 14.2 and 15°C.

Chart 8-1 presents soil temperature data at 1.54m depth, along the proposed pipeline. Although approximate, it provides a basic visual tool for interpreting soil temperatures across a spatial scale in Georgia.

8.2.5 Air humidity

Generally, the atmospheric moisture content increases from the east to the west of the country as the climate changes from dry to humid subtropical. Local humidity, however, is specific to local geographical conditions, such as altitude.

Relative humidity along the proposed pipeline route varies significantly from the estimated average annual humidity of 69% at the Azerbaijan-Georgia border. The maximum average monthly humidity (78%) in this area occurs in December, and the minimum in July (59%). The minimum mean monthly relative humidity for the region was recorded at Gardabani in July (55%).

Existing data suggests that the mean monthly relative humidity for the proposed route can be as low as 5%, and the maximum as great as 100%. The proposed route lies primarily in the subtropical climate, and thus the majority of the pipeline route is humid.

8.2.6 Precipitation

There is a distinct increase in the amount of annual precipitation from the east to the west of the country. At the Azerbaijan-Georgia border, average monthly rainfall is 35mm, and reasonably well distributed throughout the year. The largest amount of rainfall occurs between April and June, with an average 57mm of rain in each of these months. The remaining part of the year is relatively dry in comparison, with an average of 16-17mm in December, January and February. With the exception of Tbilisi, showers are relatively rare in this region. The average annual rainfall rarely exceeds 451mm, except in Tbilisi, where the average is 500mm per annum. More than 70 years of observation shows that the maximum annual rainfall in this region was recorded in Tbilisi in 1955 (767mm), and in Gardabani in 1936 (655mm). The maximum daily precipitation recorded in Tbilisi is 147mm, while in Gardabani it is 82mm. However, it is important to emphasise that these values relate to the most extreme conditions recorded within historical observations.

Mean annual precipitation in the transitional climate region is approximately 508mm, and 654mm at the Georgian-Turkish border. The majority of the precipitation falls between April and October, with May and June being considered the months with most rainfall (82mm/month and 88mm/month, accordingly). The driest months of the year in these parts are December (32mm/month) and January (30mm/month).

Precipitation data specific to the mountains and mountainous steppes near the Georgia-Turkey border are scarce. However, existing data and reports suggest that heavy and frequent rainfalls do not commonly occur in this region.

Data related to snow cover in the area are poor, although the highlands, between approximately KP 80 and KP 225 (including adjacent AGIs within this part of the section), can be covered with snow for as long as 90 days per year. There is a strong correlation between altitude and snow cover. Typically, air temperature decreases with rising altitude, leading to increasing amounts of snowfall and duration of snow cover. Precipitation can usually be expected in the form of snow when ground temperatures are below 1-2°C, although this relationship is complicated by other meteorological influences, such as the atmospheric temperature profile.

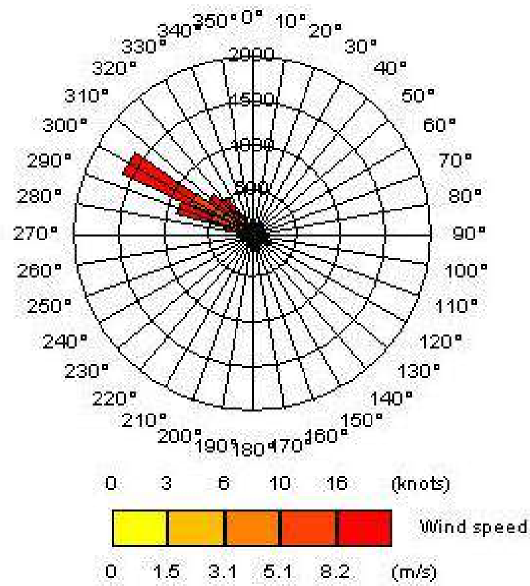
8.2.7 Winds

Average wind speeds in the first climatic zone (Azerbaijan-Georgia border) are generally highest in June (5.7m/s) and lowest in December (3.8m/s), although these values do not significantly vary from the annual average (4.8m/s). The maximum wind speed recorded within each month ranges from 20m/s in December to 58m/s in June. Approximately 50% of days in this region experience wind speeds greater than or equal to 13m/s, with an average 18.8 of these days occurring in June and 11.9 in December. The prevailing wind direction for this climatic zone is northwesterly (Chart 8-2).

Wind speeds in the transient climatic zone are reported to be lower than at the Azerbaijan-Georgia border, with an estimated annual average of 5.4m/s, although still predominantly northerly and northwesterly. However, speeds in excess of 12 m/s can occur for up to 50% of the year, with maximum wind speeds reaching as high as 30m/s. The mean number of gale days (days in which wind speeds are approximately 17-20m/s) for the above two regions is relatively low, compared to the border area, at 21 days per annum.

The final two climatic zones lying in the west of the proposed pipeline route are affected by both easterly and westerly winds, becoming increasingly strong in the high mountains (greater or equal to 15m/s). Available data suggests that average wind speed recorded near the Metering and Pressure Reduction Station (PRS) at the Georgia-Turkey border is 6.7m/s. The maximum wind speed recorded in this area over 20 years of observation was 57m/s.

Chart 8-2 Wind rose for Tbilisi, 1999 (Source: Trinity Consultants, USA)



8.2.8 Atmospheric pressure

Station level pressure was recorded for Tbilisi, in the eastern section of the pipeline. Mean annual pressure was recorded as 969.2mb, with a maximum of 973.5mb in November and a minimum of 963.7mb in July. The lowest atmospheric pressures are associated with late spring to early autumn, and the highest with the cold winter months.

Station pressure is the actual atmospheric pressure recorded, differing to sea level pressure owing to its elevated altitude. Utilising a simple meteorological equation mean annual sea level pressure for Tbilisi was calculated as 1017mb.

Further calculations showed that the large altitude range, between 200m at the Azerbaijan-Georgia border and 2,500m in the mountainous region of the Samsari range, has a large impact on the station level pressure. Assuming a winter temperature of –5°C in the mountainous range of Samsari, air pressures of 750mb could be expected, compared to 970mb in Tbilisi.

8.2.9 Constraints and limitations

It should be strongly emphasised that this climatic report has been established using limited historical data sets. The duration of studies that could be carried out in support of this ESIA were not able to significantly add to an historical data set owing to their limited duration. Historical meteorological data sets are especially lacking in the central regions of the pipeline route, extending between approximately KP80 and KP 175. In instances where data is available, such as at the Turkey-Georgia border, several important parameters, including wind speed, relative humidity and air temperature, have rarely been measured. The climate for these regions was constructed using all available data and literature reports, furthered by applying standard meteorological assumptions to the region, based on features such as topography and geographical location. It is not expected that these meteorological uncertainties will significantly affect the air dispersion modelling, for which data from Tbilisi was used.

8.3 AIR QUALITY

8.3.1 Introduction

A limited number of measurements of air quality have historically been collected within Georgia, at a number of towns and cities, of which two are near to the proposed AGT corridor: at Rustavi, and Akhaltsikhe. Such historical measurements of air quality are available between 1988 and 1994, and indicate at both locations poor air quality for the measurements period. With the progressive redundancy of Georgia's industry, such measurements indicate improvement in air quality after 1991. Similarly, fuel shortages, which began in the early 1990s have also led to a reduction in the concentration of traffic related air pollutants (which include among others: carbon monoxide, fine particles, oxides of nitrogen and benzene). Reliable measurements of air quality after 1994 are not currently available.

The majority of the proposed AGT ROW lies in predomintaly rural areas, where it is expected that air quality would be very good owing to the current relatively limited scale of industry and road traffic in Georgia.

8.3.1.1 National emissions

Historical emissions of GHGs for Georgia are presented below. Values are Thousand tonnes per year. ($CO_{2(eq)}$ represents the total emission of GHG in terms of CO_2, where GHGs other than CO_2 factored by their Global Warming Potential relative to CO_2).

	1980	**1985**	**1990**	**1995**	**1997**
CO_2	34,593	39,620	36,422	5,344	9,177
CH_4	380	411	356	150	167
N_2O	8,435	8,598	7,895	3,273	4,366
Total $CO_{2\ Eq}$	45,188	50916	46,345	9,509	14,037

Values for emissions of potentially polluting species for Georgia are also presented below.

	1980	**1985**	**1990**	**1995**	**1997**
NO_x	121	140	130	27	55
CO	648	637	526	250	429
NMVOC	46	48	46	2	3
SO_2	230	273	249	20	33

Values presented from Georgia's Initial National Communication Under the United Nations Framework Convention on Climate Change, UNDO/GEF-Government of Georgia, Project GEO/96/G31, T'bilisi, 1999.

The above information demonstrates a clear reduction in emissions since the early nineties, showing an upward trend towards 1997. This is a result of the progressive redundancy of Georgia's industry, and fuel shortages, following the collapse of the Soviet Union. With the exception of methane, emissions arising during 1997 are estimated to be a result of (in order of magnitude):

1. Energy production
2. Motor transport
3. Forestery ecosystems / utilisation
4. Agriculture
5. Industrial processes

The exception to the above is methane, which is estimated to predominatly arise from agricultural and forestary activities.

8.3.2 Baseline monitoring of air quality near to proposed AGI sites

Knowledge of existing air quality is required so that any potential for impact on air quality associated with releases to atmosphere from development activities can be assessed in an additive context. This section presents details of the existing air quality at sites of proposed AGIs associated with the ROW. The sites chosen for investigation represent those with continuous operational releases to atmosphere, ie the proposed pump stations associated with the BTC pipeline, and pressure reduction and metering stations, associated with the SCP pipeline.

As operation of the proposed AGI sites would result in releases of gases associated with the combustion of liquid and natural gas fuels, the baseline study has focussed upon potentially polluting releases typically associated with such activity ie SO_2, NO_x, and benzene. Fine particulate matter may be associated with project activities (from fossil fuel consumption). However, given the logistical difficulties associated with measurement of fine particulate matter, and that measurement of other combustion gases included in baseline characterisation may be used as a satisfactory indicator of air quality, measurement of fine particulate matter has not been undertaken.

Studies were not undertaken specifically along the ROW owing to the anticipated short-term and limited extent of atmospheric releases associated with construction phase. None-the-less, as the majority of the proposed ROW can be considered rural in nature, measurements collected at proposed AGI facilities sites can be considered representative of rural air quality in Georgia.

8.3.3 Air quality baseline characterisation methodology

For the collection of long term, representative air quality data, diffusion tubes have been used. Diffusion tubes are simple devices, consisting of a cylindrical tube, with one end open to the atmosphere. The inside of the closed end of the tube, or the tube packing, selectively reacts or retains particular gases. After an exposure period of between two weeks and one month, the tubes were submitted for laboratory analysis and the concentration of the particular analyte gas is calculated.

The diffusion tubes were deployed at four locations, which represent the proposed site of:

- The Gardabani pump station associated with the BTC development (KP4)
- The Tetriskaro pump station associated with the BTC development (KP87)
- The Georgian Offtake PRMS associated with the SCP development (KP11)
- The Georgian Turkish Border PRMS (KP246)

In order to provide representative data, several monitoring sites were chosen at each of the above locations. Figure: Map 8-2 presents the locations of air quality sampling relative to the proposed ROW. Sampling was undertaken during spring 2001, and autumn-winter 2001, in order that worst-case measurements were able to be collected (large amounts of domestic burning of fuels occurs during colder months, which can lead to local and regional deterioration of air quality).

8.3.4 Results of baseline conditions

Results of baseline air quality monitoring are presented in Table 8-1.

Table 8-1: Air quality at the proposed sites of AGT facilities

Location	Site Co-ordinates	Mean Concentration ($\mu g/m^3$) (1)			Potential Local Sensitivities / sources of atmospheric emissions
		Benzene (ppb)	NO_2	SO_2	
Sites associated with the BTC pipeline project					
Gardabani Pump Station (KP4)	8512565, 4589303	1.4	1	2	No sensitive receptors (ie residences & fauna) within 1km. A local potentially significant source of air pollution is the Gardabani power station.
	8572644, 4589726	1.1	3	4	
	8572638, 4589798	1.1	2	4	
Tetriskaro Pump Station (KP87)	8448924, 4604184	0.1	<1	2	No sensitive receptors within several kilometres. This area does not appear to be subject to any potentially significant sources of air pollutants.
	8449548, 4603393	1.2	2	3	
	8448990, 4604105	1.8	2	4	
Sites associated with the SCP pipeline project					
Georgian Offtake PRMS (KP11)	8509611, 4595538	0.4	5	3	A single occupied dwelling is located next to the proposed AGI site. Other sensitive receptors are crops at this site.
	8509261, 8509261	0.9	10	3	
	8509719, 4594279	0.5	N/A	3	
Georgian Turkish Border PRMS (KP246)	8319095, 4609097	0.4	6	3	This site is near to a relatively busy access road to the border post. This proposed site is approximately 1km from a relatively busy access road to the border post
	8318956, 4609298	0.2	6	4	
	8318622, 4609334	0.4	N/A	4	
At reference condition of 1 atmosphere and 273K N/A Sample Lost					

8.3.5 Discussion

Baseline data indicates that levels of measured pollutants are well below assessment criteria designed to protect human health (as presented in *Section 6 Regulatory and Policy Framework*), and that the air quality at the proposed AGT facilities sites is currently very good. These findings are unsurprising given the current extent of industrial activity and road transport currently within Georgia.

Contribution to the measured concentrations of target gases is likely to arise from domestic burning of wood and other fossil fuels, road transport, and limited industry.

8.4 NOISE

8.4.1 Introduction

This section of the report describes the ambient noise levels measured along the Georgian section of the proposed ROW. On-site measurements were collected between October 24th and 28th 2001.

The survey took account of the proposed locations of AGI facilities associated with the AGT development. In addition, measurements were also collected at potential pipe storage yards and temporary worker camps.

Noise levels were measured to establish the typical daily ambient noise level prior to any proposed work commencing. The noise measurements collected at these sites comprised the following noise descriptors, namely:

- $L_{Aeq, T}$ – ‘A’ weighted continuous equivalent sound level. This can be considered as the average noise level over the measurement period
- $L_{A90, T}$ – Percentile level, the sound pressure level in dB_A that is exceeded for 90% of the time interval measured. This value provides a more representative measure of ambient noise levels, where transient and noisy events affect the $L_{Aeq, T}$ value, such as a passing car, etc as it is a statistical analysis

The ‘A’ weighting referred to above is a frequency weighting devised to take into account the fact that human response to sound is not equally sensitive to all frequencies. The ‘A’ weighting takes this variability into account so that it will correlate approximately with human response and perception. These descriptors are common to environmental noise measurement and are referred to in the international standard ISO 1996-1: 1982 “Description and measurement of environmental noise. Part 1: Guide to quantities and procedures”.

8.4.2 Measurement methodology

Measurements were undertaken in accordance with the guidance set out in the international standard ISO 1996-2 “Description and measurement of environmental noise. Part 2: Guide to the acquisition of data pertinent to land use”.

A Bruel & Kjaer 2238 mediator Type 1 Sound Level Meter (SLM) that was calibrated and traceable to ISO standards was used for the purpose of the assessment. The SLM was calibrated with a Norsonic 1251 Class 1 sound calibrator prior to use at each site to ensure the validity of the data.

Wind speed was measured with a digital anemometer as required by ISO 1996-2 to ensure that the wind speed did not exceed an average of 5m/s. The SLM microphone was fitted with a large windshield to minimise the effects of wind on the results of the measurements.

Measurements were undertaken with the SLM mounted at a height of 1.2 metres on a tripod in a free-field environment (at least 3.5m away from any reflecting surface, excluding the ground) and set to measure for a 15-minute period with the operator standing away from the SLM.

Based on the ISO 9613 standards and given the rural setting of the sites, a 15-minute measurement period was a representative sample of the ambient noise level at the sites visited.

8.4.3 Measurement locations

A total of 17 locations, identified by BP as potential sites for the proposed pumping stations, pipe storage yards and temporary accommodation camps were visited. The decision on the suitability of each site was assessed based on a number of criteria including the current infrastructure, and suitability for storage, assembly and accommodation. A description of each site is given below discussing any features with respect to the noise environment of the site. Figure: Map 8-2 details the noise measurement locations (in addition to the air monitoring stations).

8.4.3.1 Site 1: Gatchiani a & Gatchiani b

This is a former WREP main pipe yard where a temporary camp had also been located. The site has a residential area to the south, approximately 10m from a stone wall (1.5m high) located on the southern boundary of the proposed site.

8.4.3.2 Site 2: Gardabani 1

The area is situated adjacent to the Gardabani power station. The site area is a mixed industrial and residential area, with occupied dwellings within 250 to 300m north of the proposed development area, and 150 to 200m to the south of the proposed development area.

8.4.3.3 Site 3: Gardabani 2

The area is located near a small oil storage depot adjacent to the main railway line. Its surroundings are similar to that of Gardabani 1 above.

8.4.3.4 Site 4: Marneuli

The proposed development area is located within the eastern town boundary of Marneuli. It is a former railway siding which is completely derelict with the nearest recognised occupied dwelling at a distance greater than 600m south west of the site.

8.4.3.5 Site 5: Kotishi

This facility is located approximately 7km from Marneuli on the main road to Tetritskaro. The area contains an electrical sub-station, a crushing plant and a farm within its boundary. The nearest receptor is identified as a farmhouse 200m to the east of the proposed development area.

8.4.3.6 Site 6: Atskuri

The site is located in the southwest of Atskuri town alongside the existing rail line. The site contains a rail spur and two small brick and concrete buildings used for a toilet and control/electrics room. The area is situated partially on fill and natural ground. Located outside of the rail yards to the southwest is a lumber yard with a large gravel area used for storage of timber.

8.4.3.7 Site 7: Akhaltsikhe

The proposed location is situated near a railway and main terminal in the town of Akhaltsikhe. The proposed pipe dump location is situated approximately 10m from a housing block to the south of the site.

8.4.3.8 Site 8: Vale 1

This is located outside the town of Akhaltsikhe, and situated near the railroads and disused railway supply depot. A sensitive receptor (a single occupied house) is located approximately 60 metres south east of Vale 1.

8.4.3.9 Site 9: Tsikhisjvari

Tsikhisjvari is located approximately 35km from Borjomi. The proposed development area lies to the south of the village with no receptors within a kilometre.

8.4.3.10 Site 10: Borjomi

Borjomi is the main line rail station between Khashuri and Bakuriani. As such, there are occupied dwellings within 10 metres from both sides of the station.

8.4.3.11 Site 11: Tetritskaro

The proposed development area is located to the south of the town of Tetritskaro. No receptors have been identified within the immediate vicinity.

8.4.3.12 Site 12: Pump Station G1a and Pump Station G1b

No sensitive receptors are within 300m of the proposed development site.

8.4.3.13 Site 13: Pump Station G2a, Pump Station G2b and Pump Station G2c

The proposed pump stations are located in a rural area with no sensitive receptors identified in the vicinity.

8.4.4 Results of measurements

The results of measurements taken at the proposed development areas are given in Table 8-2.

Table 8-2: Noise survey at proposed pipe yard, work camp and AGI locations

Location Reference	$L_{Aeq, 15\text{-minute}}$ (dB)	$L_{90, 15\text{-minute}}$ (dB)	Site Coordinates
Potential Pipe Storage Yards and Temporary Camps			
Gatchiani a	42	37	8499552, 4607079
Gatchiani b	40	36	8499674, 4606936
Gardabani 1	43	36	8508912, 4593328
Gardabani 2	42	41	8504651, 4592300
Marnueli	34	28	8484887, 4595652
Kotishi	46	29	8477054, 4598115

Location Reference	$L_{Aeq, 15\text{-}minute}$ (dB)	$L_{90, 15\text{-}minute}$ (dB)	Site Coordinates
Atskuri	49	42	8346331, 4622062
Akhaltsikhe	41	32	8335046, 4614965
Vale 1	34	28	8325031, 4613552
Tsikhisjvari	32	26	8369527, 4621240
Borjomi	52	40	8368026, 4635813
Tetritskaro	33	23	8457192, 4599311
Proposed Pump Station Sites			
Pump station G1a (BTC development)	38	23	8512589, 4589380
Pump station G1b (BTC development)	30	23	8512566, 4589443
Pump station G2a (BTC development)	25	21	8449559, 46-3235
Pump station G2b (BTC development)	32	25	8449510, 4603377
Pump station G2c (BTC development)	33	25	8448986/4603833
Proposed pressure reduction systems*			
Georgian Turkish Border PRMS (SCP development)	34	29	8319135, 4609882
Georgian off-take PRMS (SCP development)	38	23	8512589, 4589380

*Baseline noise measurements at the proposed site of the Georgian Turkish Border PRMS were also undertaken as presented in the above table. Measurements collected at the proposed site of the pump station PSG1 are considered representative of the proposed Georgian off-take PRMS site, given the similarity in setting and their proximity.

Data for four sites were not collected owing to high wind speeds on the day of measurements, or logistical reasons. These site were:

Tsalka 1 and 2 – both sites were not located near to sensitive receptors and the current noise environment (excluding wind) is comparable to other rural sites in Georgia. High winds prevented measurement.

Vale 2 – Measurements at this site were not undertaken owing to high winds on the sampling day, however again it is not expected that the noise levels at this location will not vary considerably compared to Vale 1 owing to the similarity in their geography and acoustic environment.

Andezit – Time constraints prevented measurement at this site, however earlier walkover assessments have demonstrated the rural nature of the site and indicated that the current noise environment can be considered similar to other predominately rural sites in Georgia (such as the pump station G2 site).

8.4.5 Discussion

The measured levels are typical and representative of the noise environment of the proposed development areas along the length of the ROW. The measured levels are generally very low owing to the rural nature of the areas and the lack of noise from anthropogenic sources such as roads and industry. Natural noise sources such as wind, running water, rustling of trees and foliage, birdsong and the like are mainly representative of noise sources present (unless otherwise indicated above).

Potentially noise sensitive receptors are considered as occupied dwellings, or public areas such as a national park or other area where people may congregate for leisure purposes. Most of the sites discussed above are in predominantly rural locations, with few if any receptors nearby unless otherwise stated above. However, consideration must also be given to potential faunal receptors; evidence of which lies in the fact that migrating birds are known to diverge from their migratory route where there is a significant noise source. Different species react to different degrees and depends on their current state of health, season, whether the area forms part of their territory, and is thus almost impossible to quantify.

The measured ambient noise levels may vary seasonally and with the weather. Wind (and wind direction) for example, increases noise levels owing to turbulence and the movement of trees.

8.5 GEOMORPHOLOGY, GEOLOGY AND GEOHAZARDS

The geology, geomorphology and geological hazards along the proposed pipeline route were evaluated following a desk study review of existing data and reports as described in Section 8.1.

This section includes a description of the geomorphological features and the lithological sequences identified along the proposed pipeline route. A description of the geohazards that may be encountered when constructing the pipeline is also provided. A specialist seismic engineering team (EQE) conducted a seismic evaluation of the proposed route and a summary of this is also included to provide background information on the potential for catastrophic seismic events in the area.

A geotechnical investigation was also conducted at critical points along the proposed pipeline route to evaluate the terrain characteristics in detail and to assess areas of instability along the route. The findings of this geotechnical investigation are summarised in Section 8.5.4 and further details on the geology along the route and at the main river crossings are contained therein.

8.5.1 Geomorphology

The proposed pipeline corridor geomorphology has been evaluated by a description of the geology and landforms along the route. Geological complexes of rock strata of similar genesis and lithological composition have been grouped together and four main morphological zones have been identified. The regions are described from the Azerbaijan border towards the Turkish border as follows:

- Mtkvari Basin
- Volcanic plateau region
- Western Trialeti range
- Akhaltsikhe Basin

These zones are shown on Figure: Map 8-3a-f.

8.5.1.1 Mtkvari Basin

The Mtkvari basin is composed of a piedmont plain dissected by the River Mtkvari and overlain in places by quaternary deposits. The proposed pipeline route passes from the Azerbaijan border and Jandara lake across the broad, low-lying Kvemo Kartli plain composed of unconsolidated Quaternary alluvial deposits. A low ridge of sedimentary rocks composed of marls is present near Rustavi and the topography then falls steeply towards the River Mtkvari.

Beyond the river terraced quaternary floodplain deposits are encountered overlying Tertiary sediments of the piedmont plain. The Komisi depression, formed as a result of extensive solifluction (dissolution of salts in the soil matrix, which causes localised subsidence) is noted in this area. The topography of the piedmont plain climbs gently to approximately 500m above mean sea level (AMSL) towards Marneuli and the Algeti River valley.

8.5.1.2 Volcanic plateau

The Volcanic plateau forms the largest geomorphological zone of the pipeline route and comprises steep peaks, a volcanic plain and historic lava flows. The plateau is composed of Upper Createaceous and Tertiary igneous rocks including lavas and shallow intrusive rocks such as andesite, basalt and dolerite.

The area between the Algeti River and the Bedeni Ridge is comprised of lava flows. The area between the Bedeni Ridge and Kizil-Kilisa is characterised by an undulating volcanic plain with quaternary lake basins such as Tsalka and Tabatskuri Lake and their associated unconsolidated deposits. Steeply undulating high volcanic peaks are noted in the area of Mt Tavkvetili, the Mshrali Mta mountain, and the Tskhratskaro Pass and lava flows are noted on the flanks of these mountains.

8.5.1.3 Western Trialeti range

The Western Trialeti range represent a fold of the Minor Caucasus Mountains and comprise a deeply dissected steep mountain terrain. The high peaks and the Tskhratskaro Pass are composed of Tertiary igneous rocks including pyroclastic deposits (such as tuff conglomerate, tuff breccia, tuff sandstone and tuff mudstone) and shallow intrusive rocks for example andesite sheets.

Tertiary sedimentary rocks (such as limestone, sandstone and mudstone) and clays are noted in the lower mountains at Tsikhisjvari and Tiseli and unconsolidated quaternary deposits are noted at the base of the steep mountain valleys.

8.5.1.4 Akhaltsikhe Basin

The Akhaltsikhe synclinal basin is composed of undulating hills and valleys and forms the geomorphological zone between the Trialeti range and the Turkish border. The hills are composed of Tertiary sedimentary rocks dissected by river valleys and their associated deposits. Beyond the Potskhovi river valley the topography rises gently over volcanic hills and lava flows towards the Turkish border.

8.5.2 Geology

The geology of the pipeline route is reflected in the landforms described above. The lithological types encountered along the proposed route are generally Tertiary volcanic and sedimentary deposits and Quaternary fluvial or terrigenous deposits. This section is based on an Engineering-Geology literature review (Oniani 2000).

8.5.2.1 Quaternary deposits

Quaternary deposits are widespread along the proposed pipeline corridor. These recent deposits are generally unconsolidated but may be locally cemented. They are represented by the following depositional facies:

- Fluvial Deposits: These floodplain and floodplain overlying deposits are noted in the gorges and valleys of the rivers along the route such as the Mtkvari, Khrami, Algeti, and Potskhovi. The lithological composition of these deposits includes boulders, pebbles, gravels, sands, loams and clays. Consolidated layers (clays and loams) prevail in the eastern lowland part of the proposed corridor (Mtkvari, Khrami and Algeti Rivers), whilst boulders and pebbles with sandy clays dominate in the western part

- Lacustrine Deposits: Lacustrine deposits occur in the River Mtkvari valley, the middle reaches of the River Mtkvari, its right tributary – River Khrami, and the northernmost part of the Tabatskuri Lake. Recent lacustrine deposits are found in the vicinity of, and within, the Tsalka reservoir. The lacustrine-alluvial sediments include clays and loams, with interbedded sand strata

- Floodplain Deposits: These deposits are characterised by stratified deposits of sands, gravels and clays. Floodplain deposits are noted on the left bank of the River Algeti, in the vicinity of Ialghuja Mountain and include yellow to brown and dark grey clays and loams. Deluvial-proluvial sediments on the slopes of the Ajara-Trialeti ridge include slightly rounded pebbles and gravel with some sandy clay. Other types of alluvial sediments include of weakly cemented conglomerates, cobbles, coarse gravel, silts and sandy, silty clay

- Flysch/Molasse Deposits: These deposits are formed from the sediments produced by the uplift, deformation and erosion of mountains. Such deposits are represented along the pipeline route by Palaeogene deposits and include clays, gypsiferous clays, sand stones, marls and limestones. These deposits are found in the gorges and valleys of the Rivers Mtkvari and Potskhovi, in the vicinity of mountain Ialghuji north-east of the town of Marneuli and along the north of the Akhaltsikhe basin

8.5.2.2 Igneous formations

8.5.2.2.1 Intrusive formations

Intrusive formations are created when a body of rock forces itself into existing rocks, either along a definite structural feature such as bedding planes, cleavage or joints or by deformation or cross cutting of the invaded rocks. Intrusive formations along the pipeline route include Tertiary gabbros and Palaeozoic granitoids. Gabbro outcrops are noted in the volcanic plateau region. Granite outcrops are located east of Tsalka reservoir, at Iaila Mountain (1,951m).

8.5.2.2.2 Effusive formations

Effusive or extrusive formations occur when igneous rock has flowed at the surface of the Earth and commonly include rocks formed by volcanic eruptions such as ash and lavas. Effusive formations occur over a large part of the proposed route corridor and are represented by Tertiary & Quaternary basalt, andesite, dolerite and dacite deposits. The volcanic plateau from the River Algeti to the Tskhratskaro Pass is composed mainly of lava flows whilst the rocks forming the Kashuri mountains and those near the Turkish border also include Pyroclastic deposits such as tuff, breccia, tuff breccia, tuff sandstones and conglomerates interbedded with lava flows.

8.5.2.3 Cretaceous & Tertiary sedimentary deposits

Outcrops of Tertiary sedimentary rocks occur on the Piedmont plain and ridge near Rustavi in the River Mtkvari flood plain and comprise terrigenous sediments, partially carbonate facies, limestone, marly limestone, sandstone, mudstones, marls, shales and clays. Tertiary sediments also form the undulating hills and valleys of the Akhaltsikhe Basin and the deeply dissected valleys of the Kashuri mountains. Outcrops of Palaeogenic sediments are located in the area between the Bakuriani Andesite plateaux and the River Mtkvari valley. Outcrops of Goderdzi Series sediments are found in the areas adjacent to the Turkish border.

8.5.3 Hydrogeology

8.5.3.1 Introduction

Georgia is subdivided in five hydrogeological regions. These regions are further sub-divided into 25 hydrogeological districts. The 10km wide BTC route corridor, considered for the purpose of this study, partially covers three hydrogeological regions:

1. Hydrogeological region of artesian basins of Georgian belt (Region III)
2. Pressure water system of Ajara-Trialeti Folded zone (Region IV)
3. Groundwater zone of Artvin-Somkhiti Belt (Region V)

The hydrogeological regions and districts, together with a detailed stratigraphic sub-division are shown on Figure: Map 8-3a-f.

8.5.3.2 Methodology

For the purpose of this study and based on the hydrogeology literature review (Zviadadze 2001), the proposed pipeline corridor has been divided in five segments:

- Section I – Marneuli – Gardabani Artesian Basin (KP 0-70)
- Section II - Easternmost Part of Daghet-Khachini to Southern Slopes of Bedeni Mountain (KP 70-96)
- Section III - Southern Slopes of Bedeni mountain to Tskhratskaro Pass (KP 96-KP 175)
- Section IV - Tskhratskaro Pass to Easternmost Part of Village Sakuneti (KP175-210)
- Section V – Easternmost Part of Village sakuneti to Georgia-Turkey Border (KP 210-247)

The hydrogeological settings for each segment are described in the sections below. The lithological units described below are annotated with the abbreviations (alQ_4; $N1\text{-}P_3$; etc) used in the official and reproduced geological maps and cross sections.

8.5.3.3 Section I – Marneuli – Gardabani Artesian Basin (KP 0-70)

8.5.3.3.1 Overview

The first section of the proposed corridor is located within the Marneuli-Gardabani artesian basin of porous and fissury groundwater (Region III_{12}). The section length is approximately 70km from the westernmost part of Jandara lake (Georgia – Azerbaijan state border) to the east of village Daghet-Khachini (Tetritskaro administrative district).

The morphology of the Marneuli-Gardabani artesian basin includes the Kvemo Kartli plain, the foothills of the Trialeti range and the Iaghluja mountain slopes.

Two main morphological units are identified in the lowland part of the district according to spatial distribution of relief types and characteristic forms:

1. Marneuli-Gardabani accumulative depression, which comprises a synclinal basin underlying thick Quaternary series
2. Kumisi erosive depression with characteristic wide, accumulative base and rounded surface with fairly steep sides

The geological structure of the Marneuli-Gardabani artesian basin and adjacent areas includes Cretaceous, Palaeogene, Neogene and Quaternary sedimentary formations, which are mainly represented by terrigenous and partially carbonatic facies.

The following major water-bearing horizons and complexes as well as water-impermeable layers are identified in terms of quantitative and qualitative characteristics of water content:

1. Water-bearing horizon of river-bed and floodplain recent alluvial sediments (alQ_4)
2. Water-bearing horizon of early Quaternary alluvial sediments (alQ_{3-1})
3. Water-bearing horizon of the Upper Miocene-Pliocene volcanogenic-continental facies (N_2^1- N_1^3)
4. Water-impermeable Miocene-Oligocene sediments (N_1-P_3)
5. Water-bearing complex of Eocene-Palaeocene volcanogenic-sedimentary strata (P_2-P_1)
6. Water-bearing horizon of Senton carbonate strata (K_2Sn)

The first two horizons are the most important in terms of water supply of residential areas and severity of potential impact of the proposed oil pipeline.

The third horizon consists of seven artesian sub-horizons of porous material within otherwise impermeable formations. The water bearing strata represent a limited groundwater resource. In addition, the depth of occurrence and the protection afforded by the impermeable strata of the formation make this aquifer irrelevant from a potential contamination stand point. This aquifer does however outcrop in the western part of this first segment and is therefore also described below

Horizons four to six are not significant in the context of this study as they are hydraulically isolated from the upper formations and the pipeline. Therefore they have not been described in detail in this section.

Sections 8.5.3.3.2 and 8.5.3.3.3 below describe in more detail the hydrogeological characteristics of the first and second horizons described above.

8.5.3.3.2 River-bed and floodplain recent alluvial sediments (alQ_4);

This horizon is located within beds and floodplain terraces of the Rivers Khrami, Debeda, Algeti and Mtkvari. At the Mtkvari the width of the alluvial deposits reaches 2 – 2.5km.

The water content in the recent alluvial sediments of the Algeti River is relatively low. This water is characterised by a high sulphate content and fairly high total mineralisation (1 – 5g/l). Water of the River Mtkvari is characterised by bacteriological contamination and industrial pollution. This restricts substantially the use of the alluvial deposits of these rivers for abstraction of water.

The River Khrami alluvium consists of shingle-pebbles with sand and gravel matrix. Early Quaternary sediments, with Mio-Pliocene continental facies strata in some areas, comprise the substratum of the alluvial horizon within the Marneuli lowland. The thickness of the alluvial horizon varies significantly, reaching a maximum of 30m, at the confluence of the Rivers Khrami and Debeda. Water abundance depends on the particle size of the alluvium at specific locations. The aquifer permeability is in the range of 150 – 300m/day. Spring outlets are frequent on the floodplain terraces, sometimes in groups, with total discharge of the aquifer through springs amounting to 400 – 650 l/sec. The depth of the water table varies from 1m to 2.5m and very rarely reaches 4m. The average hydraulic gradient of the underground flow is 0.005.

The composition of the minerilisation in the groundwater, within the alluvial aquifer, is mostly bicarbonate-calcium, rarely bicarbonate-sulphate calcium and sulphate-bicarbonate calcium-magnesium. The total mineralisation is 0.3 – 0.5g/l. Water temperature varies within 12 - 16°C by seasons, water hardness is 4.5 – 9.5mg/eq.

The horizon is mostly recharged by river water and partially by atmospheric precipitation and throughflow from other water bearing horizons.

This aquifer is largely exploited for the supply of potable water, eg the river-bank water abstraction facility located at the confluence of the Rivers Khrami and Debeda provides potable and industrial water for the town of Rustavi.

8.5.3.3.3 Early Quaternary Alluvial Sediments (alQ_{3-1})

Gardabani

This horizon is widely developed within the Marneuli-Gardabani artesian basin. Its lithology consists of shingles-pebbles, weakly cemented conglomerates and silts with lenses of sand and gravel.

The thickness of the horizon varies from 5 to 60m. The maximum thickness is observed within the River Khrami valley.

Three main aquifers are identified in the Early Quaternary Alluvial horizon:

Tamarisi
Gardabani
Koda

The Gardabani aquifer occurs in the study corridor and has been extensively studied by means of boreholes. According to the borehole data, the depth of the water table varies from 2m to 36m. The depth increases at the periphery of the aquifer whilst it is minimal in the central zone where it does not exceed 2m. Specific yield of boreholes is on average 1 l/sec. The water table hydraulic gradient is 0.0035, and the permeability is on average 28m/day.

The chemical composition of groundwater is predominantly bicarbonate-sulphate calcium. However, it is also often sulphate-bicarbonate magnesium type. Total water mineralisation increases accordingly and varies from 1g/l to 10g/l.

The horizon is mostly recharged by water losses from irrigation canals and atmospheric precipitation.

Marneuli Lowlands Aquifer

In addition to the Gardabani aquifer, several water-bearing strata have been found in the early Quaternary sediments of the Marneuli lowland. Their thickness varies from 4 to 50m. The lithology of these layers principally consists of friable conglomerates and partially of shingles-pebbles with a sand and loam matrix. The specific yield of the boreholes varies from of 0.1 – 2 l/sec. The permeability is in the region of 0.5 - 5m/day, rarely reaching 15-20m/day.

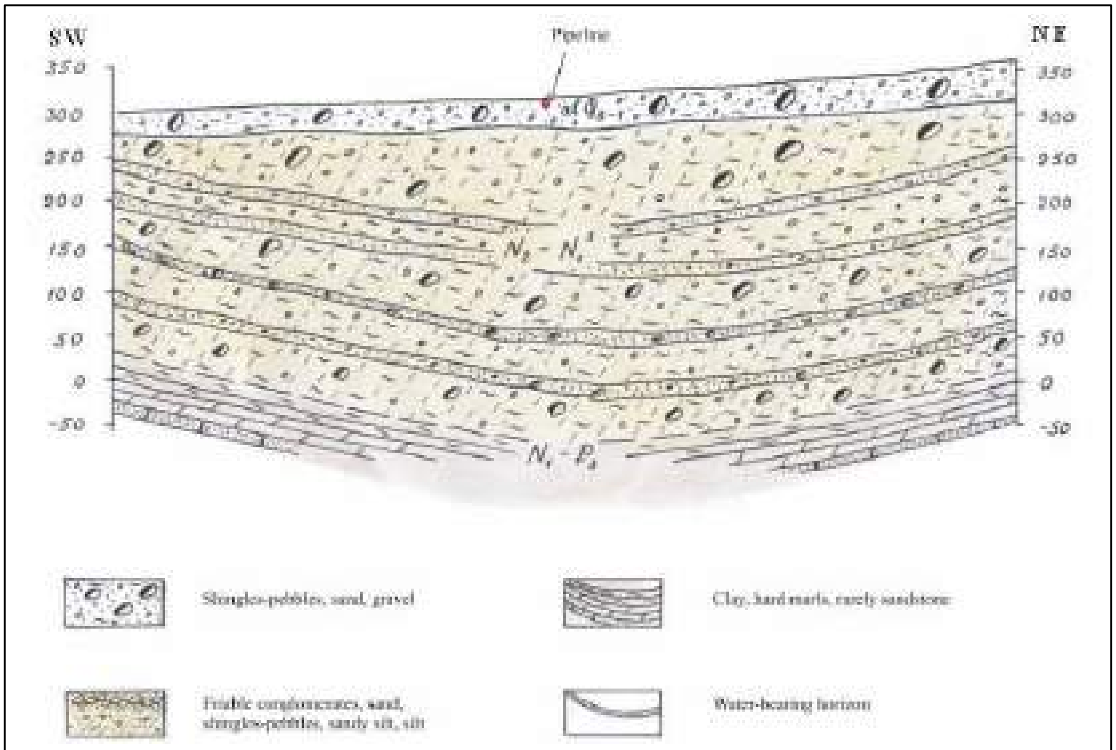
The lower horizons of the Early Quartenary sediments are characterised by local pressurisation. Most boreholes are sub-artesian with piezometric levels varying from 0.5m to 20m below ground level. The hydraulic gradient of the piezometric surface is 0.003.

The chemical composition is predominantly bicarbonate-sulphate calcium-sodium type with total mineralisation of 0.5 – 1g/l. Increase in mineralisation and artesian pressure is observed in the southern-eastern section of the aquifer.

The horizon is recharged by river and irrigation water, and precipitation. A hydraulic link has been identified with both recent alluvial horizon groundwater and underlying Mio-Pliocene pressurised water.

Groundwater of the early Quaternary sediments is used in the Marneuli lowlands for supply of water to agricultural facilities.

Figure 8-1 Hydrogeological cross section of Marneuli Gardabani Artesian basin



Cross Section equivalent to Section A-B in Figure: Map 8-3a

8.5.3.3.4 Upper Miocene-Pliocene volcanogenic-continental facies (N_2^1- N_1^3)

This horizon is mostly located in the lowland part of Marneuli-Gardabani basin where it is sometimes overlaid by early quartenary alluvial-lacustrine sediments.

Boreholes reaching 500m depth have found seven artesian water-bearing horizons. The horizon lithology comprises friable conglomerates, sands and pebbles with a silty matrix. The thickness of strata varies from 4 – 25m. Some boreholes are fully artesian with piezometric levels ranging from 1m to 12m. Most boreholes are sub-artesian with piezometric levels varying from 0.5m to 55m. Specific yield of the boreholes ranges significantly, namely from 0.1 to 10 l/sec. Permeability is within 4 - 18m/day.

This groundwater is of various chemical compositions, from hydrocarbonate-sulphate calcium to sulphate calcium-sodium types. Total mineralisation also differs considerably, namely from 0.5 to 7g/l. Water temperature varies within 12-19°C.

The horizon is mainly recharged by infiltration of river water, which takes place in the lower parts of the alluvial fans. Favourable conditions for recharge by precipitation are within the Iaghluja plateau where this formation also outcrops.

Pressurisation of Miocene-Pliocene groundwater occurs almost entirely in the central part of the lowland. Overall flow direction is from north-west to south-east. Hydraulic gradient is 0.01 and gradually decreases to 0.002 in the southern-easternmost part of the basin. Natural discharge of the horizon occurs mostly through seepage into surface water courses.

The Mio-Pliocene water-bearing complex has low practical significance in the national economy because it is only used for localised water supply.

8.5.3.4 Section II - easternmost part of Daghet-Khachini to southern slopes of Bedeni Mountain (KP 70-96)

8.5.3.4.1 Overview

The length of this segment is approximately 26km in the study area. According to the hydrogeological zoning of Georgia, this section is mainly located within the hydrogeological zone IV_3 – Tbilisi artesian system of fissury and fissury-karst water. The southern part of the 10km wide corridor covers a canyon-like gorge formed of Cretaceous tuffaceous rocks of the middle reaches of the River Khrami west of the village of Kossalari. This section belongs to the region of fissury groundwater of the eastern slope of Javakheti range - V_2.

There are two types of relief in the study area:

- Javakheti range
- Mountainous region of the middle reaches of the River Khrami

The Javakheti range is part of the mountainous region of south Georgia. It is represented by the northern-eastern and eastern slopes in the study area. These slopes are slightly inclined eastward and gradually merge with a lava layered plateau (upland) of the Khrami basin. The hydrographic system is poorly developed. Maximum absolute elevations reach 2,300m.

The mountainous region of the middle reaches of the River Khrami covers a large area at the watershed of the Rivers Algeti and Machavera. Only the central part of this region is located in the study area. It is dissected into separate massifs by deeply cut river gorges. These massifs are the Bedeni-Tavshishvela and part of the Homer massifs.

The main hydrographic unit is the River Khrami with the middle reaches located along Kvemo Akhalsheni-Kosalari route section, in hydrogeological districts IV_3 and V_2.

The hydrogeological units found in this area are as follows:

1. Water-bearing horizon of river-bed and floodplain recent alluvial sediments (alQ_4)
2. Water-bearing horizon of Middle Quaternary-Upper Pliocene lava layer ($N_2^3 – Q_3$)
3. Water-bearing complex of Upper Miocene-Pliocene volcanogenic-continental facies ($N_2^1 – N_1^3$)
4. Water-bearing complex of Eocene-Paleocene volcanogenic-sedimentary strata ($P_1 – P_2$)
5. Water-bearing horizon of Upper Cretaceous (Campanian-Danish) carbonate series ($K_2{}^{cp}{}_2{}^{-d}$)
6. Water-bearing horizon of Upper Cretaceous (Sentonian) carbonate layers (K_2^{Sn})
7. Water-bearing complex of Upper Cretaceous (Senoman-Campanian) volcanogenic-sedimentary strata ($K_2{}^{cm-cp}{}_1$)
8. Sporadic water-bearing sediments of Upper Cretaceous quartz albitophyres ($\beta\phi K_2$)
9. Paleozoic water-impermeable sediments (p_Z)

Of these, the proposed pipeline route directly crosses units 2, 5 and 8, such that these units are described in detail in this section.

8.5.3.4.2 Middle-Quaternary - Upper Pliocene Lava Layers ($N_2^3 – Q_3$);

The lithology of this formation consists of dolerites, basalts, andesites, dacites interbedded with sandy loam and loam. This formation is extensively fissured owing to atmospheric weathering and tectonic fracturing. This determines high water permeability and abundance. Another factor, which facilitates water abundance, is large volume of atmospheric precipitation in this area and favourable morphologic conditions for infiltration.

The thickness of this formation varies with its occurrence (exceeding 1,000m within the Akhaltsikhe upland) but it is generally above 100m.

Fissury springs with high yield are often found in river gorges. Springs with medium and low yield (<1.0 l/sec) are numerous on areas where impermeable strata underlay this formation.

Interbeds of volcanic ash and water-impermeable lacustrine clays are frequent in the upper part of the horizon, which conventionally divide the series in two parts: Quaternary sediments and Pliocene lavas.

Groundwater of the lava horizon is fresh, with total mineralization of 0.1- 0.3g/l. Chemical composition is bicarbonate-sulphate sodium-calcium. The water is soft with the index of total hardness not exceeding 2.5mg.eq/l.

Groundwater from this horizon is often used for potable supplies.

8.5.3.4.3 Upper Cretaceous (Campanian-Danish) Carbonate Series ($K_2^{c}P_2^{-d}$)

The water-bearing horizon of the Upper Cretaceous (Campanian-Danish) carbonate series has a limited distribution and, in relation to the proposed pipeline route it occurs only at KP 76.6 to 77.6. The lithology consists of stratified pelitic limestone interbedded with marl, carbonaceous sandstone, tuffaceous sandstone and tuffaceous breccia. The average thickness of the series is approximately 300m. Outcrops of the carbonaceous strata are frequent on the steep forested slopes of the deep and narrow gorge of the Gudaredzi River. To the east, the series plunge under the series of the Lower Eocene-Paleocene flysch sediments. Groundwater occurs in the fissured zone of the Upper Cretaceous carbonate layers.

Groundwater springs are found at the bottoms of the gorges. Spring yields typically fluctuate between 0.2-1.0 l/sec, with a small number of springs have a higher yield (> 1.0 l/sec). Spring water is characterized by low mineralisation 0.2-0.5g/l. It is mostly bicarbonate calcium-magnesium type and it is used for potable supply of residential areas (villages Abeliani, Ksovreti, Nadarbazevi).

8.5.3.4.4 Upper Cretaceous Quartz Albitophyres ($\beta\phi K_2$)

Sporadically water-bearing sediments of the Upper Cretaceous quartz albitophyre are exposed in small outcrops with characteristic peaks and closed contours. These layers are notable for a fairly high degree of fissuring. However, springs connected to this series have not been known in the study area.

8.5.3.5 Section III - Southern Slopes of Bedeni mountain to Tskhratskaro Pass (KP 96-KP 175)

8.5.3.5.1 Overview

This section of the proposed route covers 79km and crosses two hydrogeological districts:

- Trialeti artesian system of fissury and fissury-karst water - IV_2
- Akhalkalaki area of fissury groundwater of lava formations - V_1

The study area (10-km wide corridor) coincides with the border zone between two major tectonic structures: the Aspindza-Manglisi subzone of the Agara-Trialeti folded system to the north, and the Javakheti zone of the Artvin-Bolnisi Belt to the south. The latter is characterised by an extremely complicated tectonic structure, which is reflected in high seismic activity.

Several high yield aquifers occur in the 10km wide study corridor.

The proposed pipeline route directly crosses the following units:

1. Water-bearing horizon of Middle Quaternary-Upper Pliocene lava layer ($N_2^3 - Q_3$)

2. Water-bearing horizon of Lower Pliocene (upper part of Kisatibi series) lava layers (αN_2^1)

3. Water-bearing horizon of Upper Cretaceous (Campanian-Danish) carbonate series (K_2^{cp2-d})

4. Sporadically water bearing alluvial and sediments of Recent period (pdQ_4)

5. Water bearing alluvial and lacustrine sediments of Upper Quaternary ($aplQ_{3-4}$)

Units 1 and 3 have been described in detail in previous sections. Unit 1 has however peculiar characteristics in this area and is therefore discussed below. Unit 5 is of no significance with regard to the proposed pipeline project because the aquifers are of low yield and are not used; it is therefore not described further in this section.

8.5.3.5.2 Middle Quaternary-Upper Pliocene Lava Layer (N_2^3 – Q_3)

The lava cover is intensively folded within the Tsalka depression. The thickness of the lava cover reaches several hundred meters. It is characterised by water abundance, which is a result of favourable combination of various natural conditions, such as:

- Intensive infiltration of atmospheric precipitation and surface water accompanied by high condensation
- Intensive tectonic and exogenous fissuring of andesite-basalts, and alternation with impermeable lacustrine clays

All this facilitates the formation of several layers of thick groundwater horizons in the lava cover. Natural discharge of these horizons occurs through high yield springs, which frequently form river sources. These springs include the Dashbashi spring group (south-east of Tsalka) with total yield exceeding 3,500 l/sec, Bezhano spring (south-west of Tabatskuri lake) with yield of 250 l/sec, Burnasheti spring (at village Burnasheti) with yield of 2,000 l/sec.

It should be noted that groundwater horizons connected to lava cover are characterised by a fairly stable regime, which is probably owing to high permeability of the strata and the regulating influence of lakes. In addition, these unique water resources that have yields in excess of $20m^3$/sec are characterised by high quality potable properties and are widely used for water supply.

8.5.3.5.3 Lower Pliocene Lava Layers (αN_2^1)

The water-bearing horizon of Lower Pliocene (upper part of Kisatibi series) lava layers consist of andesite, andesite-dacite, liparite and their associated pyroclastic deposits.

Owing to high porosity and intensive fissuring, this formation is highly permeable. According to the degree of relief dissection, depth of the groundwater changes from 20 to 150m. Owing to the absence of impermeable strata within the Kisatibi series, groundwater is never found under artesian conditions. Pressurized groundwater has been found through boreholes only on the western shore of Tabatskuri lake, where andesite is covered by Quaternary sandy silts and silty lacustrine sediments. Water of this horizon has low mineralization ($M<0.5g/l$) and is of hydrocarbonate calcium type.

The horizon is mainly recharged by atmospheric precipitation and partially at the expense of water outflow from the Upper Pliocene - Lower Quaternary lava horizon. The Kissatibi series is connected to high yield springs (>1 l/sec). Waters of this horizon are widely used for water supply of large settlements, such as Akhaltsikhe, Adigeni, Uraveli and others.

8.5.3.5.4 Alluvial and lacustrine sediments of Upper Quaternary (pdQ_4)

These units occur in localised pockets within the Tsalka depression and in Narianis Veli. The lithology consists of friable alluvial formations (unconsolidated sands, and silts) and lacustrine clay-silts. Groundwater is shallow (depth is either less than 2m or ranges within 2 – 5m) and does not have aggressive properties. It is unlikely that these aquifers are exploited for the supply of potable water given the abundance of high yield springs in the general areas of occurrence of this formation.

8.5.3.6 Section IV - Tskhratskaro Pass to Easternmost Part of Village Sakuneti (KP175-210)

8.5.3.6.1 Overview

The route section between Tskhratskaro Pass and easternmost part of the Sakuneti village is located in the Trialeti hydrogeological district of fissury and fissury-karst artesian water system (Zone IV2).

The total length of the route section is approximately 36km.

The Trialeti range is a major orographic unit in this area and the Rivers Borjomula and Gujaretis Tskali are the main hydrographic units in this area.

The River Borjomula starts on the northern slopes of Trialeti range, in the vicinity of the village Tsikhisjvari. It flows into the River Mtkvari within the Borjomi National Park area, at an altitude of 781m. The natural outlets of the famous Borjomi mineral waters are located in the gorge of the River Borjomula. These outlets are in the form of ascending springs. The majority of the study area, from Tskhratskaro pass to the vicinity of village Sakire, overlies the Borjomi mineral water fields (Borjomi, Mitarbi, Nedzvi, Zanavi, etc). The recharge areas for principal water-bearing horizons are the northern slopes of Trialeti range.

River Gujaretis Tskali, which also flows into the River Mtkvari at the town of Borjomi (at an altitude of 775m), is a typical mountainous river with rapids and relatively warm current in some places. The gorge is deeply cut and has steep slopes.

The geological structure consists of Mesozoic, Cenozoic and Quaternary volcanic, volcanogenic-sedimentary, sedimentary strata of various lithology.

The following main water-bearing horizons occur within the 10km route corridor west of Tskhratskaro pass to the boundary of the hydrogeological zone IV2:

- Water-bearing complex of Middle Eocene volcanogenic-sedimentary strata (p2 2)
- Series of water-impermeable lagoon-marine sediments of Lower Miocene and Oligocene-Upper Eocene (N11-p23)
- Water-bearing horizon of Middle-Quaternary - Upper Pliocene lava layers (N23-Q3)

Unit 1 is described in more detail below. Unit 2 is not significant in the context of this study as it bears no groundwater and it provides an impermeable protective cover for underlying water-bearing strata. Unit 3 occurs only between KP 191 and 192.5 and has been described in the previous sections.

8.5.3.6.2 Middle Eocene volcanogenic-sedimentary strata ($p_2^{\ 2}$)

The water-bearing complex of Middle Eocene volcanogenic-sedimentary strata is present both in the northern part and also in the southern 5km of the route corridor.

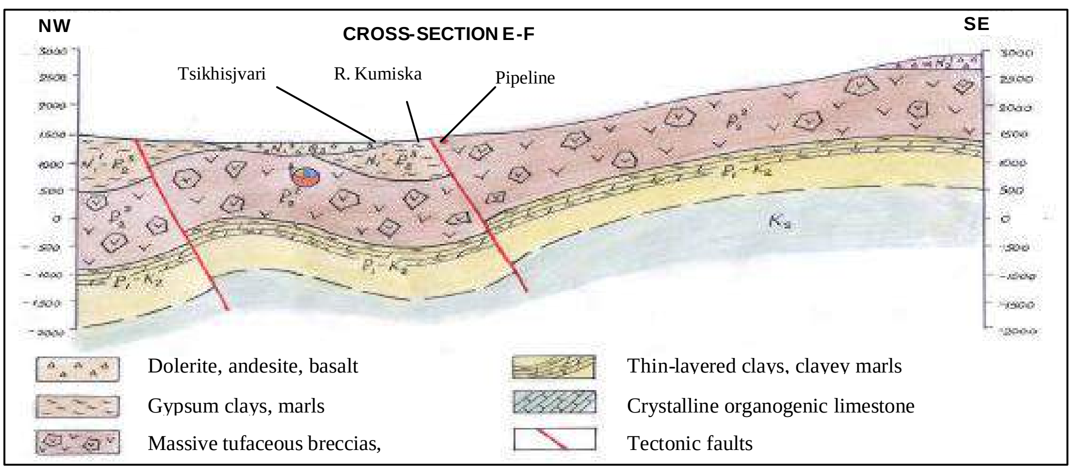
On the whole, the complex consists of volcanogenic formations - alternation of massive tuff breccia and with thin-layered siltstone, tuffaceous clay, marl and clayey sandstone, frequently with massive lava breccia and basalt. Cumulative thickness is up to 4,000m. Coarsely fractured tuff breccias, andesite, basalt and tuffaceous sandstone layers are most permeable owing to fissuring and high porosity.

The volcanogenic strata of the Middle Eocene are characterised by the presence of a thick zone of secondary exogenous fissuring, which hosts large reserves of groundwater. In addition, deep tectonic fissures have developed in the series owing to tectonic strain thus allowing groundwater of deep circulation to be hydraulically linked with the more shallow flows. Spring yield varies within 0.1-1.0 l/sec. However, higher yield springs are connected to open exogenous fissures and outlets of groundwater are sometimes observed in the form of groups of springs in the proximity of major tectonic faults. The yield of these springs can reach several litres per second.

The water of the volcanogenic-sedimentary complex of the Middle Eocene has low mineralization, approximately 0.1 – 0.4g/l. It is mainly bicarbonate calcium-magnesium. Total hardness does not exceed 3mg/eq.

Deeper circulating groundwater within this horizon include mineral and thermal waters of impeded circulation, exhibiting varying mineral and gaseous content. In addition to natural outlets, these waters have also been abstracted through numerous test boreholes because of their drinking quality and therapeutical properties.

Figure 8-2 Hydrogeological cross section near Tsikisjvari



8.5.3.7 Section V – Easternmost part of village Sakuneti to Georgia-Turkey Border (KP 210-247)

8.5.3.7.1 Overview

The study area is located within the Akhaltsikhe artesian basin of fissury water - hydrogeological district (Zone IV4). The total length of the route section is approximately 37km from the easternmost part to the Georgia-Turkey state border.

The hydrographic system of the study area includes the upper reaches of the River Mtkvari, from the state border with Turkey to the beginning of Borjomi gorge. Within this area, the Rivers Postkhovi and Kvabliani (left tributaries) flow into the River Mtkvari.

The study area is a folded district of complex genesis. The geology consists of Meso-Cenozoic volcano, volcanogenic sedimentary and marine facies formations.

According to the geotectonical zoning of Georgia, the Akhaltsikhe basin is located in the southern part of the Agara-Trialeti folded system, ie within the Akhaltsikhe subzone and partly, the Javakheti tectonic zone.

The thickness of the sedimentary complex is 4-6km within the Akhaltsikhe depression, according to geophysical survey data. The lithology consists of Cretaceous, Paleocene and post-Paleocene volcano cycles resulting in formation of mostly alkaline (partially, of medium acidity) effused lava, and rarely thick intrusive series.

The Akhaltsikhe depression is a synclinal structure in tectonic terms, extremely complicated by intensively shrunk folds and numerous fragmented dislocations. The lithology consists of Middle and Upper Eocene and Oligocene volcanogenic and sandy-clayey formations and volcanogenic strata of the Kisatibi series (Miocene).

Freshwater, high-temperature mineral carbonated and nitric water types occur in the study area dependent on formation conditions of water-bearing horizons, location and distribution in the stratigraphic profile, as well as chemical and gaseous composition. It is often impossible to identify boundaries between these groups precisely as in many cases fresh cold water gradually turns into mineralized water enriched with carbonic acid (CO_2) and nitrogen (N_2).

The chemical and gaseous composition of mineral water is much influenced by recent tectonic movements resulting in deep faults, which facilitate water circulation, migration of carbonate acid and enrichment of groundwater with trace elements.

The hydrogeological units occurring in the study area are as follows:

1. Water-bearing horizon of recent alluvial sediments of river bed and floodplain (alQ_4)

2. Water-bearing horizon of Lower Pliocene (upper part of Kisatibi series) lava layers (αN_2^1)

3. Water-bearing complex of Upper Miocene-Lower Pliocene (lower part of Kisatibi series) lava layers ($N_1^2 - N_2^1$)

4. Series of water-impermeable lagoonal-marine sediments of Lower Miocene and Oligocene - Upper Eocene (N_1^1 - P_2^3)

5. Water-bearing complex of Middle Eocene marine volcanogenic-sedimentary strata (P_2^2)

The above units are described in detail below, with the exception of Unit 4 that is not significant in the context of this study because it does not host water reserves.

8.5.3.7.2 Recent Alluvial sediments of river bed and flooplain (alQ_4)

Water-bearing horizon of recent alluvial sediments of river bed and floodplain have a wide distribution on the wide valley areas of the Mtkvari, Tsinubnistskali, Abastumani, Potskhovi and Kvabliani. Sediments of the lower floodplain terraces contain water, while the upper terraces are sporadically water-bearing. The yield of springs connected to alluvial sediments varies within a wide range, namely from 0.01 to 12.0 l/sec. The yield of only one spring, located near village Tmogvi, reaches 30 l/sec.

Water of bicarbonate calcium-sodium chemical composition predominates. Bicarbonate-sulphate magnesium water is less frequent. Correspondingly, mineralization varies from 0.1 to 1.1g/l. Fluctuation in temperature is within 4-18°C according to the seasons.

8.5.3.7.3 Lower Pliocene lava layers (αN_2^1)

Water-bearing horizon of Lower Pliocene (upper part of the Kisatibi series) lava layers is exposed in outcrops on a fairly large area in the vicinity of villages Mikeltsminda and Tsira within the study area. Refer to previous sections for detailed description of this horizon.

8.5.3.7.4 Upper Miocene-Lower Pliocene Lava Layers (N_1^2 - N_2^1)

Water-bearing complex of Upper Miocene-Lower Pliocene (lower part of Kisatibi series) lava layers is exposed over a large area, namely south of the village Arali (northern part of the 10km route corridor), between the villages Skhvlisi and Tskaltbila (southern part of the 10km route corridor) and south of the village Varkhani.

The lithology of the complex includes andesite, andesite-dacitic and dacitic tuff and tuffaceous breccia lava layers. The water content varies significantly and depends on the degree of fissuring of the strata. Thus, yield of springs connected to the lower part of the Kisatibi series does not exceed 0.2 l/sec in the central part of Akhaltsikhe depression, while high-yield springs (50-80 l/sec) occur in these series outside the 10km route corridor, namely near the village Atskvita. Circulation is mostly of through fissure systems, less frequently through natural porosity as well as fissures.

Groundwater chemical composition of the Kisatibi series is generally bicarbonate calcium-sodium or calcium-magnesium. Mineralization varies from 0.1 to 0.7g/l. Temperature reaches 13^0C.

8.5.3.7.5 Middle Eocene Marine volcanogenic-sedimentary strata (P_2^2)

Like Agara-Trialeti folded system, majority of tectonic structures in Akhaltsikhe depression and its adjacent areas are comprised of Middle Eocene volcanogenic-sedimentary strata. The strata are exposed over large areas both north and south of the route. These strata comprise the Tsnisi and Akhaltsikhe anticlines complicated by the secondary disjunctive dislocations.

Fresh water outlets are connected with Middle Eocene tuffs and tuffaceous deposits, in particular fragmented tuff breccia, sandstone and andesite layers. Circulation is mostly through fissure systems. Spring yield is 0.2-1.5 l/sec, sometimes reaching 20-30 l/sec. Water, which is naturally discharged in the form of ascending springs, occur on the areas, where the Middle Eocene water-bearing complex is overlaid by Miocene-Upper Eocene water impermeable sediments. This water is bicarbonate, rarely bicarbonate-sulphate, with low mineralisation (up to 1g/l); temperature varies from 4 to 150°C according to seasons and altitudes.

Carbonated (CO_2) and nitric (N_2) mineral waters have a wide distribution in the Akhaltsikhe depression and adjacent areas. Local population uses these springs as drinking water and for therapeutic purposes. Also, dry outlets of carbonic acid gas are numerous, which could become an important factor for the economic development of this region. In addition to the numerous natural outlets, mineral water is abstracted by a number of bottling plants by means of boreholes. Most of the nitric waters are characterized by high temperature (>30^0C) and are classified as thermal waters.

8.5.3.7.6 Conclusions

The majority of the proposed pipeline route lies over aquiferous strata. The exception is small sections around Samgori to the east of the route and a long section between KP 183 and 240 where the dominant terrains are water impermeable marls and clays. The use of the water resources varies significantly along the route as a function of water quality and spring yield. Most of the used water originates from descending springs draining volcanic terrains. The proposed pipeline route also intersects a mineral water field located to the south of the famous Borjomi mineral water field and part of the same regional of volcanogenic water mineralisation.

8.5.4 Geohazards

Geohazards identified along the proposed pipeline route corridor include processes caused by the gravity transport of weathering products such as slope erosion (gullying), mud flows, debris flows, scree or rock avalanches and also landslides caused by the mass movements of unstable materials and seismic hazards. Other potential geohazards such as solifluction, swamping and salinisation have been noted along the route but owing to their limited significance with regard to the route specific territory have not been described in this report. A full report produced by WS Atkins details the comprehensive geohazard assessments that have been conducted along the pipeline route and are summarised below. Figure: Map 8-4a-c shows the occurrence of geohazards along the proposed pipeline route.

8.5.4.1 Gullying

Gullying is caused when surface runoff of unconsolidated materials such as silt rich soils, shales and marls occurs in concentrated flow paths. Continued runoff in these paths may create wash outs and finally channels which collapse to form gulleys. This gullying process occurs mainly in alluvial-proluvial and alluvial-lacustrine deposits. Gullying has been noted to occur in the vicinity of Lake Jandari to Akhali Samgori where the depth of gulleys reach 3 - 5m in some places and the process is also noted in the vicinity of the village of Lemshvaniera.

8.5.4.2 Mud & debris flows

Mud flows are formed when large quantities of water disrupt the soil or clay to water ratio causing the mud or rock to behave as a liquid which flows like a wet concrete. These flows usually occur suddenly, have a high velocity and are highly efficient eroding agents that may transport large boulders considerable distances, before settling and forming a cohesive deposit. Mudflows have been noted in dry gorges along the proposed route. Well-defined mudflows are noted in the vicinity of Samgori and Gamarjveba, on the slopes of Ialghuja and in the vicinity of Krtsanisi.

8.5.4.3 Rock /scree slides & falls

Rock falls occur following the de-stabilising of a mass of rock or scree fragments, generally as a result of gravity or a sudden excess of water. The rate of displacement will vary from slow creep to rapid movements (eg mudslides) to sudden collapses (eg rockfalls).

Volcanogenic, carbonaceous and terrigenous formations are vulnerable to destabilisation primarily owing to mechanical weathering caused by freezing and thawing of interstitial water weakening the rocks internal structure. Chemical weathering is common in volcanic rocks along the pipeline corridor where hydrothermal changes result in deposits become more clayey in character.

Loose rock and scree is noted on slopes along the pipeline route and rock falls have been observed on the western slopes of Ialghuja Ridge, the Trialeti range and on the slopes of the Javakheti volcanic mountainous massif.

8.5.4.4 Landslides

Landslides causing ground displacement form when a sliding movement of a mass of rock or soil takes place on a definite plane. This displacement may occur along a structural plane such as bedding, joints or schistosity or along a curved shear plane causing rotation, heave or slumping of the ground. Landslides commonly occur following movement along a lubricated bedding plane, often at the interface of permeable and impermeable rock types. Slumping in clays involves a rotary movement along a curved shear surface. The ground movement may be initiated by gravity; tectonic effects or water and the rate of displacement may vary from slow creep to a sudden event.

Existing landslides and areas of potential instability have been identified along the proposed pipeline route and have been assessed following a desktop review of existing data. An intrusive geotechnical investigation has been undertaken to determine the nature and extent of the observed landslides of concern.

8.5.4.4.1 Landslides and areas of potential instability

Lanslides are common in rock deposits that are fairly unstable on slopes such as lacustrine-alluvial deposits, scree slopes and eroded slopes. Numerous landslides occur in areas of outcrop with visible landslides observed on the right bank of the River Mtkvari, and in the middle reaches of the Rivers Khrami and Mtkvari. Landslides also occur on the banks of the River Algeti and on the left bank of the River Khrami. The pipeline route passes through landslide prone areas in the volcanic plateau such as the Kodiana pass, and the edges of the steep mountains such as those in the Kashuri Mountains and those at the Turkish border.

Fourteen landslides and potential areas of instability have been identified along the proposed piepline route and are summarised below.

- Marneuli / Algeti River
- Bedeni Ridge
- South of the village Santa
- Ascent west of Kizil Kilisa
- Proximity of village Tabatskuri
- Tskhratskaro Pass
- Ascent to Kodiana Pass: Gully 1
- Ascent to Kodiana Pass: Gully 2
- Ascent to Kodiana Pass: Gully 3
- Ascent to Kodiana Pass: Gully 4
- Descent from Kodiana Pass to the Kodiana summer village
- Ascent west of Tiseli
- Minadze Plain Mudslide
- Ascent west of Vale

A field analysis of these landslides has revealed the need for further investigation at two locations where no alternative route alignment was possible to avoid the areas of instability. These two locations are discussed below.

8.5.4.4.2 Landslides encroaching the route

Intrusive geotechnical investigations have been carried out on and around mudslides at the ascent to Kodiana Pass (gullies 1 to 4) and in the Minadze plain.

At Kodiana pass the visual and intrusive investigations have enabled the nature of the gravitational processes to be established and can be explained as superficial mudslides overlying vertical strata of Lower Miocene and Oligocene-Upper Eocene lagoonal-marine deposits: gypsum clays, clayey marls, and sandstones.

Figure 8-3 Aerial view of the Kodiana system of mudslides

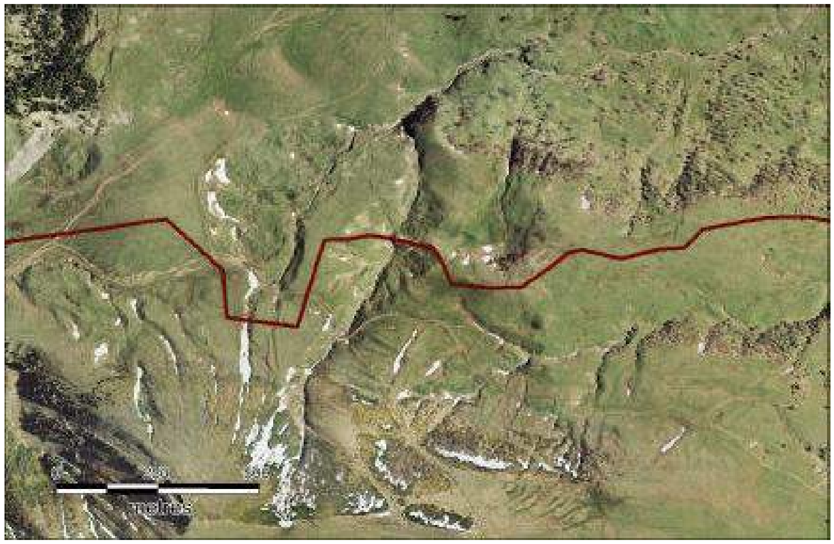


Figure 8-4 Landslide in the vicinity of Minadze Plain

8.5.5 Seismic hazards

The evaluation of the seismic hazards along the proposed pipeline route was conducted through the review of existing data, namely the *Seismic Hazard (Fault) Identification, EQE International, October 2001*.

8.5.5.1 Regional evaluation

The Greater and Lesser Caucases form the central Asian segment of the 'Alpine-Himalayan Fault and Fold Belt'. This belt extends from the Swiss Alps in southern Europe to the Himalayan ranges of India and Nepal.

The region is actively being deformed by the collision of the African, Arabian and Indian tectonic plates with the southern margin of the Eurasian continent. The east-west trending faults are characterised by compressive thrust movements. The north-east or north-west trending faults generally exhibit lateral strike-slip movements.

8.5.5.2 Fault classification

Two types of fault movement are commonly observed along the study area, namely Reverse and Thrust Faulting. Both are compressive styles of faulting and involve one fault block pushing up and over the second fault block. The 'thrust' and 'reverse' designations are distinguished by the dip angle of the fault plane. Thrust faults are characterised by dip angles of less than 45 degrees, and Reverse faults exhibit dip angles of greater than 45 degrees.

8.5.5.3 Proposed pipeline fault crossings

The proposed pipeline route crosses several old and recent tectonic faults as it can be seen in the general geological map in Figure: Map 8.3a-f. The seismic hazards identification study referenced above identified the active faults along the route based on the following criteria:

- Evidence of activity in the past 10,000 years (Holocene)
- Evidence of ground rupture
- Evidence of seismic intensity of 6.5 Richter or more

All faults that were deemed active based on the interpretation of existing literature, topographic maps and aerial photos were investigated in the field to gather visual evidence of the faults dynamics. The field verification identified the faults listed below as potentially active. Figure: Map 8-4a-c shows the location of the faults.

- Rustavi fault: a reverse fault with NNW-ESE surface orientation and an estimated potential vertical displacement during a seismic event of 0.9m
- Manglisi fault: a reverse fault with a NNW-ESE surface orientation and an estimated potential displacement of 0.6m
- Tsalka-Bedeni fault: a reverse fault with W-E orientation and an estimated potential displacement of 0.9m
- Vale fault: a reverse fault with a W-E surface orientation and an estimated potential displacement of 2.0m

8.6 SOILS

8.6.1 Introduction and methodology

A literature review (Oniani 2000) was undertaken which identified different soil types occurring along the pipeline route along with their characteristics. The results of the review are presented in Section 8.6.2. In addition, a soil erosion assessment of the route was carried out by Cranfield University, Silsoe during the Spring and Summer of 2001. Section 8.6.3 presents the approach and results of the erosion assessment. Additional data has also been gathered by Cranfield University on the reinstatement programme planned for the ROW (see Appendix A, Annex I Reinstatement Summary Plan).

8.6.2 Soil types

The types of soils present along the proposed ROW are briefly described below. Figure: Map 8-5 shows the general locations of these soil types.

1. Swampy soils
2. Brown sierozem with saline soil complexes
3. Alluvial carbonate and non-carbonate soils
4. Solonetz and saline soils with humus containing gypsum crystals
5. Peat-rich carbonate soils developed on various strata
6. Brown soils
7. Black and peat-rich mountainous-meadow soils of southern mountainous region
8. Weathered carbonate black mountainous soils
9. Peat-rich and primitive mountainous-meadow soils
10. Brown forest soil

8.6.2.1 Swampy Soils

Swampy soils occur in the vicinity of the Jandari and Kumisi lakes within the proposed corridor.

Swampy soils are characterised by the tendency to become of prevalent clayey composition or by the possible formation of peat in the long term. This soil type is not homogenous with the upper part consisting of clays whilst the lower part is predominantly loam.

8.6.2.2 Brown Sierozem with saline soil complexes

These types of soils are found in the Marneuli and Gardabani districts within the study area. The brown sierozem soil zone is characterised by the following:

- Climate – mild winters and hot summers with most precipitation falling in the winter and spring months when temperatures are relatively low and evaporation is not intensive. Owing to this, precipitation runoff facilitates intensive depletion of nutrients from the soil structure
- Relief – slightly drained accumulative plains in the study area (individual sites on the old terraces of the Mtkvari, Khrami, and Algeti Rivers), at altitudes of 150 – 200m above sea level. The groundwater table is close to the surface and affects the soil profile

periodically by interacting with the lower layers of the soil and causing periodic mineralisation or dissolution of minerals

- Strata – old alluvial and deluvial-proluvial clayey carbonate sediments or Loess-like silts in some areas, which have more limited distribution. These strata are fairly thick and contain gypsum in some areas
- Vegetation – the majority of brown sierozems occur in irrigated arable land within the study area. Vegetation cover is relatively dense on meadow brown sierozems

Brown sierozems are characterised by:

- Claying particularly evident in the middle part of the soil profile, which is owing to depletion processes in the soil
- Substantial carbonatisation processes resulting in the soil profile being carbonate through the entire depth

Brown sierozems have a heavy composition. This soil type is characterised by a high content of fine particles (particles with <0.001mm make up 40 – 53%). Dark varieties of brown sierozems are characterised by a relatively high content of humus (4.5 – 5.5%).

Sierozems suffer a negative humidity balance. A high deficit of humidity occurs in the summer months, therefore, such soils require irrigation. Improper irrigation practices result in secondary salinization of some areas.

8.6.2.3 Alluvial-carbonate and non-carbonate soils

Alluvial-carbonate and non-carbonate soils are developed in alluvial sediments of rivers. These soil types vary with regard to mechanical composition, matrix, profile thickness, tenure of carbonate and other characteristics. Such soils are found on the terraces of the Mtkvari, Algeti, and Khrami Rivers along the proposed corridor. These soils are divided into two large groups:

- Recent soils developed on young terraces
- Old alluvial soils developed on old terraces

Alluvial soils are relatively recent. They are characterised by only slightly differentiated horizons and stratification.

Meadow alluvial soils are characterised by a high content of carbonates and a silty composition.

8.6.2.4 Solonetz and saline soils with humus containing gypsum crystals

Solonetz and saline soils with sulphate, occur in the Marneuli and Gardabani plains. These soils contain soluble salts in quantities toxic to agricultural vegetation. Soils with gypsum are characterised by a thin humus horizon overlying fairly thick gypsum horizon.

Solonetz is characterised by high soil salinity, high alkaline reaction, formation of soda, high dispersivity and poor water permeability, as well as a tendency to over compaction and a lumpy structure when dry versus looseness and a high adhesive capacity when damp. The solonetz soils have a heavy textural composition.

Another characteristic of these soils is the accumulation of silica (SiO_2) in the upper layers and displacement of iron and aluminium oxides into the underlying horizons. Content of calcium oxide (CaO) and magnesium oxide (MgO) is highest in carbonate horizons when these are present.

The physical properties of these soils are as follows:

- High specific mass, which does not change significantly throughout the profile
- A substantial decrease of porosity with depth
- The absolute humidity index is higher than the total porosity, owing to the presence of hydrophile colloids
- Low filtration coefficient

8.6.2.5 Peat-rich carbonate soils developed on various strata

These soils are developed on limestones, marls, and other types of carbonate substrates. Basal carbonate soils are saturated, contain calcium carbonates, and are characterised by a neutral or weak alkaline reaction. These soils are characterised by a black granular humus horizon and by the virtual absence of lower transitional horizons as the soils overlay rocks. They are among the most fertile soils owing to high content of humus and good physical properties.

Turf-carbonate soils are however prone to erosion.

8.6.2.6 Brown soils

Brown soils are mostly found on the slopes of the Agara-Trialeti Range. Such soils are formed in relatively mild and humid climatic conditions. Groundwater is located at a significant depth below ground level and does not participate in the soil formation process.

Characteristic relief forms are ridges and slopes with different aspect and gradient, dissected by deeply cut river gorges and ravines. Soil forming strata are: sandstones, clays, shales, abyssal strata and scree. Deluvial-proluvial and in some places skeletal non-carbonate sediments occur at the base of slopes.

Typical brown soils mainly occur in beech forests. However, they can sometimes be found in hornbeam forests or hornbeam forests with oak. Dark brown soils are developed in spruce forests while skeletal brown soils are weakly developed in pine forests.

Strata are intensively weathered in the brown soil zone and therefore, scree and overlying topsoil are of heavy loamy mechanical composition.

The profile of brown soils is well differentiated. Humus content varies between 3 and 10%. The soils are characterised by an acid reaction, which decreases with depth; approaching neutral with depth.

The brown soils are prone to washout (surface) erosion.

8.6.2.7 Black and peat-rich mountainous-meadow soils of southern mountainous region

These soils are mostly found in sub-alpine and alpine zones at higher elevations than the brown soils. Soil formation is very slow under the cold climatic conditions. The soils are protected from surface erosion by the extensive root system of herbaceous plants that forms a strong turf. The root system also provides ample organic matter for humus formation, which results in these soils being rich. In some cases organic matter accumulates in the form of peat.

These soils are characterised by well-developed humus of granular structure, a mostly weak acid or acid reaction and good physical properties. Since the soils support a good vegetation cover with a good diversity of plants, they provide valuable summer pastures and hay fields. Erosion processes are ongoing in these soils, particularly when the vegetation on these soils is grazed intensively.

8.6.2.8 Weathered and carbonate black mountainous soils

These soils are found in the vicinity of Tsalka reservoir.

The relief in the zone of mountainous black soils (Javakheti) is a volcanic plateau formed with layers of the Neogene Quartenary period consisting of andesite-basalt. The carbonate black soils occurring in this area have no silica content and are characterised by a dark grey upper horizon, with thickness varying from 30 to 50cm and good structure. The lower horizon is relatively carbonaceous. Typically, the soil thickness is 100 – 120cm.

The average humus content is 3 – 15% and decreases with depth. Black soils are highly fertile.

8.6.2.9 Peat-rich and primitive mountainous-meadow soils

These soils occur in the sub-alpine and alpine zone in the vicinity of Bakuriani and are formed under humid and relatively cold climatic conditions. An extensive system of herbaceous plants forms a strong turf, which protects the soil from surface erosion and provides ample organic material for the formation of humus. As a result, mountain-meadow soils are relatively rich in humus and are prone to the formation of peat if organic matter accumulates.

Skeletal and primitive varieties of this soil type are developed in debris cones and alluvial fans. They are characterised by a solid matrix, relatively low thickness, and differentiated profile.

8.6.2.10 Brown forest soils

This soil type occurs mainly in the Akhaltsikhe depression, at altitudes of 900 – 1,200m, on slopes of different aspect and gradient, alluvial fans and on sloping plains. Brown forest soils mainly develop on weathered crusts of sandstones and deluvial-proluvial sediments. Vegetation cover includes oak forests and oak forests with hornbeam. Mean annual precipitation varies within 500 – 800mm in the zone of forest brown soils. The water table is located at a significant depth below ground level and does not participate in soil-formation processes.

Leached brown soils are found at the upper altitudes in the distribution zone for the soil type. Carbonate-brown soils occupy the lower zone where there are favourable conditions for calcium carbonate accumulation. The upper horizon is characterised by granular structure. Humus content varies from 3 to 5%. Brown soils are fertile.

8.6.3 Soil erosion potential along the proposed route

A detailed soil erosion assessment of the proposed pipeline route was carried out by Cranford University, Silsoe in the spring and summer of 2001. The aims of the assessment were to evaluate the proposed pipeline route with regard to the potential for soil erosion and consequently evaluate suitable stabilisation measures to implement as part of the ROW reinstatement operations. The assessment was carried out in two steps: a desk based exercise was carried out first to calculate, on the basis of literature data, the potential for soil erosion owing to natural causes such as prolonged rainfall. The second step consisted of carrying out field verification of the variables used in the desk study and thus calibrate the calculations of the soil risk factors.

The desk study involved collection information on soil type, rainfall, slope length and gradient, vegetation cover and altitude along the entire pipeline route. The second step consisted of verifying in the field the slope lengths and gradients and the soil type.

As a result of the assessment procedure, sections of the ROW were classified into erosion classes. Definitions of the classifications used are detailed in Table 8-3 and the results of the assessment are presented in Table 8-4.

Table 8-3: Erosion severity classes

Erosion class	Erosion Descriptions	Erosion rate (tonnes/ hectare)	Visual assessment
1	Very slight	< 2	No evidence of compaction or crusting of the soil. No wash marks or scour features. No splash pedestals or exposed roots or channels.
2	Slight	2-5	Some crusting of soil surface. Localised wash but no or minor scouring. Rills (channels < 1m^2 in cross-sectional area and < 30cm deep) every 50-100m. Small splash pedestals where stones or exposed roots protect underlying soil.
3	Moderate	5-10	Wash marks. Discontinuous rills spaced every 20-50m. Splash pedestals and exposed roots mark level of former surface. Slight risk of pollution problems downstream.
4	High	10-50	Connected and continuous network of rills every 5-10m or gullies (> 1m^2 in cross-sectional area and > 30cm deep) spaced every 50-100m. Washing out of seeds and young plants. Reseeding may be required. Danger of pollution and sedimentation problems downstream.

Erosion class	Erosion Descriptions	Erosion rate (tonnes/ hectare)	Visual assessment
5	Severe	50-100	Continuous network of rills every 2-5m or gullies every 20m. Access to site becomes difficult. Revegetation work impaired and remedial measures required. Damage to roads by erosion and sedimentation. Siltation of water bodies.
6	Very severe	100-500	Continuous network of channels with gullies every 5-10m. Surrounding soil heavily crusted. Integrity of the pipeline threatened by exposure. Severe siltation, pollution and eutrophication problems.
7	Catastrophic	> 500	Extensive network of rills and gullies; large gullies (> 10m2 in cross-sectional area) every 20m. Most of original surface washed away exposing pipeline. Severe damage from erosion and sedimentation on-site and downstream.

Table 8-4: Erosion assessment along the ROW

KP	Erosion class	Characteristics	Special requirements
0-18	3	Piedemont plain/river terrace complex	None
18-25	3	Low ridge	None
25-26	4	Scarp slope to low ridge	None
26-28	3	Low ridge	None
28-28.5	4	Scarp slope to low ridge	None
28.5-29	2	Flood plain (Mtkavri river crossing	None
29-37	2	Backswamps and terraces	None
37-52.5	3	Piedmont plain/river terrace complex	Gully crossings
52.5-54.5	5	Gorge (Algeti river crossing)	None
54.5-72.5	3	Piedmont plain.river terrace complex	Gully crossings
72.5	5	Gorge (Geti river crossing)	None
72.5-76	3	Piedmont plain/river terrace complex	None
76-94	4	Dissected hills	Gully crossings; ecological conservation (Tetritskaro area (oak forests); Cherepanovka Lake)

KP	Erosion class	Characteristics	Special requirements
94-102	4	Undulating plateau (Bedeni Ridge)	Gully crossings
102-107	4	Upland ridge	Landslide risk; potential archaeological area
107-111	3	Undulating plateau	Trafficability when wet
111-115	4	Upland ridge	Landslide risk
115-118	3	Undulating plateau	Trafficability when wet
118-125	4	Upland ridge	Landslide risk
125-129	4	Lacustrine plateau	Trafficability when wet; vertisols
129-135	4	Undulating plateau (volcanic dome)	Trafficability when wet
135-139	3	Lacustrine plateau	Trafficability when wet; vertisonls potential archaeological area
139-146	4	Undulating plateau (volcanic scarp)	Trafficability when wet; gully crossings
146-149.5	5	Volcanic mountain slopes (sides of Tvkavetli)	Soilfluction lobes; reinstatement of boulder fields
149.5-155	5	Volcanic mountain peaks (Tvkavetli)	Rock glaciers and stone-patterned ground; reinstatement of boulder fields
155-159.5	3	Lacustrine plateau	Trafficability when wet; vertisols
159.5-163	5	Volcanic mountain slopes	Solifluction lobes
163-173	5	Upland ridge	Landslide risk
163-173	5	Upland ridge	Landslide risk
173-195	5	Very deeply dissected mountains (Veli and Oshori Ridges in Trialeti Range)	Difficult gully head crossings (especially km185-189); debris flows (km174-176); ecological conservation (Tskhra Tqaro area (alpine meadows/birch-beech forests)
195-204	6	Very deeply dissected mountains (Veli and Oshori Ridges in Trialei Range)	Difficult gully crossings (km 197 & 199); swelling clay soils; ecological conservation (Tskhratskaro area (alpine meadows/birch-beech forests)
204-208.5	5	Very deeply dissected mountains (Veli and Oshori Ridges in Trialei Range)	Landslide risk (km205-206); ecological conservation (Tskhratskaro area (alpine meadows/birch-beech forests))
208.5	4	Intermontane basin	Gully crossing; Tkemlana mudslide (km215); potential archaeological area
219.5-221	5	Gorge (Mtkvari river crossing)	None
221-236.6	4	Intermontane basin	Gully crossings
236.5-237.5	2	Flood plain (Potshovi river crossing)	Unstable river banks (protection needed)
237.5-241.5	4	Intermontane basin	Gully crossings

KP	Erosion class	Characteristics	Special requirements
241.5	2	Flood plain (Potshovi river crossing)	Unstable river banks (protection needed)
241.5-246.5	4	Intermontane basin	Gully crossings; ecological conservation (Tiseli-Vale area (mountain forests/open meadow)

NB: Plan KPs were used for the erosion assessment, hence the route length totals 246.5k

8.6.4 Conclusions

As a result of the desk study and field work, erosion severity classes were identified along the proposed ROW. The findings of the study indicate that:

4% (9.5km) of the proposed ROW is subject to slight risk of erosion
32% (79.5km) of the proposed ROW is subject to moderate risk of erosion
39% (96km) of the proposed ROW is subject to high risk of erosion
21% (52.5km) of the proposed ROW is subject to severe risk of erosion
4% (9km) of the proposed ROW is subject to very severe risk of erosion

Figure: Map 8-5 shows the areas with very severe and severe erosion potential along the proposed route. Where areas of high, severe and very severe erosion risk are identified, corresponding special requirements to minimise erosion are outlined in Table 8-4.

8.7 CONTAMINATION

8.7.1 Introduction

A contamination baseline assessment was completed along the whole ROW and at a number of selected locations off the ROW. The sites were selected either for specific reason by BP (eg proposed pipe-yards) or for additional information by URS. For each site, the following was undertaken:

- A visual assessment of each site for potential contamination in conjunction with reference to previous reports (where available)
- A visual estimation of the area considered to contain potential contaminants with a number of soil samples collected for laboratory analysis
- Recording of baseline river quality at several proposed river crossing locations
- Recommendations concerning the potential disposal of contaminated soils
- The collection and analysis of water samples from various sources

In addition to this the ROW underwent two walkover assessments:

- The first during the route definition stage of the works
- The second during the topographical survey

A final walkover was undertaken as part of the Baseline Contamination Assessment (BCA) in February 2002. The February walkover ensured that these re-route areas underwent assessment.

8.7.2 Sampling methodology and analytical program

The sampling methodology and analytical program was based on a review of historical information, including past land use and potentially contaminating practices, as well as observations of contamination made while on-site. Soil sampling was focused on areas of suspected contamination whilst water sampling was restricted to locations identified by BP. The contamination assessment included sampling of:

- Soil
- Suspected potential asbestos containing materials (PACM)
- River sediment
- Surface water
- Groundwater

8.7.2.1 Soil

Soil samples were selected on the basis of visual and olfactory observations. Owing to the lack of detailed historical information associated with the proposed test-sites, this approach was considered better suited than analysis for targeted compounds. The laboratory schedule comprised:

- Total petroleum hydrocarbons (TPH), speciated aliphatic/aromatic
- Heavy metals (ICRCL 10 metals)

- Semi-volatile organic compounds (SVOC), including the 16 USEPA Priority PAH Pollutants
- Volatile organic compounds (VOC)
- Polychlorinated bi-phenyls (PCB)

8.7.2.2 Asbestos

Where suspected PACM were encountered (eg lagging, cement products, tiles), a sample was collected and dispatched to the UK for confirmatory analysis. All PACM was dampened prior to sample collection in order to remove the possibility of releasing airborne fibres into the environment during sample analysis.

8.7.2.3 River sediment

River sediment samples were collected from selected river crossing locations along the route. Sediment samples were collected from close to the waters edge using disposable sampling equipment. The objective of the sediment sampling was to assess whether there was potential for the release of contaminants into the water during the excavation works.

8.7.2.4 Surface water

Surface water quality sampling was undertaken at eight river-crossing and lake locations. The field analyses was completed using a portable “Hydrolab® – Quanta®” with the following parameters recorded:

- pH
- Temperature
- Specific conductance
- Dissolved oxygen
- Turbidity

In addition, the following were analysed for using portable laboratory equipment:

- Microbiological analysis (total Coliform and E-coli (Most Probable Number) – using a portable incubator
- Sulphate reducing bacteria – using HACH field test kits
- Hardness

Surface water samples were also collected and returned to the UK for laboratory analysis. Target analytes are as follows:

- TPH – speciated TPH as aliphatic/aromatic
- Metals – ICRCL 10 metals
- Semi-Volatile Organic Compounds (SVOC) - including the USEPA 16 Priority PAH pollutants
- Volatile Organic Compounds (VOC)
- Chemical Oxygen Demand (COD)
- Fatty Acid
- Sulphate
- Barium

- Calcium
- Chloride
- Hardness
- Carbonate
- Bicarbonate

Water samples collected from rivers were collected close to the banks, in order to minimise potential health and safety risks associated with fast flowing rivers.

8.7.3 Site assessments

The sites assessed during the investigation are listed in Table 8-5 and shown in Figure: Map 8-6a-c.

Table 8-5: Site identification and locations

SITE ID	SITE NAME	LOCATION TYPE	EASTING	NORTHING
1	Gardabani 1	Pipe Yard	8504657	4592315
2	Gardabani 2	Pipe Yard	8508792	4593150
3	Gatchiani	Pipe Yard	8499584	4607128
4	Marneuli	Pipe Yard	8484975	4599631
5	Kotishi	Pipe Yard	8477055	4598123
6	Tetritskharo	Pipe Yard	8457667	4599520
7	Tsalka 2	Pipe Yard	8428690	4609855
8	Tsalka 1	Pipe Yard	8420865	4606318
9a	Hotel Geology, Bakuriani	Camp	-	-
9b	Hotel Sputnik, Bakuriani	Camp	-	-
9c	Hotel Dynamo, Bakuriani	Camp	-	-
9d	Hotel Khazbegi, Bakuriani	Camp	-	-
9e	Hotel Iveria, Bakuriani	Camp	-	-
10	Borjomi	Pipe Yard	8368015	4635750
11	Andezit	Pipe Yard	8373360	4621266
12	Tsikhisjvari	Pipe Yard	8369385	4621142
13	Atskuri	Pipe Yard	8346270	4621921
14	Akhaltsikhe	Pipe Yard	8334987	4614935
15	Vale 1	Pipe Yard	8325095	4613617
16	Vale 2	Pipe Yard	8324218	4613941
RC1	Rail Crossing 1	Rail Crossing	8500634	4605328
RC2	Rail Crossing 2	Rail Crossing	8488393	4604242
RC3	Rail Crossing 3	Rail Crossing	8448178	4606098
RC4	Rail Crossing 4	Rail Crossing	8337787	4616343
RC5	Rail Crossing 5	Rail Crossing	8482625	4598368
WREP 1	WREP 1	Service Crossing	8509116	4595358
WREP 2	WREP 2	Service Crossing	8508890	4604225
-	Mtkvari 1	River Crossing	8500468	4605155
-	Mtkvari 2	River Crossing	8339121	4616622
-	Algeti	River Crossing	8481046	4597547
-	Potskhovi 1	River Crossing	8323658	4614775
-	Potskhovi 2	River Crossing	8320802	4611387
-	Kumisi Lake	Lake	8488428	4605499
-	Tsalka Reservoir	Lake	8385419	4615343
-	Tabatskuri Lake	Lake	8421656	4611661

8.7.4 Analytical results

8.7.4.1 Soil results

In general the contaminant concentrations encountered were low and below the Dutch Intervention Values (DIV). Samples exceeding the DIVs are shown in Table 8-6.

Table 8- 6: Elevated soil contaminant concentrations

Sample	Location	Analtye
HA1C	Gardabani 1	Copper (2362mg/kg), Zinc (2380mg/kg); Arsenic (216mg/kg)
HA3A	Gatchiani	Cadmium (2mg/kg), Copper (266mg/kg), Zinc (3540mg/kg)
HA5A	Kotishi	DRO (surface sample 8844mg/kg)
HA6A	Tetritskaro	Arsenic (138mg/kg), Cadmium (2mg/kg)
HA6B	Tetritskaro	DRO (sample 0.2-0.4m, 13376mg/kg & duplicate 2 12898mg/kg))
HA8A	Tsalka 1	Total PCBs (77,281ug/kg)
HA8B	Tsalka 1	DRO (sample 0-0.2m, 19114mg/kg)
HA8C	Tsalka 1	Copper (872mg/kg); DRO (surface sample 17393mg/kg)
HA10A	Borjomi Pipe-yard	Arsenic (61mg/kg); Copper (1548mg/kg); Nickel (231mg/kg); Lead (3800mg/kg); Zinc (924mg/kg); DRO (4908mg/kg)
HA13A	Atskuri	Arsenic (107mg/kg); Copper (621mg/kg); Nickel (263mg/kg); Lead (3308mg/kg); Cadmium (9mg/kg), Zinc (3624mg/kg)
HA13B	Atskuri	Lead (653mg/kg)
HARC1	Rail Crossing 1	Copper (2887mg/kg)

DRO – Diesel Range Organics
PCB – Polychlorinated Biphenyls

8.7.4.2 River sediment results

The results from the river sediment samples were also compared to DIVs as initial criteria for screening. Where no DIVs were available USEPA Region 9 screening criteria were applied. Elevated SVOC were encountered in two of the samples analysed as shown in Table 8-7, however, the values were below the screening criteria for SVOC in sediments. Generally the sediment samples did not contain any significant concentrations of contaminants.

Table 8- 7: Elevated sediment contaminant concentrations

Sample Location	Analtye
Mtkvari River (2)	Bis(2-ethylhexyl)phthalate (522ug/kg)
Potskhovi River (2)	Bis(2-ethylhexyl)phthalate (238ug/kg)

8.7.4.3 Groundwater results

Five groundwater samples were collected from the proposed pump-station locations, as well as two samples collected from a river adjacent to IPS-G1. None of the samples exceeded the UK Drinking Water Standards (which were used as initial screening criteria). Elevated total coliforms and E-coli were detected in samples BTC-PS1-BH04 and BTC-PS3-BH05.

8.7.4.4 Surface water results

The surface water sample results were compared to UK Drinking Water Standards. In a number of instances the detection limits of the laboratory procedures were higher than the UK Drinking Water Standards. Table 8-8 details the results, which are above the UK DWS. A full list of the surface water quality results, from the study are given in Section 8.8 (Hydrology).

Table 8-8: Elevated surface water contaminant concentrations

Sample	Location	Analtye
Kumisi	Kumisi Lake	Boron (3.77mg/l), Nickel (0.12mg/l), Selenium (0.08mg/l); Arsenic (0.07mg/l)

8.7.4.5 Sulphate reducing bacteria (SRB)

Potential concentrations of Sulphate Reducing Bacteria (SRB) were determined for the water samples collected at the river crossings. SRB are a group of anaerobic bacteria that generate hydrogen sulphide (H2S). Levels of these bacteria were determined using the "BART" field test method, developed by HACH Europe ®. Results are given in Table 8-9.

Table 8-9: Results of sulphur reducing bacteria tests

	Days Running								Results	
									Potential SRB Population	Dominant Bacteria
Sites	1	2	3	4	5	6	7	8	(cfu/mL)	
River Crossings										
Mtkvari 1	~	BB	BB	BB	BA	BA	BA	BA	100000	Complex bacterial consortium with SRB present
Mtkvari 2	~	~	~	BT	BT	BT	BA	BA	10000	Complex bacterial consortium with SRB present
Algeti	~	BT	BA	BA	BA	BA	BA	BA	100000	Complex bacterial consortium with SRB present
Potskhovi 1	~	~	~	~	~	~	BT	BT	1000	Aerobic slime bacterial and SRB consortium
Potskhovi 2	~	~	~	~	BT	BT	BT	BA	10000	Complex bacterial consortium with SRB present
Lakes										
Kumisi	~	~	~	BB	BB	BB	BB	BB	10000	Dense slime bacterial and SRB consortium
Tsalka	~	~	~	BT	BT	BT	BT	BA	10000	Complex bacterial consortium with SRB present
Tabatskuri	~	~	~	~	~	~	~	BT	100	Aerobic slime bacterial and SRB consortium

8.7.4.6 Hardness

Hardness is a measure of the calcium carbonate concentration in water. Results for relative hardness of water are given in Table 8-10.

Table 8- 10: Total hardness results

SITES	CaCO3	HARDNESS
River Crossings	**(ppm)**	
Mtkvari 1	120-250	hard
Mtkvari 2	120	hard
Algeti	425	very hard
Potskhovi 1	25-50	soft
Potskhovi 2	25-50	soft
Lakes		
Kumisi	425	very hard
Tsalka	50	soft
Tabatskuri	25-50	soft

8.7.4.7 Hydrotest parameters

Hydrotest ® provides a general indication of water quality. There were no results of concern returned from the Hydrotest sampling.

8.7.4.8 Asbestos

Potential ACM was encountered at all of the proposed pipe-yards as well as the hotels with the exception of the following:

- Site 7 (Tsalka 2)
- Site 11 (Andezit)
- Site 12 (Tsikhisjvari)
- Site 13 (Atskuri
- Site 15 (Vale)

Analysis of the samples of this material collected generally indicated that the material is chrysotile asbestos. The majority of the material observed was in the form of asbestos cement sheeting, some broken and some remaining intact.

8.7.5 Conclusions

In general, the majority of sites were found to be free of significant soil contamination. Elevated contaminant concentrations detected in the samples analysed were generally representative of minor, isolated areas of contamination surrounding stockpiles of contaminated materials on the sites. Further assessment and clean-up of the sites would be prudent prior to the use of the sites.

The majority of the sites have ACM in a broken form scattered on the ground surface to varying degrees and many of the structures encountered on the sites have used asbestos cement sheeting in their construction.

Other areas of contamination considered to be of significance were:

- Heavy metal contamination in surface soils at Gardabani 1, Gatchiani, Tetri-Tskaro, Tsalka 1, Borjomi Pipe-yard, Borjomi Pipe-yard, Atskuri and Rail Crossing 1
- Minor petroleum contamination (Diesel Range Organics) at Site 10 – Borjomi
- Elevated heavy metal (Boron, Selenium) concentration from the sample taken at Kumisi Lake

8.8 HYDROLOGY AND SURFACE WATER QUALITY

8.8.1 Introduction

The following section provides a baseline assessment of the hydrological and surface water quality conditions along the proposed pipeline corridor based on literature and recent field surveys. The corridor covered within this report is 10km.

This section describes the methodology used to gather relevant historical data and offers a description of major watercourses within the study area indicating the current conditions of wetland and fish-breeding environments. Numerous water samples were collected in the field for laboratory analysis of key parameters, with the aim of indicating current surface water quality conditions. Results from these samples are presented.

8.8.2 Methodology

A literature review (Ukleba 2001) was undertaken to extract relevant information from historical data. Areas, where the proposed pipeline route intercepts major watercourses, were mapped out within the GIS. Planimetry calculations were used to estimate the basinal area for each of the major rivers. It was noted that within the historical data set there was an absence of information describing the numerous minor rivers, nameless streams and dry gorges.

The following sources of historical information were used for this section of the report:

- Reference Manual Surface Water Resources of USSR (Report for: 1964, 1969 and 1974)
- Hydrogeology of USSR (1970)
- Hydrological Feasibility Surveys, from the Design Institute Saktskalproekti archives

Within this report, the terminology used to differentiate between minor and major river systems is arbitrary and is not based on a specific hydrological classification. However, these terms have been used following site specific field surveys and is therefore, based on an actual field assessment.

8.8.3 Hydrological monitoring stations

The majority of quantitative hydrological information quoted in previous reports has been derived from numerous hydrological monitoring stations gathering data upon the rivers intersected by the proposed pipeline route. The complete list of monitoring stations is given in Table 8-11 below, along with their operational period. It is clear that many of the stations have been operating for a considerable periods of time, allowing short and medium-long term fluctuations in river discharge to be evaluated.

Table 8- 11: Hydrological monitoring stations on rivers crossed by proposed route

No.	River Name	Hydrological Station	Managing Organisation	Distance from River Head (Km)	Catchment Basin Area (km^2)	Monitoring Operating Period	
						Started	Terminated
1	Mtkvari	Khertvisi	Hydromet Service	1,141	4,980	1935	1992
2		Minadze		1,099	8,010	1932	1992
3		Likani		1,049	10,500	1931	1992
4		Dzegvi		920	18,000	1927	1992
5		Tbilisi		890	21,100	1904	1992
6	Potskhovi	Skhvilisi	Hydromet Service	10	1,730	1928	1992
7	Algeti	Partskhisi	Hydromet Service	65	359	1937	1992
8	Ktsia	Kushi	Hydromet Service	155	408	1936	1992
9	Ktsia-Khrami	Tsalka	Tbilhidroproekti	124	1,080	1927	1947
10		Dagetkhachini	Hydromet Service	65	2,150	1937	1992
11	Korsuchai	Beshtasheni	Tbilhidroproekti	0.9	47.8	1947	1960

N.B. *No hydrological monitoring stations have been operational in Georgia since 1992.*

8.8.4 Baseline conditions

During the study, it is estimated that the proposed pipeline corridor crosses approximately 120 water-courses, these include:

- 6 major river systems
- 27 minor rivers
- 15 nameless streams
- 49 nameless gorges
- 19 irrigation canals
- 4 drainage canals

Figure: Map 8-7a-f shows the location of these water features in relation to the proposed pipeline route. Table 8-12 and 8-13 below summarises the known hydrological characteristics of the rivers crossed by the proposed route. The ROW crosses eight river floodplains at KP 28.8-29.2 (Mtkvari west), KP 53.5-53.54 (Algeti), KP 135.7 (Gumbati), KP 137.8 (Ktsia), KP210-212 (Mtkvari east), KP 221-221.7 (Mtkvari Crossing), KP238.2-238.5 (Potskhovi north) and KP242.8-243 (Potskhovi south).

Table 8-12: Summary of major river crossings

Water-Course Name	Basin area km^2	Length of the stream	Maximum water discharge in m^3/sec - τ indicates the return time in years				Standard solid discharge kg/sec	Standard turbidity g/m^3
			τ 40	τ 30	τ 20	τ 10		
River Mtkvari – east (KP29.1)	21900	510	2410	2200	1900	1700	300	1330
River Algeti (KP53.5)	585	66.0	300	250	195	160	-	-
River Ktsia – (KP137.8)	260	46.0	105	85.0	70.0	55.0	-	-
River Mtkvari – west (KP221.4)	9850	269	1110	990	770	645	-	-
River Potskhovi – north (KP238.2)	1640	45.8	485	440	350	290	10.0	450
River Potskhovi – south (KP242.8)	735	41.5	325	300	235	195	-	-

Table 8-13: Watercourse basin area and stream length

Water-Course Name	Basin area km^2	Length of the stream	Water-Course Name	Basin area km^2	Length of the stream
KP 0-29.1			Gorge N 37	0.06	0.42
Stream N 1	42.0	8.00	Gorge N 38	2.16	3.06
Stream Aji-su	1.16	2.40	Gorge N 39	0.16	0.50
River Mtkvari east (KP29.1)	21900	510	Gorge N 40	0.61	1.62
KP29.1-53.5			Gorge N 41	1.53	1.12
Gorge N 2	0.41	1.25	Gorge N 42	0.08	0.50
Gorge N 3	0.50	1.80	Gorge N 43	1.14	0.75
Gorge N 4	0.70	1.88	Gorge N 44	0.17	0.50
Gorge N 5	0.03	0.69	Gorge N 45	1.40	1.38
Stream N 6	4.35	2.88	Stream N 46	2.96	2.31
River Algeti (KP53.5)	585	66.0	Stream N 47	11.1	5.06
KP 53.5 – 137.8			Stream N 48	4.66	5.12
Karandigdere Gorge	12.5	8.00	Stream N 49	5.45	5.75
Gorge N 7	4.70	3.93	River Kumiska	32.2	5.80
River Geti	23.9	11.0	Stream N 50	0.91	1.55
Gorge N 8	6.77	4.75	River Oshora	29.0	6.50
Gorge N 9	1.44	1.69	Gorge N 51	0.25	0.62
Gorge N 10	1.63	1.38	Stream N 52	0.60	1.31
Gorge N 11	2.64	4.50	Stream N 53	0.16	0.56
Stream N 12	0.77	2.81	Stream N 54	0.12	0.38
Gorge N 13	0.94	2.75	River Sakirula	33.0	7.00
Gorge N 14	0.43	0.87	River Dviri – 1	2.41	2.25
River Chiv-chavi	19.1	10.5	River Dviri – 2	0.55	0.75
Gorge N 15	2.37	4.62	Gorge N 55	1.48	1.50
Gorge N 16	1.20	3.12	Tiseli Ghele – 2	3.90	2.40
Gorge N 17	0.24	0.87	Tiseli Ghele – 3	24.5	6.00

Water-Course Name	Basin area km^2	Length of the stream	Water-Course Name	Basin area km^2	Length of the stream
Gorge N 18	0.29	0.96	Guslevi water		
Gorge N 19	0.28	0.88	Gorge N 56	0.95	1.12
Gorge N 20	0.18	0.75	River Tkemlanis Ghele	6.42	5.56
Gorge N 21	0.29	0.66	River Sakvanis Ghele	4.96	5.62
Gorge N 22	0.24	0.79	Gorge N 57	0.30	1.10
Gorge N 23	0.34	0.69	Kara-Ghele gorge	2.40	4.00
Gorge N 24	0.54	0.71	River Kara-Chakhrokhis Ghele	3.90	3.60
Gorge N 25	0.91	0.94	River Tsinubani Tskali	12.8	4.40
River Korsunchai	48.5	15.8	River Patara Elisi	3.66	2.38
River Chil-chil	200	12.0	River Mitkvari-2 (KP221.4)	9850	269
Gorge N 26	5.38	2.94	KP 221.4 – 247.6		
Gorge N 27	2.62	2.25	River Chvinti	45.2	17.8
River Gumbati	98.2	16.3	Stream N 58	3.96	3.38
River Ktsia-1 (KP137.8)	260	46.0	Gorge N 59	0.29	0.70
KP 137.8 – 221.4			R Lazutneri-Tsor	5.98	4.12
Gorge N 28	2.42	2.62	Gorge N 60	1.60	2.20
Gorge N 29	0.72	1.25	River Lertsiana	19.2	7.00
Gorge N 30	0.66	1.62	River Varkhanale-Tsor - 1	8.75	5.80
Gorge N 31	1.44	1.95	River Varkhanale-Tsor - 2		
Gorge N 32	1.71	1.56	Stream N 61	2.88	2.85
Gorge N 33	1.85	1.25	Stream N 62	4.92	3.85
River Ktsia –2	50.1	17.0	Gorge N 63	0.36	1.25
Gorge N 34	0.28	1.22	Gorge N 64	2.91	3.75
River Ktsia – 3	38.4	11.5	River Potskhovi-1 (KP238.2)	1640	45.8
Gorge N 35	2.52	2.50	River Potskhovi-2 (KP242.8)	735	41.5

8.8.5 Major water bodies

8.8.5.1 River Mtkvari

The River Mtkvari starts at the springs on the northern-eastern slopes of Kizil Giadik mountain in Turkey, at an altitude of 2,720m. The total length of the river is 1,364km, the area of the water catchment basin is 188,000km^2. The river length is 360km in Georgia while the area of the catchment basin is 26,200km^2. This river intersects the ROW at KP29 and runs almost parallel to the southern side of the channel after the crossing for approximately 200m.

Figure 8-5 River Mtkvari near Rustavi crossing

The river is recharged by snow melt, rain and groundwater; contribution of glacial runoff is negligible. Highest water levels are observed during spring when discharge is at its greatest with approximately 53% of the annual discharge occurring. Summer discharge makes up 25% of the annual figure with low-flow conditions experienced in autumn and winter when seasonal discharges constitute just 12% and 10% respectively of annual discharge.

The maximum recorded flow rate of the River Mtkvari was observed in April 1968. The return period of this event ranges from 100 to 150 years, depending which observation station is used for the estimation. The solid sediment load in the River Mtkvari is closely related to the river's discharge rate. Maximum average daily loads range from 470kg/sec to 32,000kg/sec at various observation stations. Water turbidity is also significant, with maximum levels recorded to fluctuate from 2,700g/m^3 to 120,000g/m^3 at various monitoring stations.

Ice cover has been observed only in extremely severe winters at the following locations: Khertvisi, Likani and Dzegvi. The maximum duration of ice cover is 35 days and was observed at the hydrological observation station at Dzegvi in 1949–1950.

There is a discharge head regulating facility constructed within the Gardabani (Marinski) canal and the inlet canal to Tbilisi Power Station on the River Mtkvari, north of Rustavi (Figure 8-5). The proposed Mtkvari East pipeline crossing is located upstream of this rivers head facility where the river dams up and flows in one main bed. The river-bed is comprised of alluvial sediments at both Mtkvari crossings. Maximum flow rates at the two proposed crossings of the River Mtkvari are shown in Table 8-14 below.

Table 8-14: Maximum discharge rates at Mtkvari River Crossings

Crossing Point	**Discharge rate m^3/sec** (1 in 10 years)	**Discharge rate m^3/sec** (1 in 20 years)	**Discharge rate m^3/sec** (1 in 30 years)	**Discharge rate m^3/sec** (1 in 40 years)
Mtkvari East	1700	1900	2200	2410
Mtkvari West	645	770	990	1110

8.8.5.2 River Potskhovi

The River Potskhovi starts on the eastern slopes of Arsiani ridge in Turkey, at an altitude of 2,720m AMSL. It flows into the River Mtkvari from the left bank at the village of Kotlakhevi. The river is approximately 64km long, the water catchment basin occupies 1,840km^2. The river length in Georgia is approximately 35km while the catchment basin is 1,331km^2 (Figure 8-6). This river is intersected by the ROW twice at KP 238 and 243, owing to the steep sloping topography within this region, the pipeline is not considered to be placed within the floodplain area.

Figure 8-6 River Potskhovi Near Vale

The river is recharged by snow melt, rain and groundwater. It is characterised by spring floods and flashfloods owing to heavy summer-autumn precipitation rains and low-flow conditions in winter. Spring discharge is 55% of the annual volume, summer discharge 25%, 13% in autumn and 7% in winter.

Observations on the River Potskhovi were conducted at the hydropower station of Skhvilisi where the maximum flow rate observed is 394m^3/sec. Long term average solid sediment load is estimated to be 10kg/sec. A maximum solid sediment load of 230kg/sec was observed in May 1968 under flood conditions. Water turbidity typically fluctuates from 670g/m^3 to 9,800g/m^3. Average duration of ice cover is 55 days whilst the maximum, 90 days, was observed in 1956-1957.

Maximum flow rates at the proposed crossing locations, are shown in Table 8-15 below:

Table 8- 15: Maximum discharge rates at Potskhovi River Crossings

Crossing Name	**Discharge rate m^3/sec** (1 in 10 years)	**Discharge rate m^3/sec** (1 in 20 years)	**Discharge rate m^3/sec** (1 in 30 years)	**Discharge rate m^3/sec** (1 in 40 years)
Potskhovi north	290	350	440	485
Potskhovi south	195	235	300	325

8.8.5.3 River Ktsia

The River Ktsia (Ktsia-Khrami, termed Khrami in lower reaches) originates from nine springs on the southern slopes of the Trialeti range, in the proximity of Tskhratskaro pass, at an altitude of 2,422m AMSL. The Ktsia flows into the River Mtkvari from the right bank at the village of Shakhlisi. The river is approximately 201km long; the water catchment basin occupies 8,340km^2 (Figure 8-7).

Figure 8-7 River Ktsia Near Kizil Kilisa

The River Ktsia intersects the ROW in four different places. The river is recharged by snow melt, rain and groundwater. Reduced groundwater levels are observed in winter when approximately 12% of the annual discharge occurs. Discharge rates as a percentage of the annual volume are: spring 37%, summer 26% and autumn 25%.

Maximum flow rates are observed during spring floods. The maximum flow rate observed at the station of Kushi nearest to the proposed crossing locations is 52.6m^3/sec Maximum sediment load registered at this monitoring station is 1.5kg/se, with highest turbidity recorded as 770g/m^3. The river freezes along the channel edges for 15 – 20 days per year.

8.8.5.4 Tsalka Reservoir

The Tsalka water reservoir is created by a stone dam 33m high and 113m long, at Tsalka (Plates 8-8 and 8-9). The reservoir has been functioning since 1949. The approximate length of the reservoir is 14.5km, its maximum width is 3.5km and its maximum depth is 25m. The water catchment basin occupies 1,047km^2. The total volume is 313million m^3. The typical water levels lie at an altitude of 1,512m AMSL although the water level is subject to variations depending on the weir level which is maintained at the dam. During the winter 2000-2001 the water level was observed to be well below maximum historic levels with the shoreline being recessed some 100m in the area where the proposed pipeline crosses the reservoir. The reservoir is mainly used for power generation and irrigation.

Figure 8-8 North East shore of Tsalka Reservoir

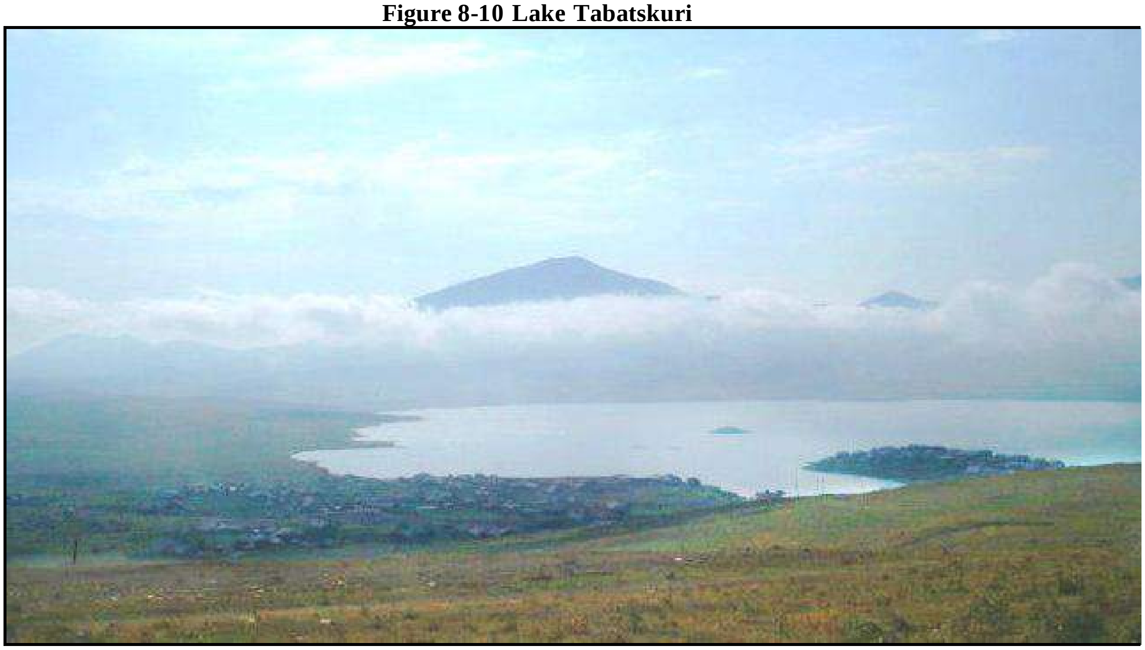
Figure 8-9 Northern shore of Tsalka Reservoir

8.8.5.5 Lake Tabatskuri

Lake Tabatskuri is one of the most important natural reservoirs in southern Georgia (Figure 8-10). The lake water is of low mineralisation (0.5g/l). The hydrocarbonate-calcic water reportably complies with the requirements set to potable and fishery water. The lake lies to the south of the ROW at a distance of 1,300m to 2,400m between KP 162 and 165. The basic hydrographic characteristics of the lake are summarised below:

- Surface area: 14.2 sq. km
- Catchment basin: 83.1 sq. km
- Altitude (AMSL): 1990m AMSL
- Maximum depth: 40.2m

Figure 8-10 Lake Tabatskuri



8.8.5.6 River Algeti

The River Algeti starts on the eastern slopes of Trialeti Range, at an altitude of 1,900m AMSL. It flows into the River Mtkvari from the right bank at village Kesalo. The river is predominately recharged by snow melt and rain, with a negligible contribution by groundwater. The highest water level is observed in spring when 50% of the annual discharge occurs. Summer discharge constitutes 23% of annual flow with autumn and winter contributions of 12% and 15% respectively. No data is available to indicate sediment load. The river intersects the ROW at KP 53.5 where the channel sides steeply slope either side of the channel.

The Algeti (Tsnisi) water reservoir is situated near the vicinity of Tsnisi village, where water is used for the irrigation of approximately 14.5 thousand ha of arable land, and has been operational since 1983. The length of the reservoir is 4.2km, with a maximum width of 1.2km and depth 72.5m. Total capacity is estimated to be 65 million m^3.

The Tsnisi water reservoir regulates the discharge of the River Algeti, although during periods of exceptionally high precipitation, very significant discharges have been reported within the lower reaches.

8.8.6 Minor rivers, nameless streams and gorges

Approximately 75% of the surface water features that are intersected by the proposed pipeline route are minor rivers, nameless streams and gorges, which have not been previously studied in hydrological terms. This is possibly owing to their relatively low importance as a potential water source and/or potential for hydropower generation.

The minor rivers, streams and gorges within the study are typically mountainous rivers, some of which are characterised by sudden flash floods of a catastrophic nature during rapid snow melt and are highly responsive to heavy precipitation events. A good example is the dry gorge Agaburuni located on a previously considered pipeline route option, where a flashflood washed out the bed in a few minutes and exposed an existing 1,500mm diameter steel pipeline. The flashflood had been caused by highly localised heavy rain, which was not recorded by the regional meteorological stations located in the surrounding area. Within the study, environmental characteristics such as the rapid erosional capacity of specific rivers have been noted and incorporated into the engineering design where applicable, as described in *Section 10 – Environmental Impact & Mitigation.*

The ROW crosses nineteen irrigation and four drainage canals. Water volumes in irrigation canals are regulated by flow control facilities and flash-floods can therefore be excluded. All irrigation systems are working, although to some extent re-modernisation is required to improve their efficiency.

8.8.7 Surface water use

Only two out of six spring clusters identified as being located within the 10km route corridor are located downstream of the proposed water-course crossings (Dzelkva, 2000). These are:

1. Tskhratskaro springs located approximately 410m downstream of gorge 36 located between KP 174 to 176
2. Tsikhisjvari sulphur spring located approximately 530m downstream of the River Kumiska crossing KP183.1

Three flow control facilities were identified by archive sources, to be located within the 10km route corridor. These include:

1. Head facility of Gardabani irrigation system is located approximately 1km downstream of the proposed Mtkvari east crossing
2. Khrami-Arkhi head facility located approximately 18km downstream of the proposed Geti crossing, downstream with its confluence with the River Khrami
3. Tskaltbila irrigation system facility located upstream of the pipeline route

Minor irrigation systems listed below are located downstream of the two proposed Potskhovi crossings.

Irrigation System No.	Upstream Crossing	Upstream Confluence	Downstream Distance Km
1	Potskhovi north	N/A	14.210
2	Potskhovi north	N/A	7.500
3	Potskhovi north	N/A	4.600
4	Potskhovi south	R. Kvabliani	4.060
5	Potskhovi south	R. Kvabliani	3.850
6	Potskhovi south	N/A	2.840
7	Potskhovi south	N/A	2.690
8	Potskhovi south	N/A	2.090

In addition, three pump stations servicing irrigation systems are located downstream of the route:

1. Kushi irrigation system with pump station – approximately 2.750km downstream of the Ktsia crossing 1, downstream of its confluence with the River Khrami
2. Rustavi pump station – approximately 14.800km downstream of the proposed Mtkvari crossing 2, downstream its confluence with the River Potskhovi
3. Giorgitsminda Irrigation System with Pump Station - approximately 7.800km downstream of the proposed Kara Chakhrokhis Gele crossing, downstream its confluence with the River Mtkvari

8.8.8 Assessment of water quality

A number of water samples were collected during the field surveys for subsequent laboratory analysis. Prior to sample collection, water was tested for a variety of field parameters and immediately transferred into laboratory bottles. At each location, a photograph was taken to record the location, along with the geographical co-ordinates using a hand-held GPS.

The purpose of the water sampling programme was to: (1) indicate current water quality conditions within the overall environmental baseline assessment; and (2) help identify suitable water resources to meet requirements of the pipeline hydrotesting programme (refer to *Section 5 - Project Description*).

The surface water sampling and analysis also helped determine what impact, if any, the existing operations within the study area has had upon river and lake water quality. Local facilities near the ROW such as liquid petroleum tanks at re-fuelling stations have been observed to feature hydrocarbon soil contamination during the field assessments (see Section 8.7).

An example where current activities are known to be causing significant environmental degradation, is Site 10 Borjomi, which lies approximately 300m south of the Mtkvari River, and comprises a former rail siding. Significant oil staining and free hydrocarbon product was observed within this facility, with an oil trail leading directly into a minor river system located just outside the mechanical workshop.

8.8.8.1 Methodology

Surface water quality sampling was completed upon five river crossings and three lakes and photographed at each location. The suite of criteria shown below was measured, as being indicative of water quality (further descriptions of these criteria are given in Section 2 *Glossary*). All field parameters were recorded using a portable 'Hydrolab® - Quanta®'; and include:

- pH
- Temperature (Temp)
- Specific Conductance (SpC)
- Dissolved Oxygen (DO)
- Turbity

In addition, the following parameters were analysed using portable laboratory equipment:

- Microbiological analysis (total Coliform and e-coli Most Probably Number) using a portable incubator (method 8001)
- Sulphate Reducing Bacteria (SRB) – using HACH® field test kits
- Total Hardness (using test strips developed by *HACH Europe Ltd*)

Surface water samples were also collected and returned to the UK for laboratory analysis by Alcontrol Geochem, a United Kingdom Accreditation Service (UKAS) accredited laboratory under full chain of custody procedures. Target analytes are listed below along with the relevant analytical methodology. Owing to the technical aspect of the methodology terminology, some of the abbreviations are not expanded upon below, but are fully incorporated in *Section 2 - Glossary:*

- Total Petroleum Hydrocarbons (DRO) - GC-FID after solvent extraction
- Metals – USEPA Target List 13 by ICP MS
- Semi Volatile Organic Compounds (SVOC) - based on USEPA 8270
- Volatile Organic Compounds (VOC) - based on USEPA 8260/624
- Polychlorinated Biphenyols (PCB) – Solvent extraction followed by GC MS
- COD - according to APHS BS6068
- Fatty Acids (expressed as total) – by steam distillation followed by GC analysis
- Sulphate – Spectrophotometric Quantification
- Barium / Calcium – ICP MS
- Chloride – Spectrophotometric Determination
- Carbonate/Bicarbonate – Methodology BS2690

8.8.8.2 Water sample locations

The sample locations were determined based upon the proposed river crossing locations or as water bodies from which water may be abstracted or discharged as part of the hydrotest programme. Table 8-16 below lists the location details for each water sample collected:

Table 8-16: Surface water sample locations

SITE ID	SITE NAME	EASTING	NORTHING
River Crossings			
	Mtkvari 1	8500468	4605155
	Mtkvari 2	8339121	4616622
	Algeti	8481046	4597547
	Potskhovi 1	8323658	4614775
	Potskhovi 2	8320802	4611387
Lakes			
	Kumisi Lake	8488428	4605499
	Tsalka Reservoir	8385419	4615343
	Tabatskuri Lake	8421656	4611661

For reasons of Health & Safety, all surface water samples were collected along the side of the river-bank only. The photographs illustrating each sampling location are presented in the following sections within Plates 8-11 to 8-17 inclusive:

Figure 8-11 Mtkvari River

Sample Point Mtkvari River 2 : 8339121 E, 4616622 N

Figure 8-12 Potskhovi 1. 8323658 E, 4614775 N

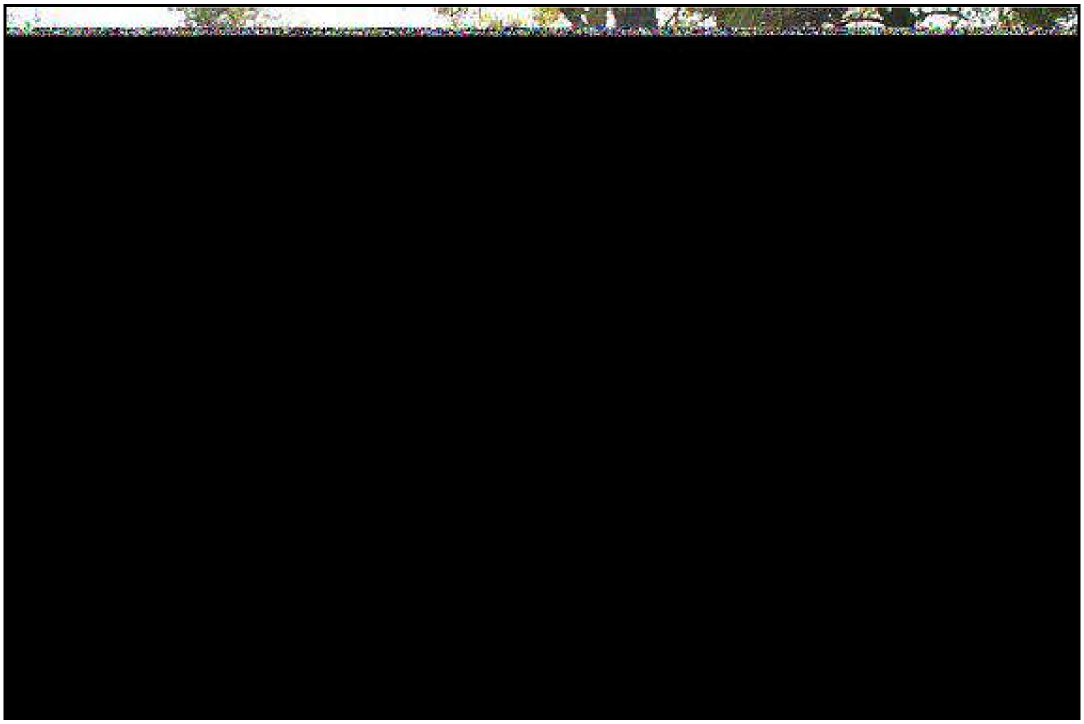
Figure 8-13 Potskhovi 2. 8320802 E, 4605499 N

Figure 8-14 Lake Kumisi. 8488428 E, 4605499 N

Figure 8-15 Lake Tabatskuri. 8421656 E, 4611661 N

Figure 8-16 Tsalka Reservoir. 8385419E, 4615343N

Figure 8-17 Algeti River Crossing. 8481046E, 4597547N



8.8.8.3 Water quality sample quality assurance protocols

Analytical quality assurance (QA) protocols appropriate for the surface water sampling study were adopted for the study. Together with the field and sampling practices employed, these were adequate to ensure sufficient confidence in the analytical results for the level of conclusions sought from the investigation. The laboratory's internal QA/QC measures included:

- Single-use sample containers
- Inclusion of a VOC 'trip blank' where appropriate
- Submission of selected (blind) sample duplicates
- Laboratory measurement of sample pack temperature upon receipt
- Laboratory inspection of sample vessel integrity upon receipt
- Storage of samples within stipulated temperature ranges
- Analysis of samples within stipulated maximum holding times
- Adherence to analytical QA protocols, to include: lab blanks and 'spiked' analysis within the sample set

8.8.8.4 Water quality assurance results

None of the water samples submitted to the laboratory for analysis, were found on receipt by the laboratory to be either broken or damaged. Analysis of all samples submitted was completed within the stipulated maximum holding times.

Each batch of VOC samples received from the field was analysed in conjunction with a blank vial, as part of the internal laboratory's QA/QC procedures. The parameter of VOC was chosen as this is the most easily contaminant transferred between samples. The results indicate that there was no significant transfer of VOCs between the samples and the sample blanks.

The repeatability of the analysis for TPH from the surface water samples was tested by a duplicate analysis of Tsalka Reservoir (Duplicate 3). The results of the duplicate analysis indicate that there is no detection of tested compounds within either sample.

8.8.9 Analytical results

The following section details both the field and analytical results of the hydrological testing completed at each major surface water system. Definitions of the main water quality criteria are given in *Section 2 - Glossary.*

8.8.9.1 Results of the field analysis

All field testing was completed between 19th – 22nd November 2001. The results are given in Table 8-17.

Table 8- 17: Results of the field parameters

Site Name	ANALYTES							
	Temp °C	SpC mS/cm	DO mg/l	pH	TDS g/l	DO %	Turbidity NTU	Hardness $CaCO_3$ (mg/l)
River Crossings								
Mtkvari – east	5.95	0.46	20	8.4	0.3	153	57	120 – 250
Mtkvari – west	2.19	0.22	15	8.5	0.1	111	26	120
Algeti	5.47	1.60	17	8.5	1.0	111	6.6	425
Potshhovi – north	1.80	0.15	16	8.3	0.1	116	37.5	25 – 50
Potshkovi – south	1.57	0.14	14	8.0	0.1	107	33.0	25 – 50
Lakes								
Kumisi	5.93	11.74	13	8.5	7.5	119	63.2	425
Tsalka	-0.18	0.15	22	8.0	0.1	150	2000*	650
Tabatskuri **								25 - 50

NTU: Nephelometric Turbidity Units
** A high percentage of ice within the sample caused measured turbidity levels to be in error*
*** Bad Weather conditions prevented access for the field crew at this location*

8.8.9.2 Analytical results

The analytical results show that all VOC and SVOC concentrations in surface water (at the same locations as in Table 8-17) are below 1µg/l. One exception is the level of Carbon Disulphide in Kumisi Lake, which was 1µg/l. Metal Concentrations in Surface Water (mg/l).

Additional analytical results are shown in Tables 8-18 to 8-20.

Table 8-18: Metal concentrations in surface water (mg/l)

Location	Arsenic (mg/l)	Boron (mg/l)	Barium (mg/l)	Cadmium (mg/l)	Chromium (mg/l)	Copper (mg/l)	Mercury (mg/l)	Nickel (mg/l)	Lead (mg/l)	Selenium (mg/l)	Zinc (mg/l)
River Systems											
Mtkvari – east	<0.05	0.22	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mtkvari – west	<0.05	0.11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Algeti	<0.05	0.46	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Potskhovi – north	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Potskhovi – south	0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lake Systems											
Kumisi Lake	0.07	3.77	<0.05	<0.05	<0.05	<0.05	<0.05	0.12	<0.05	0.08	<0.05
Tsalka Reservoir	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Tabatskuri Lake	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table 8-19: Results of various surface water quality parameters

Location	TOTAL PCB (µg/l)	TPH (µg/l)	Fatty Acid (mg/l)**	COD (mg/l) O_2	Calcium (mg/l)	SO4 (mg/l)	Cl (mg/l)	Alkalinity CaCO3 (mg/l)	Bicarbonate (mg/l)
River Systems									
Mtkvari – east	<1	<10	<10	<10	60	79	17	<1	170
Mtkvari – west	<1	<10	<10	<10	24	10	14	<1	300
Algeti	<1	<10	<10	<10	148	632	29	<1	220
Potskhovi – north	<1	<10	<10	<10	19	27	10	<1	90
Potskhovi –west	<1	<10	<10	<10	19	3	12	<1	80
Lake Systems									
Kumisi Lake	<1	16*	<10	192	567	7832	790	<1	170
Tsalka Reservoir	<1	<10	<10	15	19	7	11	<1	80
Tabatskuri Lake	<1	<10	<10	13	16	10	14	<1	70

* One Discrete Peak between C16-17 was observed
** As total of Acetic, Propionic, iso-butyric, n-butyric, iso-valeric and n-valeric acid
A duplicate sample analysis from Tsalka recorded an identical result of < 10mg/l

Table 8-20: Results of the microbiological testing programme

Location	SRB (cfu/ml)*	Comments	Total Coliform MPN per 100ml	*E.Coli* MPN per 100ml
River Systems				
Mtkvari –east	100,000	Complex bacteria consortium with SRB present	>23.0	>23.0
Mtkvari – west	10,000	Complex bacteria consortium with SRB present	>23.0	>23.0
Algeti	100,000	Complex bacteria consortium with SRB present	>23.0	>23.0
Potskhovi – north	1,000	Aerobic slime bacterial and SRB consortium	>23.0	>23.0
Potskhovi – south	10,000	Complex bacteria consortium with SRB present	>23.0	1.1
Lake Systems				
Kumisi Lake	10,000	Dense slime bacterial and SRB consortium	>23.0	>23.0
Tsalka Reservoir	10,000	Complex bacteria consortium with SRB present	16.1	>23.0
Tabatskuri Lake	100	Aerobic slime bacterial and SRB consortium	NS	NS

* cfu = colony forming unit
MPN = Most Probable Number
NS = Not Sampled

8.8.10 Conclusions

The hydrological review has indicated the nature and distribution of surface waters within the study area, and has allowed the basic geochemical characteristics to be observed. The major catchment basins within the study area have also been described and the study has indicated where extra care should be taken with respect to the intersections between the ROW and water courses.

Water quality tests completed in the field indicate the surface waters to exhibit a wide range of conductivity, turbidity, hardness and temperature characteristics; whilst dissolved oxygen and pH lie within the expected range of surface waters. The conductivity for Lake Kumisi at 7500mg/l, is significantly above what was anticipated.

Although only a few major ions have been analysed from the surface water samples, it is clear that water from the Kumisi Lake is of $Ca\text{-}SO_4$ type with appreciable quantities of Cl^- in solution. This chemical signature is related to gypsum, which was observed during the geotechnical investigation, within the soil horizon surrounding the lake. With respect to the other surface waters, the concentration of dissolved ions in solution is generally low.

The results indicate that the water samples are all free from SVOCs, PCBs and fatty acids. The results for TPH were below detection limits with the exception from Kumisi Lake, which indicated a discrete peak within the C16 – C17 range with a concentration recorded at 16µg/l. Considering this narrow carbon range, potential sources include trace quantities of motor oil or similar hydrocarbon liquid.

All VOC parameters were recorded below detection limits with the exception of a single analyte from Kumisi Lake: Carbon Disulphide was recorded at 1µg/l. Owing to the absence of similar compounds the source of Carbon Disulphide is likely to be linked to environmental background concentrations. It is considered that this compound is a metabolic product from anaerobic and aerobic bacteria that will naturally be found within basal lake sediments.

The COD results were recorded below detection limits for all of the five river samples, with the lake waters ranging from 13mg/l O_2 to 192mg/l O_2. The results for Kumisi lake with COD 192mg/l O_2 indicates that significant quantities of organic matter within the water are susceptible to oxidation. The natural concentration of COD observed in surface waters is typically 20mg/l O_2 rising to 200mg/l O_2 or greater from waters receiving effluents. The cause of the high BOD from Kumisi Lake is unclear, although effluent from the surrounding residential settlements or light industry may be responsible.

The results of the microbiological sampling programme indicate that Sulphur Reducing Bacteria (SRB) is present within all of the waters tested, ranging from 1,000 to 100,000 colony forming units per ml of sample. Coliforms were detected only within Tsalka Reservoir and *Escherichia coli* was singularly detected in Potskhovi south crossing. *Escherichia coli* is an intestinal bacteria sourced from the human/animal gut and can be transferred to river systems through the discharge of sewage effluent. The low concentration of 1.1 per 100ml indicates the extent of dilution within the river body from the source upstream. The positive identification of Coliform from Tsalka Reservoir also indicates evidence for human and/or animal waste within the river system.

8.9 LANDSCAPE AND LANDUSE

8.9.1 Landscape

8.9.1.1 Introduction and methodology

This section describes the existing visual environment along the proposed pipeline route and summarises the Reconnaissance of Visual Impact on Landscape Report (Shanshiahsvili 2001). In order to describe the environment, a landscape assessment was undertaken, which incorporated:

- A literature review of landscape features along the pipeline route with regard to their geomorphological and botanical connotations (geo-botanical description)

- A field evaluation of the aesthetic quality of the landscape along the proposed pipeline ROW

The proposed route corridor has been divided into eight sections to describe the main landscape types from a geo-botanical perspective (Figure: Map 8-8). These sections are further sub-divided where the landscape changes significantly with altitude. The corridor width covered in the literature review report was 500m.

8.9.1.2 Results

8.9.1.2.1 From Georgia-Azerbaijan border to River Mtkvari crossing (KP0-29)

Landscape type (1) – semi-desert steppe on swampy soils, brown sierozems and alluvial carbonate and non-carbonate soils. The relief is an undulating plain. The vegetation comprises beard grass, beard grass-absinth and herbaceous plants adapted to a dry climate with moderately cold winters and hot summers. The primary (natural) landscape has been modified as a result of human activities. A cultural landscape comprising irrigated land, pastures and hay meadows, with arable land and waste ground over the northern part of the section. The surrounding area is sparsely populated. A number of small villages and the outskirts of the town of Rustavi lie within 3km of the proposed route.

Figure 8-18 Landscape Type 1

8.9.1.2.2 From River Mtkvari crossing to village of Kumisi (KP29-45)

Landscape type (2) **-** beard grass and beard grass-absinth steppe on brown cierozems. The relief varies significantly, incorporating areas of insignificant to high inclination. There are a number of ravines/gullies (which were dry at the time of the work) that cut across the ROW. Vegetation comprises herbaceous plants adapted to moderately cold winters and hot summers. The primary (natural) landscape has been modified substantially as a result of human activities. A cultural landscape comprising arable land, hay fields, and pasture prevails along the corridor section and adjacent areas. The surrounding area is sparsely populated. A number of small villages such as Kumisi lie within 2km of the proposed route.

Figure 8-19 Landscape Type 2

8.9.1.2.3 From village of Kumisi to Deget-khachini (KP45-74)

Landscape type (3) - shrubby steppe comprising clumps of shrubs of *Paliurus spina christi*, *Rhamnus pallasii*, and pistachio-tree *Pistacia mutica*, including areas of beard-grass and *Festuca* steppe, on turf carbonate and brown forest soils. This type of landscape has been formed as a result of forest felling. The forest survives in a number of small fragments and predominantly consists of oak *Quercus* and maple *Acer*. The surrounding area is sparsely populated. The town of Marneuli is located approximately 2.5km south of the proposed route.

Figure 8-20 Landscape Type 3

8.9.1.2.4 From village of Deget-khachini to northern-eastern border of Bedeni Plateau (KP74-94)

Landscape type (4) – predominantly comprises deciduous forest on brown soils. The relief is moderately mountainous and includes a number of ravines. Oak forest is distributed to an altitude of 1,200m; oak-hornbeam forests to altitudes of 1,200-1,400m and beech forests above 1,400-1,500m. Pine groves occur in some places as well as scrub (oak, and hazelnut) and meadows formed as a result of tree felling. Three villages (Deget-khachini, Samshvili, and Tetritskaro) lie within 2km of the proposed route.

Figure 8-21 Landscape Type 4

8.9.1.2.5 From Bedeni Plateau to village of Bashkoy (KP94-115)

Landscape type (5) – sub-alpine meadows with secondary meadow grass vegetation on black soils. The only populated area within the section is the village of Bashkoy, which lies approximately 1km north of KP115.

Figure 8-22 Landscape Type 5

8.9.1.2.6 From village of Bashkoy to Tskhratskaro Pass (KP115-174)

The following landscape types are represented at the altitudes of 1,500 – 2,500m AMSL:

Landscape type (6) - foothill steppe meadows and mountain steppes developed on black soils.

Figure 8-23 Landscape Type 6

Landscape type (7) – sub-alpine and alpine meadows on turf and turf-peat soils

Figure 8-24 Landscape Type 7

At a number of locations, the meadow and steppe vegetation is replaced where the land is used for pastures or has been cut. Natural floristic associations are preserved only in remote areas where access is difficult. The surrounding area is sparsely populated. A number of settlements lie within 2km of the proposed route including Ktsia, Kizil-Kilisa and Tabatskuri.

8.9.1.2.7 From Tskhratskaro Pass to River Mtkvari Gorge in the vicinity of Atskuri Village (KP174-210)

The following landscape types are represented at the altitudes of 1,000m – 2,400m AMSL:

Landscape type (8) 1,000-1,100m – oak-forests, and mixed forest types comprised of spruce, birch, lime-tree, chestnut, oak.

Figure 8-25 Landscape Type 8

Landscape type (9a) 1,100-1,500m – beech forests with some fir-beech forests and fir forests with spruce and beech.

Figure 8-26 Landscape Type 9a

Landscape type (9b) 1,500 - 2,000m – coniferous forests comprising spruce, pine and spruce-fir along with mixed forest of fir and beech.

Figure 8-27 Landscape Type 9b

Landscape type (10) Above 2,000m – sub-alpine forests; trees are widely spaced with contorted stems on grey-brown soils.

Figure 8-28 Landscape Type 10

Landscape type (11) Cultural and modified (anthropogenic) landscapes developed as a result of forest felling in the vicinity of settlements.

Figure 8-29 Landscape Type 11

(12) Fragments of sub-alpine thinned forests, sub-alpine and alpine meadows with forbs and tall herbaceous vegetation on peat rich soils.

Figure 8-30 Landscape Type 12

Within this section, two villages (Tsikhisjvari and Sakire) are located within 1km of the proposed route.

8.9.1.2.8 From the village of Agara to Georgia – Turkey Border (KP210-248)

This section covers altitudes between 900 and 1,400m AMSL and the landscape (predominantly type 12) comprises secondary forest-steppe with short herbaceous plants and grasses on different types of alluvial and brown soils. Modified floodplain forests (tugai) survive in small fragments along the river-beds. The surrounding area is sparsely populated. A number of settlements (including Agara, Akhaltsikhe and Vale) are located within 2km of the proposed route.

8.9.2 Land use

8.9.2.1 Introduction and methodology

This section describes the existing land use within the pipeline corridor, based on land use survey work, which took place during the baseline walkover surveys in 2000 and the analysis of aerial photographs. For the purpose of this section, the 247km pipeline route is divided up into 10 sub-sections for analysis. Land use within each of these sub-sections is described below and detailed in Figure: Map 8-9a-c.

8.9.2.2 Results

8.9.2.2.1 Georgia-Azerbaijan Border to River Mtkvari crossing (KP 0-29)

Land use comprises predominantly pastureland and hay meadows intersected by irrigation channels. Small pockets of arable land largely supporting wheat and maize at the time of survey are scattered throughout the area. There are also a small number of fields supporting root crops including potato and cabbage.

The surrounding area is industrial. The ROW is crossed by numerous power lines, particularly to the north and east of Rustavi.

8.9.2.2.2 River Mtkvari Crossing to River Algeti Crossing. KP29-54

Land use comprises arid and semi-arid low quality grazing on light sandy soils. Vegetation is thin and is adapted to hot summers. Wheat is grown on a small number of arable fields. To the north of Marneuli a number of fields support potatoes, cabbage and swede at the time of survey. The area is intersected by irrigation channels almost all of which are in a poor state of repair.

The surrounding area is arid and semi-arid. The Iagludja mountain range lies approximately 2km to the south.

8.9.2.2.3 River Algeti Crossing to Deget-khachini village. KP54-73

Within the eastern part of the section, land use comprises medium quality grazing land on light sandy soils. To the west, soil quality improves significantly. Here, irrigated arable fields support wheat, maize, potatoes and cabbage at the time of survey. These fields are interspersed by grazing lands of mixed quality.

Tetritskaro forest lies approximately 1km to the north. The River Khrami and associated gorge runs approximately 2km to the south.

8.9.2.2.4 Deget-khachini village – Northern border of Bedeni Plateau. KP73-95

Land use within the ROW is varied. To the south, the land use comprises grazing land, arable fields and oak forest. To the north and east of Tetritskaro, land use within the ROW is predominatly mixed age oak-hornbeam forest interspersed with open grass/meadow grazing land and scrubby areas. The route also crosses open areas associated with a stone track which is crossed 3 times and a railroad which is crossed 5 times. With increasing altitude, the forest cover thins out opening up to the lower reaches of Bedeni Plateau.

The surrounding area consists of Tetritskaro forest, which is made up of a mixture of oak, oak-hornbeam, beech and pine species.

8.9.2.2.5 Bedeni Plateau to Bashkoi village. KP 95-116

Bedeni plateau comprises a series of sub-alpine grass meadows. To the east (below 800m) well developed soils support grass meadows used for nomadic grazing. Grass is cut and stacked in late summer for use as winter supply. To the west (above 800m) thin turf soils support secondary meadows.

Where the ROW leaves Bedeni plateau, land use becomes more cultivated and comprises high quality grazing land along with fields supporting wheat, potato, swede and cabbage at the time of survey.

8.9.2.2.6 Bashkoi village to Kizil-Kilisa village. KP 116-139

The eastern part of this section comprises secondary grassland on thin soils. This area is predominantly used for nomadic grazing. To the west, land is of a higher quality. Here, arable fields support potatoes and turnip at the time of survey. A number of fields were ploughed and looked to be under preparation for winter planting of wheat and maize.

To the north of the ROW, marsh and wetland rises upwards towards Kariani village. To the south lies Tsalka Reservoir.

8.9.2.2.7 Kizil-Kilisa village to Tskhratskaro Pass. KP 139-174

Land use comprises a series of sub-alpine meadows. Below 2,000m primary meadows, wet meadows and grazing lands are located on well-developed soils. Above 2,000m secondary meadows are located on thin soils and are used predominantly for nomadic grazing. There are a number of small pockets of woodland and scrub within the ROW, particularly to the east.

To the north of the ROW, land rises upwards towards the Trialeti mountain range. To the south, land drops down towards Tabatskuri village and lake.

8.9.2.2.8 Tskhratskaro Pass to Sakire village. KP 174-198

With the exception of open land associated with river crossings along with a number of areas of open pasture (particularly to the west), land use within the ROW is made up of forest land, the species composition of which varies with altitude. Below 1,500m oak, spruce, chestnut and lime dominate, where as above 1,500m spruce, pine and spruce-fir dominate.

To the north, forested and pasture land rises upwards and then drops down towards the Mtkvari River gorge. To the south, forested and pasture land rises up towards the western part of the Trialeti mountain range.

8.9.2.2.9 Sakire village to Mtkvari River crossing. KP 198-221

The eastern part of the section comprises forest land interspersed with small areas of meadow and a number of arable fields. Forest species composition varies with altitude, once again with oak, spruce, chestnut and lime dominating below 1,500m and spruce, pine and spruce-fir dominating above 1,500m.

Within the western part of the section, open semi-arid areas are interspersed with small pockets of woodland and a number of arable fields. Here, the pipeline crosses a series of dry ravines.

To the north, forested and open semi-arid land drops down towards the River Mtkvari gorge. To the south, largely forested land rises up towards the Trialeti mountain range.

8.9.2.2.10 Mtkvari River crossing to Georgia-Turkey border. KP 221-247

To the east and in close proximity to the Mtkvari River gorge, land use comprises a mix of arable fields interspersed with primary and secondary pasture, small areas of coniferous and broadleaved woodland and a number of orchards. There are also a number of small areas used for growing horticultural crops.

Towards the border with Turkey, land use comprises semi-arid scrubland used for primary and secondary grazing interspersed with a small number of ploughed fields. There is a small area of land used for growing horticultural crops to the west of Vale.

To the north of the ROW, agricultural and forested land rises upwards towards the Mesketi mountain range. To the south, semi-arid and forested land rises upwards towards the Turkish Border.

8.9.2.2.11 Other Land Uses

In addition to the pipeline ROW, there will be a number of sites used as pipe dumps, and maintenance/storage yards. A number of potential sites have been surveyed for their suitability. The location of these sites and their current land use is detailed in Table 8-21 below.

Table 8- 21: Land use at pipe dump and maintenance yard locations

Site	Co-ordinates	Size	Current Land Use
Gardabani 1	8504627 4592320	Not yet defined	Industrial land adjacent to power station
Gardabani 2	8508885 4593364	<1,000m^2	Waste ground adjacent to oil storage depot and factory units
Gatchiani	8499672 4606933	18,000m^2	Former WREP pipe yard
Marneuli	8484893 4595635	35,000m^2	Storage yard
Kotishi	8477063 4598111	Not yet defined	Industrial land containing an electric sub-station & a crushing plant.
Tetritskaro	8457157 4599321	Not yet defined	Farm land adjacent to railway sidings and associated derelict maintenance buildings
Tsalka 1	8421113 4606577	Not yet defined	Existing rail station and associated sidings
Tsalka 2	8428546 4609878	Not yet defined	Secondary grazing land
Borjomi	8368026 4635813	Not yet defined	Railway sidings and derelict buildings
Tsikhisjvari	8369525 4621250	Not yet defined	Secondary grazing
Andezit	8373333 4621273	Not yet defined	Secondary grazing
Atskuri	8346357 4622089	Not yet defined	Farm land adjacent to railway sidings being used as a scrap metal operation & secondary grazing
Akhaltsikhe	8335050 4614954	50,000m^2	Railway sidings & storage facilities
Vale 1	8325143 4613582	17,000m^2	Railway sidings & disused platform
Vale 2	8337217 4616374	Not yet defined	Railway station, sidings and oil depot

8.10 CULTURAL HERITAGE AND ARCHAEOLOGY

8.10.1 Introduction

The Georgian nation has a long written history and a wealth of historic sites, monuments, and artefacts. It also has archaeological sites dating to periods long before written records began. Its earliest archaeological sites date to the late Pliocene geological epoch nearly two million years ago, and have yielded early hominid fossils *(Homo erectus)*. Later remains include churches, monasteries, castles, and fortifications, which date to the well-known medieval period. Larger settlements in Georgia contain a diverse stock of historic secular and non-military buildings from a number of international styles that date up until the time of Soviet Period, which began in 1922. Among the best known and most frequently encountered archaeological remains in Georgia are those of the Middle and Late Bronze Age Periods (approximately 3000-800 BC). This period marks the earliest substantial evidence of social stratification, which is exemplified by objects of intricately worked gold, gold and semi-precious stones that are among Georgia's national treasures. The best known of these objects have been recovered from the *kurgans*, burial chambers of the Trialeti Culture (3000-1500 BC) where presumed warrior leaders were buried. This category of site is, according to literature search and site reconnaisance, the most abundant type of heritage resource present in the pipeline corridor.

The summary of heritage resources in the project area that follows includes archaeological sites and historical monuments, including known and potential resources. Archaeological sites are defined as below-ground historical resources, while monuments are above ground. The distinction between the two is made for resource management purposes because protection of each requires different types of investigative and possible mitigation procedures. Certain resources may include a combination of archaeological and structural components thus qualifying them as archaeological sites and monuments.

Archaeological Sites. Archaeological resources consist of surface and near-surface artefacts and related materials in a spatial and stratigraphic context, which constitute a scientific record of the past cultures that created them. Where no contemporary written records of a culture exist, archaeological remains may constitute the only extant record of that culture. Without necessary knowledge and planning, ground-disturbing projects such as the proposed pipeline have the potential to damage archaeological sites and artefacts, thereby diminishing scientific and cultural resources that are a part of the cultural patrimony. Archaeological sites are considered to be an important and irreplaceable aspect of Georgia's cultural patrimony. Although heritage management principles always favour protection of archaeological sites by avoidance, such sites can often be rescued by scientific excavation, in which case a ground disturbing project may go forward with limited adverse impact to the resource.

Historic Monuments. Historic monuments are remaining structures that owing to aesthetic qualities, association with significant events or people, or through great age alone represent a significant and irreplaceable historic resource. Monuments, in addition to being of interest for art historical study, may also be highly visible and well known, symbolising the importance of past events and possibly historic persons to the general public. The value of an important historic monument is closely attached to its specific location and setting, and to the surrounding landscape. Unlike archaeological sites, it is very rare that an historic monument can be moved or altered without substantial loss of its scholarly and public value. Avoidance and direct protection are almost always preferred for historic monuments.

Resources in the pipeline corridor include 54 archaeological sites and 219 historic monuments. In the case of archaeological sites the total includes those lying along previous and present alignments. The historic monument total includes those lying within a 10km wide corridor centred on the pipeline alignment. Know archaeological sites along the pipeline alignment date from the Late Neolithic (aeneolithic) onward, monuments date from the Bronze Age onwards. It is highly likely that previously unreported pre-Bronze Age archaeological sites are present along the alignment but have yet to be identified. The following types or resources are, however, known to be present:

- Archaeological Sites: Late Neolithic and Bronze Age settlements and burial features including large and small tombs grouped together in *necropoli* (burial grounds), and ruined and abandoned medieval settlements are confirmed. (Potential sites include rock shelters and remains of open air camps and villages, all of the prehistoric period.)

- Historic Monuments: Bronze Age, Iron Age, Medieval, and Modern Period monuments have been identified in the 10-km wide pipeline corridor (Table 8-22). Most numerous are vaulted churches. There are some basilicas and cross-shaped dome churches. Most important, are the Bronze Age fortified settlements, also known as cyclopean structures for their boulder construction technique, which date from III and II Millennia BC. Some of the latter Bronze Age features were originally below the ground surface but were excavated by archaeologists; they probably retain archaeological deposits. Other Bronze Age monuments survive as ruined structures evident at the surface. None of these monuments, however, is crossed by the proposed pipeline alignment owing to a number of re-routes which have been implemented

Table 8-22: Summary of historic monuments located within the 10km-wide project corridor

District	**Monument Period**						Total
	Bronze Age	*Iron Age*	*Ancient*	*Medieval*	*Modern*	*Uncertain*	
Marneuli	0	0	0	3	2	0	5
Bolnisi & Tetretskaro	2	0	0	60	25	0	87
Tsalka	0	2	0	12	26	0	40
Borjomi	0	0	0	20	5	0	25
Akhaltsike &Adigeni	2	1	0	31	13	15	62
Total	4	3	0	126	71	15	219

Archaeological sites and historic monuments identified in the course of surveys and available information reviews are shown on Figure: Map 8-10a-f.

8.10.2 Methodology

Consultation with the Georgian Academy of Sciences' Centre for Archaeological Studies (CAS) led to the creation of a project archaeology strategy aimed at identifying and protecting archaeological resources. CAS has also been designated the responsible government agency for project monuments protection issues. Consequently an equivalent monuments strategy is also being developed with CAS. Literature research, aerial photographic and map interpretation, and walkover field reconnaissance have been implemented to generate the preliminary lists of heritage resources (archaeological sites and monuments) in the project's area of influence. The present archaeological resource list has already been used by project engineering staff to create corridor re-routes, avoiding potential impacts to the largest and most obvious known sites. Avoidance of monuments has also been a key consideration in route selection.

Potential project impacts to archaeological sites and monuments differ substantially. For archaeological sites the concern is direct physical impact on fragile subsurface resources from earthmoving equipment and heavy vehicle transit. For monuments the immediate concerns are accidental vehicle impacts, damage to the surrounding landscape setting, destabilisation and impact from continuous heavy vehicle passage or use of high explosives. Monuments are also prone to secondary impacts such as those caused by temporary or permanent increases in population, sometimes referred to as induced development. Such impacts may include unauthorised and inappropriate occupation of monuments, robbing of monuments for building materials, and degrading of the monuments' surroundings from a variety of unplanned uses. Archaeological resources are less prone to such impacts because of their underground location.

In addition to the difference in impact types just noted, there is another important difference between archaeological sites and monuments.

- Archaeological sites are most often underground and are therefore difficult to identify. Further, those surface indications of archaeological sites that do exist are not always a reliable measure of the extent or importance of subsurface resources. Avoidance of archaeological remains that are discernible from the surface, large burial mounds for example, is good practice but does not ensure that less obvious subsurface remains will not be adversely affected

- Historic monuments are by definition above ground and are therefore easy to identify in project planning studies. Their evaluation is also more straight-forward because subsurface investigation is seldom required. Visibility and accessibility make monuments protection studies less elaborate and less time-consuming. Ease of access is also a cause for the most common impacts noted above, requiring preservation solutions that operate to protect against impacts that result from continuous and long-term public access

Further potential impacts will be defined for both archaeological sites and monuments as temporary and permanent pipeline support facilities are designed and sited. Also, in the case of archaeological sites, there are further potential impacts associated with late finds. This is because current baseline data cannot include previously unreported subsurface sites. In this latter case of unreported finds, the historical context is particularly important for defining the types of impacts that might be expected.

8.10.3 Historical context for Georgian heritage resources

A historic context consists of culture-historical information needed to understand the significance of a particular archaeological site or monument and to predict what types of sites might be present in a previously un-investigated zone. The historic context developed below is a period-by-period series of brief vignettes of Georgian prehistory and history. It thus provides a general background on events of scientific and public significance of each of the periods. Known resources in the project area identified by the literature search and other means are summarised and highlighted for each period as well.

8.10.3.1 Lower Palaeolithic (2,000,000-200,000 years ago)

This is a time before the emergence of anatomically modern humans. Early members of the genus Homo (*Homo erectus*) lived in small bands, apparently foraging radially from a home base located near some key environmental feature. Fossil remains and crude flake or cobble stone tools are the only artefactual remains from these earliest period of human history. Remains of this period are extremely scarce world-wide and their importance lies in the clues to anatomical development and behavioural patterns of these earliest members of the genus *Homo*. Sites from this period can be dated by archaeomagnetic study and by potassium/argon dating if volcanic deposits are present.

The site of Dmanisi south-east of Tbilisi yielded a series of Pliocene faunal remains and was first investigated in the 1980s. Later, in 1991 and again in the summer of 2001, international archaeological teams recovered fossilised *Homo erectus* bones from the site. In addition, simple chipped-stone tools of the so-called Oldowan and Acheulean tradition have been found at the site. The site of Dmanisi, dating to between 1.8 and 1.4million years ago is one of the earliest *Homo erectus* find sites outside of the African continent. Along with the Ubdaisa find site in the Jordan Rift valley of Israel, Dmanisi finds seem to represent an early hominid migration path out of Africa. Current evidence suggest that the Dmanisi finds may be the oldest *Homo erectus* find outside of Africa, possibly older that better known east Asian finds of Sangria in Java and Zhoukoudian in China.

Sixteen sites with Acheulean type stone tool assemblages and thus potentially dating to this period or somewhat later have been reported throughout Georgia. Two of these lie in south central Georgia, within the region of the pipeline corridor. No known sites of this age are located in or near the project area. The Dmanisi find site lies well out of the project area, some 40km to the south of Tsalka.

8.10.3.2 Middle Palaeolithic (200,000-30,000 years ago)

This very long period corresponds to the emergence of archaic *Homo sapiens* such as *neanderthalensis*. Throughout Europe and Southwest Asia the latter part of this period of human history is marked by what is called the Mousterian stone tool assemblage which in comparison to the Acheulean stone-tool kit, involved more elaborate and skilfully made tools, and a wider variety of tool shapes. As was the case in northern Europe during much of this period, Georgia was a glacial or peri-glacial environment.

Over seventy-five sites with Mousterian stone tools have been found throughout Georgia. Seven such sites have been found in south-central Georgia in the general region of the project area.

8.10.3.3 Upper Palaeolithic (30,000 years ago - 12,000 BC)

The Upper Palaeolithic corresponds to the Late Pleistocene period and saw the appearance in Europe, Southwest Asia and Georgia, of anatomically modern humans. Technologically the period showed a dramatic rise in the variety and complexity of stone tool types. Tool assemblages with distinctive stylistic patterns can be tracked geographically, suggesting to some archaeologists the emergence of culturally and perhaps linguistically distinctive groups, ie ethnic groups. It is also suggested by some that this period saw the full development of human linguistic capability. Upper Palaeolithic peoples of Georgia probably relied on group hunting techniques of a few types of large animals such as deer, bison, wild horses, mountain goat, bear, and mountain lion, the remains of which are found in abundance at Upper Palaeolithic sites.

Natural rock shelters and caves and places strategically located to exploit movements of their prey were the most common habitation sites of this period.

At least thirty-three significant Upper Palaeolithic sites are known throughout Georgia, three of them in south-central Georgia. None is reported in or near the pipeline corridor.

8.10.3.4 Mesolithic (12,000-8,000 BC)

The start of Mesolithic Period is marked by the end of the Pleistocene epoch and the start of the Holocene. Retreat of the Würm glaciation created a more moderate climate allowing exploitation of a wider range of environments. Hunting continues to be a major focus of economic activity, but now focuses on a wider range of prey. Individual animals of a variety of sizes, both herd animals and solitary species were hunted, suggesting smaller scale individualistic hunting techniques. Wild prey included a variety of deer, boar, horses, and sheep. Systematic foraging for seasonal plant resources also became an important part of the economic repertoire. Open air sites became more common than cave sites at this time in Georgia and elsewhere in Europe and Southwest Asia. The most notable shift in artefact assemblages for this period was the proliferation of tool-making materials and tool types. Microliths (small flint and obsidian blades) and polished grinding stones, all of which were used for plant processing, became common. Net-sinker stones and harpoons suggest greater reliance on fish. The shift from Upper Palaeolithic to Mesolithic society is interpreted, quite simply as adaptation to a different and broader range of resources that became available in the temperate Holocene environment.

Only twelve significant Mesolithic sites are known throughout Georgia, none are in the immediate vicinity of the pipeline corridor.

8.10.3.5 Neolithic Period (8,000-3,500 BC)

The beginning of the Neolithic Period is sometimes referred to as a revolution because of the dramatic shift in the human economy that it brought. With the coming of the Neolithic, humans shifted from a hunting and gathering way of life, to one based on the domestication of animals and plants, that is on agricultural and animal husbandry. Along with these basic changes came the invention of pottery for cooking and storage of plant foods and the wide-scale introduction of ground and polished stone tools such as adzes, hoes, and axes for clearing the land and tilling the soil. Building technology both for shelter and food storage also saw major advances. It appears that the Neolithic way of life was introduced in a full-developed form from elsewhere, as there is no evidence for the slow transition to an agricultural existence.

In contrast to the Palaeolithic and Mesolithic periods, pottery sherds (the remains of cooking and storage jars) become the dominant artefacts in Georgian archaeological assemblages, reflecting the importance of food processing and storage. Georgian Neolithic pottery forms are typically flat-bottomed, round-sided jars and bowls without handles. Appliqué and incised decorations are common from the very start of Georgia's pottery-making tradition. Surface treatment often includes burnishing. Round-sided bowls and relatively small jars are the most common forms. A wide variety of locally available tempering materials are seen in these early ceramics, including gravel, sand, ground ceramic, straw, and crushed obsidian.

The first stand-alone Georgian Neolithic houses consisted of a series of abutting and interconnected rooms made of mud and mud bricks supported by wood beams and probably roofed with saplings and mud. Rooms were round or elliptical in plan with different sized rooms apparently having different standard uses. Large rooms (c. 2.5 x 5m) had built-in hearths and were probably used for socialising and sleeping. Medium-sized rooms (c. 1.25 x 2m) were probably used as a craft area, and small rooms (c.0.5 x 0.75m) must have served for storage. This settlement organisation is exemplified at the site of Imiris-Gora in south-central Georgia.

Approximately sixty Neolithic sites are known throughout Georgia; most are in western Georgia, although south-central Georgia has a concentration of sites from this period. One Late Neolithic (aeneolithic) site is located along the project alignment, in the Akhaltsikhe District.

8.10.3.6 Bronze Age (3,500-800 BC/IV-I Millennia)

Bronze Age cultures throughout Europe, the Mediterranean and Southwest Asia depended on the plant and animal domesticates and associated technical advances such as pottery and the working of native metals, to build a new type of society. This new society was ruled by a military and priestly elite who apparently practised a religion that included elaborate burial rituals and specific belief in an afterlife in which worldly material goods were of value. The rulers of these first stratified societies justified their status and set themselves apart from the common social classes through elaborate burial rituals and the consumption of luxury goods such as finely crafted ornaments of bronze and precious metals, and precious stones. Other, perishable commodities were surely involved but have left no physical record for us to interpret. Increased technical sophistication of craftspeople and geographically extensive systems of land and sea trade provided the logistic underpinning of these societies in differential access to luxury goods that was an immutable fact of life. All of these physical and social characteristics of Bronze Age society emerged slowly over a period of hundreds of years in Georgia, first becoming apparent in the Kura-Araxes culture of the aeneolithic and Early Bronze Age periods (3,500-3,000 BC) and later during the Middle Bronze Age "florescent period" of the Trialeti Culture (2,500-1900 BC). Both cultures appear, from the geographical distribution of their remains, to have been centered in Georgia, especially south-central Georgia, but to have extended beyond into Armenia, Azerbaijan, eastern Turkey and further south.

A characteristic aspect of Bronze Age society was the apparent stability and slow pace of social change, although this may be in part an artefact of the absence of written records of with which history is normally charted. Trialeti Culture as it is defined by archaeologists lasted nearly 2,000 years with a florescent period of nearly 600 years. Florescent periods of Greece, Rome, Egypt and Akkadia for example are measured in periods that are far shorter, typically far less than half a millennium.

The Kura-Araxes Culture (also known as Mtkvari-Araksi), the first Bronze Age culture of Georgia, corresponds to the Aeneolithic and Early Bronze Age periods in the area (3500-3000 BC). It is so named because of the geographical concentration of its occupation sites between the Mtkvari and Araxes rivers of Georgia. Sites include necropoli (burial clusters) and settlements. Typical houses were single storey, constructed of mud brick, stone, and dried mud with wood reinforcement. Floor plans were very similar, being rectangular with a small rectangular room at the door end and an adjoining, larger, square room at the rear. Variation in size, but not proportions, was common. A typical overall house plan was 4m x 7m. Houses were clustered together in rows, oriented to optimise solar exposure and shelter from the wind and tended to be located on small rises just above the floodplains. Typical settlement area was approximately one-half of a hectare.

The Kura-Araxes culture, as defined by characteristic ceramic decorative traits and other diagnostic elements, is first identified in the Late Neolithic. Kura-Araxes peoples either developed or adopted bronze smelting technology in the mid-fourth millennium BC.

The Trialeti Culture (3000-1500 BC) corresponds to approximately the Middle Bronze Age in Georgia. Its area of influence extended beyond the boundaries of present-day Georgia, especially to the South and East. The culture is named for the Trialeti Plateau, an area of south-central Georgia traversed by the proposed pipeline corridor where the culture was first investigated archaeologically in the 1930s. This is also the area that has the densest concentration of Trialeti remains. The Trialeti culture is best known for the large and elaborate tombs or kurgans which characterise its florescent period (2,500-1,900 BC). These were large circular stone and wood tomb constructions, some as large as 12m high and 100m across. Although the largest of the *kurgans* were robbed in antiquity, much of the funerary ritual can be reconstructed from the burial goods. Cobbled roads led to the tomb entrance and four-wheeled ox-carts present in the central chambers suggest a funeral procession in which the deceased and their burial goods advanced on the road along with the animals and commoners selected for ritual sacrifice. Trialeti's florescent period is marked by the first *kurgans* designed as the resting places of single elite individuals previously the tombs held the remains of multiple individuals who were interred sequentially over time. Burial goods include an array of plain and decorative chipped stone, ground stone, and metal tools and weapons, as well as ornamental objects of gold, silver, and precious stones. Some of the best known and most impressive objects displayed in the Treasury of Georgia's National Art Museum were excavated from large Trialeti *kurgans*.

Although the elaborate burial rituals suggest something about Trialeti social structure, almost nothing is known about the domestic life of the Trialeti people because very few if any examples of Trialeti settlements have been found. Systematic efforts have been mounted to locate and investigate Trialeti settlements but without result. One could speculate that a highly mobile life-style dependent on herding did not require substantial and durable structures, but this seems inconsistent with social stratification and agriculture, both of which are clearly in evidence. Another possibility is that Trialeti houses and settlements were located in a specific topographic or geomorphologic setting, which has proved unstable for natural or cultural reasons over the millennia, preventing the subsurface preservation of these types of sites. In any case, we can assume that there were Trialeti settlements in the general vicinities of the Trialeti *kurgans*. The latter tend to cluster in ravines and along well-watered valley floors. Both types of areas, it has been noted by archaeologists, are zones that are most prone to primitive irrigation agriculture and cattle husbandry, supporting the inference that these were the bases of the Trialeti economy's surplus production.

The Middle and Late Bronze Age in Georgia saw the start of the historical distinction between eastern and western Georgia. At this time west Georgia, including the area of the Black Sea Littoral, saw the complementary development of the Colchis (Kolkheti) Culture. This Culture was, from its early stages, distinct from the Trialeti tradition in nearly all aspects of its material culture. The Colchis (Kolkheti) culture, whose designation became synonymous with western Georgia, lasted well into the Iron Age and was in commercial contact with Greeks from Miletus and elsewhere. The best known Colchis (Kolcheti) site is Vani, a major commercial, political, and religious centre that has been subject to years of archaeological excavation and study.

Stylistic parallels have been noted between the Bronze Age of Georgia and the Caucasus on the one hand, and those of Asia Minor (Turkey) and adjacent areas of Southwest Asia. In particular these parallels are evident in the design of the kurgans of Middle Bronze age necropoli. A major distinction between the Bronze Age of the Caucasus and contemporary cultures of Asia Minor and Southwest Asia to the south, is that the former seems to have had an economy more influenced by the Steppes of Central Asia, with an emphasis on stock raising and earlier introduction of domesticated plants and animals. Further, while Middle Bronze Age settlements appear to have been ephemeral in the Caucasus (to the point where none from the Middle Bronze Age has yet been identified), this same period saw the development of the first cities in Southwest Asia and Asia Minor.

A total of twenty-two Bronze Age sites are located along the pipeline alignment; the most substantial Bronze Age remains, however, have already been avoided by pipeline re-routes. Ten of the Bronze Age sites that could not be avoided by pipeline re-routes are scheduled for subsurface investigation prior to the start of construction (Table 8-23). Four Bronze Age monuments are located within the 10-km wide project corridor, two are located in the Akhaltsikhe District and two are located in the Tetritskaro Region.

Table 8- 23: Sites scheduled for further field investigation

Site ID and Coordinates	District	Local Site Name	Site Description (based on surface inspection)
SCPA-1/(a)	Tetritskaro	Daget Khachini	Medieval Site (tile and ceramic fragments visible on surface).
SCPA-2 /(844 9450 – 460 3250)	Tetritskaro	Tkemlana	Medieval Site (crude boulder-work wall visible on surface).
SCPA-3/(844 8240 – 460 4632	Tetritskaro	Nadarbazevi Complex	Medieval Site (AD twelfth century, many structural remains visible on surface).
SCPA-4/(844 7991 – 460 6088)	Tetritskaro	Takhtitskaro	Medieval Site (crude boulder-work walls visible on surface).
SCPA-5/(842 2566 – 461 2741)	Tsalka	Aia-Ilia	Late Bronze/Early Iron Age Site (Early first millennium BC Cyclopean walls), Medieval Period site (crude boulder-work, ruined church).
SCPA-6/(841 8371 – 461 2541)	Tsalka	Santa Village	Middle Bronze Age Site (Third through second millennium BC, kurgans/burial mounds and ritual roads, possible multiple burial tombs). This is a very large site that stretches about 2-3km along the pipeline alignment and is attributable to the Trialeti Culture. Larger, even more substantial, remains of the same period were avoided by re-route.
SCPA-7/(-)	Tsalka	Eli-Baba	Late Bronze Age Site (Late second millennium BC); Settlement with Cyclopean construction.
SCPA-8/(838 2802 – 461 8698)	Borjomi	Tavkvetili	Middle Bronze Age Site (Third through second millennium BC, burial mounds).
SCPA-9/(838 3231- 461 5137)	Borjomi	Mt. Msralimta	Middle Bronze Age Site (Third through second millennium BC, two burial mounds visible from surface).
SCPA-10/ (838 0111 – 461 4516 838 0400 – 461 4516 838 0400 – 461 4382 838 0553 – 461 4439 838 0570 – 461 4304 838 0643 – 461 4335 838 0817 – 461 4452)	Borjomi	Moliti	Middle Bronze Age Site (Third through second millennium BC, seven burial mounds).
SCPA-11/(835 4540 – 462 2800)	Borjomi	Siliani	Bronze Age Site (tombs), possible Iron Age tomb and Muslim settlement.
SCPA-12/(835 4575 – 462 2807)	Borjomi	Dgvari	Middle Bronze Age Site (Third through second millennium BC, burial mounds and pit tombs).

Site ID and Coordinates	District	Local Site Name	Site Description (based on surface inspection)
SCPA-13/(834 5738 – 461 9349)	Akhaltsikhe	Agara	Early Bronze Age Site (tombs); AD first millennium site (settlement).
SCPA-14/(831 8598 – 460 8720)	Akhaltsikhe	Orchosani	Bronze Age Site (Third through second millennium BC burial mounds); AD first millennium site (settlement); AD 1600s site (ruined church with crypt).

(NOTE: SCPA-X is proposed as the internal project archaeological site code for Georgia to be used in archeological field investigations and subsequently as a basis for artifact coding and subsequent curation. SCPA signifies 'South Caucasus Pipeline Archaeology.' The X signifies a sequential site number.)

8.10.3.7 Iron Age (800-400 BC)

The transition from the Late Bronze Age to the Iron Age is in fact very difficult to identify. A conservative archaeological opinion is that iron-working did not become the predominant metallurgical technology until the first quarter of the First Millennium BC. Nonetheless it is clear that long before this, in the late Bronze Age (after the demise of the Trialeti Culture) a series of significant technological and economic changes were occurring. Not all of these changes were caused by or even associated with a shift from the alloy casting bronze techniques to iron smelting. The changes included use of an increasingly effective range of agricultural techniques, including deeper ploughing facilitated by draft animals and more sophisticated ploughs, use of crop rotation, and the development of drought-resistant wheat. These agricultural improvements in turn assisted in a transition from nomadic to sedentary herding techniques. All of the technological changes led to a larger more sedentary population which also appears to have made populations more prone to regional economic independence. In Georgia and elsewhere in Europe and Southwest Asia it has been speculated that the wider distribution of raw materials for iron working and the more robust and diversified local agricultural economies were the primary factors that allowed greater regional independence. According to this view, the earlier Bronze Age economies required greater access to trade goods to assure access to needed food and craft products.

There are hundreds of significant Iron Age sites throughout Georgia. Sites are concentrated in alluvial settings in both West Georgia (traditional Colchis or Kolkheti) and East Georgia (traditional Iberia).

Two possible Iron Age sites are scheduled for subsurface investigation prior to construction. One is in the Tsalka Region and the other is in the Borjomi Region; both sites are associated with more securely dated Bronze Age remains that are also scheduled for investigation.

Prehistory to History. Traditionally the Iron Age comes to an end, not because of new technological developments but rather because of the advent of history, written accounts which allow us to identify societies not by their typical artefacts or material but reference to specific named kings, dynasties, wars and invasions. Typically this increased detail brings additional complexity that challenges historical understanding. In the case of Georgia this is especially true. The sweep of events and cross-cutting influences in Georgian history is almost overwhelming, involving cross influences from numerous civilisations, numerous ethno-linguistic and religious groups, and a seemingly countless series of invasions and re-invasions. As this cultural background discussion turns to the historic period, the time line in Table 8-24 will assist the reader in chronologically organising some of these influences and patterns in Georgian history. Context for resource management of Georgia's historic period can best be presented as a series of three periods, each of which interacted with one another and with indigenous Georgian cultural patterns in a different way.

Table 8- 24: Georgian cultural timeline: significant events and periods in Georgia's history and prehistory

Date	Event	Significance
1.8 Million Years Ago	Homo Erectus *settlements in Georgia at site of Dmanisi (Pliocene Epoch)*	Dmanisi is one of the earliest, if not the earliest, *Homo Erectus* find outside of Africa. Dmanisi and Ubdaisa (Israel) suggest a northward migration path of *Homo Erectus* out of the African continent and into Europe.
30,000 Years Ago	Archaic humans (eg *Homo Sapiens neanderthalensis*) hunt large mammals in Arctic-like environment of Georgia (Pleistocene Epoch)	Pleistocene, peri-glacial environments such as that of Caucasus and Northern Europe are thought to be environments in which *Homo Sapiens sapiens* may have evolved.
8,000 Years Ago	Introduction of Neolithic way of life into Georgia	Settled village life begins, relying on domesticated plants and animals and construction of first permanent villages.
4,000 BC	Development of Steppe Cultures	Domestication of horse and introduction of circular burial vaults.
3500-3,000 BC	Kuro-Araxis Culture	This poorly known group enters area from Steppes to the north and occupies all of present-day Georgia and beyond. They are possible proto-Georgian ethno-linguistic stock, ie possibly the 'first Georgians.'
2,500-1,900 BC	Florescence of Trialeti Culture	Elaborate burial rituals with finely made craft items including gold and precious stones as burial goods. Some of these *kurgans* (circular burial mounds) housed burial of single 'warrior king'. Some of the *kurgans* are as much as 100m across and 12m high.
2,000-1,200 BC	Hittite Culture based in Anatolia	Established one of the largest most important early Near Eastern empires. Included urban centers, writing and highly developed crafts.
1,000-500 BC	Urartian Kingdom	Fortresses and settlements developed in eastern Anatolia and present-day Armenia in vicinity of Mount Ararat, which derives its name from Urartu. Civilization was overrun from the East by mobile Scythian warriors in mid-first millennium BC.
Approximately 600BC	Founding of Greek port of Phasis (Phasii) (near Poti) on Georgia's Black Sea Coast	Marks consolidation of trade relations between Greeks (of Miletus) and Georgia, probably to advantage of Greeks. Greek trade items are found archaeologically far inland in Georgia. Colchis (Kolcheti) (west Georgia) was counterpart to Greek controlled Phasis (Phasii). Historic pattern of Georgian contact with Greek world occurs by sea, from West across the Black Sea. Traditionally, western Georgia has been subject to greater Greek influence with Persian being stronger and more direct in the East of the country.
4th Century BC	Writing system developed for the Georgian language	The earliest surviving example of the Georgian writing system in Georgia is an inscription in the Bolnisis Sioni Church dating to AD 483 some 800 years later.
Approx. 300 BC	Georgian State founded at Armazi-Mtskhets (modern Mtskheta)	Mtskheta remains traditional and religious capital of Georgia through Christian times. The home land of the people the Greeks called 'Iberio.' Mtskheta, because of its Christian Monuments and Pre-Christian Archaeology is presently a UNESCO World Heritage Site.

Date	Event	Significance
334-324 BC	Conquests of Alexander the Great of Macedonia (northern Greece)	Alexander's Greek army expands south and eastward. Alexander defeats Persians, ending Achmaenid Dynasty and going on to conquer most of the world that was known to the Greeks. Greek invasion of Georgia apparently did not damage the newly developing pattern of urbanism there.
Appx. 200 BC	Regular overland trade between eastern Mediterranean and Far East commences. Network of east-west trade is later referred to as the 'Great Silk Road.'	Variety of formerly local exchange routes are used, including those connecting Caucasus with Anatolia and Greece.
66 BC	Roman Republican General Pompey Enters Caucasus and defeats armies of King Mithridates I halting Parthian expansion.	Most of Georgia falls to Roman Legions and then becomes buffer zone between Rome and Parthian Empire (Persia).
AD 331	Traditional date of Georgian King Mihran's conversion to Christianity.	Start of Christian Georgia, which becomes one of the longest lasting national Christian traditions.
AD 361	First Mongol Invasions	Disrupts development of Christian Georgian culture and society. .
Late AD 400s	King Vachtang Georgaseli	Asserts Iberian independence from Colchis (Kolcheti) (western Georgia), establishes capital in Tbilisi.
AD 600s	Islamic Expansion out of Arabian Peninsula, founding of Ummayad Dynasty in Syria.	Arab armies defeat Sassanid Persians converting Persia (Iran) to Islamic nation. Subsequent Persian influence on Georgia is therefore also Islamic where before it had been Zoroastrian.
AD 705	Muslim Arab armies enter Georgia establishing their capital in Tbilisi	So-called Tbilisi Emirate is short-lived.
AD 750	End of Ummayad dynasty and founding of Abbasid Caliphate	Center of Islamic power moves east to newly founded Abbasid capital of Baghdad, directly south of the Caucasus.
AD 1055	Islamic Seljuk Turks take Baghdad	Becoming major power threatening Byzantium from East.
1000s-1200s	Georgia's Golden Age	Christian Culture and society are revived in Georgia under King David the Builder, who defeated Turks, and expelled Arabs from Tbilisi. A great number of Georgia's most important surviving monuments, especially churches and monasteries, were built during this period.
1200s	Poet Shota Rustaveli	Best known Georgian literary figure composed National Epic Poem entitled *The Knight in the Tiger Skin.* Rustaveli was probably a member of the court of Queen Tamar (1184-1213).
1200s-1300s	Mongol Period	Mongol Invaders including Tamerlane disrupt Georgia's Golden Age.
1453	Ottoman Turks take Byzantium/Constantinople, which becomes Istanbul	Moribund Byzantine Empire meets its end, center of eastern Christendom permanently displaced; church Hagia Sophia is converted to a mosque.
1502	Shiite Safavid control Persia founding dynasty.	Azerbaijan becomes part of Safavid Empire temporally but majority of population is permanently converted to Shiite sect of Islam.

Date	Event	Significance
1801-1917	Georgia becomes part of Russian Empire	Under Tsar Alexander I (1801-1825) Russia takes control of the Caucasus. Georgia trades independence for protection from Ottoman Empire. Cultural contact with Europe expands substantially. Russians replace Ottoman Turks as Georgia's 'threatening foreign power.'
1917-1922	Social Democratic "Menshevik" Period	The three Trans-Caucasian nations of Georgia, Azerbaijan, and Armenia are independent democratic countries for a few short years.
1922-1991	Soviet Period	Georgia is forcibly incorporated into Soviet State greatly reducing its cultural contacts outside of the 'Soviet Block.' Construction of international style architecture in Georgian cities ceases.

8.10.3.8 Ancient Historical Period (500 BC to Late AD 400s)

The major civilisational influences on Georgia in ancient times were:

- Nomads from the Central Asian Steppes. There was constant contact between Caucasian peoples and horse-riding nomads since about 300 BC onward.

- Persians and Persian Empires. The Achaemenid Empire dominated Eastern Anatolia and the Caucasus directly between approximately 550-330 BC. At that time a number of proto-Georgian groups were pushed northward along the Black Sea coast. Persia's access to Georgia came overland from the south and east, thereby affecting eastern Georgia more directly. Many believe that the Greek influence on Georgian culture is more evident in the later shared Christian traditions and that the Persians had a more profound effect on pre-Christian socio-political systems than did the Greeks. The old Georgian socio-economic system, '*naxarar*' was also more Iranian and less classical. In this system a semi-divine monarchy and a clan structure are the central elements of the political process, as opposed to elected magistrates with a centralised bureaucracy as was the case with Rome and Byzantium. Graphic and other decorative arts of the later Medieval Christian period still showed the strong influence of the Persian artistic tradition.

- The Greeks. Greek traders, and later the conquest of Alexander the Great are just two examples among many of Greek influence on Georgia during the ancient period. Greek presence in, and knowledge of the area is attested to by the writings of Greek historians such as Herodotus and by Greek legends (which were based on experiences that extend back into the Bronze Age). Construction of the Greek trading port of Phasis (Phasii) the Georgian coast of the Black Sea, and the inland distribution of identifiable Greek artefacts are elements of the Greek influence attested to by the archaeological record. The Kingdom of Colchis (Kolkheti) in western Georgia, with its inland capital at Vani was the principal counterpart for Greek trade in the Classical period. The most marked and continuous contact between Greece during the Archaic and Classical periods was via sea trade across the Black Sea. Later a major overland influence came to Georgia as the Greek armies of Alexander defeated the Achmaemenid Persians in the 330s BC, also occupying Georgia.

- Romans and the Roman Empire. The Romans replaced the Greeks as the dominant "Classical Civilisation" competing for control of the Eastern Mediterranean and other adjacent regions. The Roman Legions, led by Pompey, occupied Georgia in the first century BC as part of a successful military campaign against the Parthians of Persia. The writings of the Greek geographer Strabo (Strabon) provide some of the most reliable information on ancient Georgia at the time of the Roman occupation.

There are numerous archaeological sites and excavated monuments from this period. Recent archaeological excavations at the fifth-fourth century BC site of Vani, in Colchis (Kolkheti), have yielded artefacts with Iranian motifs. An archaeological site in the suburbs of Tbilisi that dates to the second to third century AD is the Hellenistic necropolis at Armazis-Khevi near the medieval Iberian capital of Mtskheta. A bowl was recovered there with an inscription in Pahlavi, and other artefacts were recovered that display both Iranian and Classical influence. Parthian gold coin hoards were recovered in Iberia (west Georgia). Other archaeological evidence includes carved stone stele showing seventh century AD Iberian and Armenian nobles wearing Iranian dress.

The most important sites of this period are located on prime agricultural land in alluvial valleys in western and eastern Georgia.

There are no known archaeological sites from this period located within the project corridor. It is possible that remains from this period are present in multi-component sites scheduled for investigation, whose primary remains are presently dated to earlier or later periods. No monuments are reported for this period within the project corridor.

8.10.3.9 Medieval Period (Late AD 400s-1450s)

Indigenous Christianity. The Georgian Christian tradition began shortly before the start of the Medieval period when St. Nino came from Cappadocia (north-eastern Turkey) to evangelize in Georgia in the early fourth century AD. King Mirian of Georgia converted to Christianity in AD 347. The earliest surviving example of the Georgian writing system in Georgia is an inscription in the Bolnisis Sioni Church dating to AD 483, shortly after that time. A slightly earlier inscription has been identified in Jerusalem. (Nearly 800 years earlier, in 4^{h} century BC, the Georgian King Pharnavaz had developed a system of writing for the Georgian language.) . Since the fourth century conversion of Mirian, despite numerous Pagan and Muslim incursions, Georgia has retained its identity as a Christian nation.

- Nomadic Invaders. There was constant contact between Caucasian peoples and Central Asian nomads since the fourth century BC. In the 11th century, the Seljuks appeared. Georgia, however, continued as a united political entity in the face of such invasion, until the later Mongol Period in the 13th and 14th centuries. In the 15th century the Ottomans conquered Anatolia, and as a result they made frequent incursions into the Caucasus. Georgia, Azerbaijan, and eastern Armenia then fell under the rule of the Persians once more, and there was continued fighting between the Turks and the Persians

- Arab Invasions. Beginning in the 7^{h} century the Arabs invaded and held portions of Western Georgia, conquering Tbilisi for the first time in AD 645. During the Arab period, major Georgin centers fell to the Arabs and were again liberated by Christian uprisings. For a period of time in the 9th century, western Goergia was ruled directly by the Islamic "Tbilis Emirate"

- Despite Arab incursions, Byzantium remained a regional Christian power to the south of Georgia throughout the Medieval Period, until it fell to the Ottomans who had invaded the area and established themselves in Anatolia (Turkey)

There are numerous archaeological sites and monuments from this period throughout Georgia. Some structures are complete, well preserved, and still in use. Others are dilapidated. Some remains are in still poorer condition, being limited to foundation stones of main buildings, or sometimes partially standing walls or parts of buildings.

The most significant monument of this period in the vicinity of the project corridor is the Nadarbazevi complex, shown on Figure 8-31. The photograph shows the largest structure of the complex, which no longer has a roof but has standing basalt-block walls preserved up to approximately 5m high. The complex extends over many hectares and includes ruins of a bath, storage facilities, a bakery, defensive walls and other features. It is likely that there are substantial archaeological deposits associated with the complex. Dating to the 12th century, the complex is, based on literary evidence, thought to have been the summer residence for Tbilisi-based Georgian nobles, perhaps including Queen Tamar (1184-1212). The pipeline has been re-routed to avoid passing next to the center of this site. Nonetheless preconstruction investigations are scheduled along the proposed pipeline section that passes near the site.

Figure 8-31 Medieval Nadarbazevi complex; a monument and archaeological site of national importance

A total of eight Medieval Period archaeological sites are located along the pipeline alignment and 126 Medieval Period monuments are located within the 10-km pipeline corridor. Engineering features such as bridges are included on the corridor monuments list from this period. Five of the Medieval archaeological sites are scheduled for subsurface investigation prior to the start of pipeline construction.

8.10.3.10 Modern Period (AD 1450s -present)

Historical themes of the Modern Period include internal political fragmentation in Georgia, as well as influence and aggression from a new mix of foreign powers vying for control of the area. The foreign powers included:

- The Ottoman Turks, who captured Byzantium in 1452 and extended their control westward into the Balkans and southward through the eastern Mediterranean into Egypt. The Ottoman Empire became a force for relative stability and later of secular modernisation in the region. The Ottomans invaded and ruled parts of Georgia until the start of the 19th century, fighting with the Persians for control of the Caucasus

- Persia under the Shiite Safavids expanded its influence in the 1500s directly into the area, taking control of the eastern Caucasus and incorporating Azerbaijan into its Empire. Shiite orientation of Azeri Islam dates from this period. The 16th century also saw Safavid invasions in eastern Georgia. Under the combined threat from Safavid, Persia and Ottoman Turks, and as a result of declining regional overland trade with the Orient, this was a period of decline and fragmentation for Georgia

- The Russian Empire expanded southeastward into the Caucasus under Tsar Nicholas I (1801-1825). Weakening of the Persian Safavids allowed the Russians to enter the eastern Caucasus. The steadily mounting power of Russia throughout this period brought the Russians into a three-way struggle for control of the Caucasus. The three powers were the Ottomans, the Safavids, and the Romanov royal family

- Soviet Union (1922-1991). Georgia and the other Caucasus states were forcibly incorporated into the Soviet Union in the 1920s. Unlike previous Russian Imperial involvement in Georgia, the Soviet Period had the effect of cutting off cultural contact with international traditions. This had a dramatic affect on architecture of all types. Civic buildings including government and cultural structures, residential structures, industrial structures and civil works all took on standard characteristics of the centrally planned Soviet Economy. The effects are still visible in Georgia today, all the more so because many of these Soviet period structures are now abandoned, or transformed by alternative uses

The modern period was a time of regional decline for the Eastern Mediterranean and the Middle East and of national decline for Georgia as well. The European discovery of alternate sea routes to the Orient and the European discovery of the Americas at the end of the 15th century marginalized the formerly central economic role of the Middle East. Centres of Christian political power also moved westward, leaving local Christian communities and states increasingly isolated. Georgia experienced internal fragmentation, splitting into three separate kingdoms in the 1500s. At the same time Tbilisi, once a large and thriving city, shrank to near insignificance, having a population of no more than two thousand households. Subsequent centuries saw only increasing fragmentation and decline. Finally, after the Safavid decline, mounting pressure from the Ottoman Empire compelled the Georgians to take sides with their Russian co-religionists. Georgia became part of the Russian Empire, trading its fragile independence for the security of its Christian tradition. Later, Georgia experienced a short period of independence between the fall of the Romanov Dynasty in the early 20th century and the Soviet take-over of the Transcaucasus a few years later.

Subsurface remains from the pre-Russian part of this period have a legitimate archaeological value in Georgia, although they have not been a major focus of investigation to date. No such archaeological deposits have been identified for the project area. Later subsurface remains (from the Russian and Soviet periods) have not yet taken on archaeological significance.

There are numerous significant monuments from the modern pre-Russian and Russian period throughout Georgia. A total of seventy-one monuments of this period has been identified within the 10-km pipeline corridor. None has been identified for the project area. Such monuments, including churches, theatres, government and residential structures, are most often located in towns or urban centres, which have been avoided by pipeline siting criteria. Engineering features such as bridges are included on the corridor monuments list from this period.

Structures from the Soviet Period are generally not considered to be a positive aspect of Georgia's architectural heritage and are rarely inventoried as historic monuments. None of interest has been recorded within the 10-km project corridor. Some folk monuments of possible local importance, especially religious architecture are recorded on the monuments list. Some of these may require further investigation to confirm their dating and possible importance.

8.10.4 Heritage resources requiring further study

8.10.4.1 Archaeological sites

Fourteen archaeological sites have been selected in consultation with CAS for pre-construction subsurface investigation. These site evaluations are identified by the project archaeological strategy as Phase II investigation. The sites are identified in Table 8-23 and are also mentioned above in Section 8.10.1 under the corresponding period. Many of the sites are, or may be, multi-components sites, that is sites with strata dating to more than one period of time.

Archaeological sites and possible sites identified in aerial photographs but not included on the Phase II evaluation list in Table 8-23 will be subject to further reconnaissance by environmental monitors and archaeologists during the construction 'look ahead' process and Phase IV selective archaeological construction monitoring. The approach to these potential sites will also be reconsidered in light of Phase II field findings.

Depending on Phase II findings, more intensive (data recovery) investigations specified in Phase III of the project archaeology strategy may be undertaken on selected sites.

8.10.4.2 Historic monuments

In total, 219 historic monuments have been identified within the 10km proposed project corridor. A total of 60 of these sites are considered to be of national importance; 99 are considered to be of local importance; the remaining 60 are of lesser importance or lack sufficient information to make such a determination. The monuments were identified through published literature sources supplemented by unpublished but validated field survey data. Most numerous are vaulted churches. There are some basilicas and cross-shaped dome churches. Engineering features such as medieval stone bridges still in use are included on the list. Finally, Bronze Age cyclopean structures and other features dating from II millennium BC are located within the ten-km zone.

Literature review process and consultation with various experts confirmed that the proposed corridor is the best option in terms of limiting possible impacts on monuments. Moreover, the corridor can be further investigated in the course of project. Additional investigation will include recording of precise monument locations, further technical description and study of selected monuments, local inquiry and record searches regarding selected monuments. Precise requirements for further study will be developed jointly by CAS and BP as was done with the Project Archaeology Strategy and will, in part, depend on the siting of additional project support features not on the pipeline alignment itself.

Individual monuments typically have protection zones of 50m in radius while protection zones of monastery complexes and castles vary from 150m to 250m in radius, which also ensures protection of the adjacent natural landscapes and the visual setting (viewshed) of the protected monument. No reserves or protected areas of multiple use are associated with monuments located in the proposed corridor, except for an historical-architecture museum in the Tsalka District. Protection and landscape zones of monuments are specific for each feature and can be accurately indicated once a final option of the corridor and additional support features are defined. It should be noted that some monuments may have unidentified archaeological resources associated with them that could require protection as well.

Owing to initial pipeline siting criteria and some earlier corridor re-routes there are in fact no historic monuments that would be impacted by construction activities in the corridor itself. Monuments already identified within the 10-km corridor could, as mentioned, need additional study as camps, access routes, staging areas, and other temporary or permanent pipeline support facilities are designed and sited.

8.10.5 Significance of Georgian history

The protection of heritage resources from potential project impacts is a straightforward matter of planning, and of implementing practical measures of design and construction. The public value placed on heritage resources, however, is a subjective and culturally variable matter. It is therefore of interest to briefly consider the place of history and the past in Georgian society. A concern for national history and cultural heritage, a common theme in all societies, is unusually strong in Georgia and shows no sign of diminishing. Georgians, more than most, define their identity through a long and well-remembered past. Two Greek myths, well known to Georgians, justify the importance of history and historical awareness to the Georgians: one is the story of Jason and the Argonauts who sought the Golden Fleece in Colchis (Kolkheti); the other is that of Prometheus who stole fire from the Gods in the Caucasus and gave it to the human race. The Golden Fleece legend is widely interpreted as a reference to the ancient Georgian practice of recovering gold from placer deposits using a perforated sheep-skin. The Promethean legend is more abstract but just as significant. Together the two legends suggest to Georgians that since Classical times their country has been widely recognised as a place of wealth and of useful knowledge. The Georgian sensitivity to history and tradition may come in part from being a small nation in an area of frequent imperial involvement, and violent invasion, and from being a Christian nation in an area with numerous adjacent Moslem populations. High levels of interest in history and archaeology are typical of countries in the process of ‘nation building.’ The example of the modern state of Israel can be mentioned as another example. Whatever its explanation, this notable public sentiment contributes to Georgia’s proud and protective attitude towards its tangible cultural remains of archaeological sites, artefacts, and monuments. An additional factor particularly applicable to prehistoric relics is the strong archaeological research tradition that was fostered during the Soviet Period. The volume of archaeological research conducted annually in Georgia has diminished substantially since Georgian independence, but the national interest in archaeology has not. Because the discovery and study of sites and monuments is often a by-product of project preservation measures, the pipeline project has the potential to create positive impacts on Georgian society.

8.11 ECOLOGY

8.11.1 Introduction

This section of the ESIA addresses the following subjects:

- Flora
- Fauna (terrestrial and avian fauna, fish and fisheries)
- Habitats and ecosystems

The first two sections describe the occurrence of floral or faunal species along the proposed pipeline corridor. Section 8.11.3 describes the habitats (interaction of morphological, botanical and faunal elements in a discrete geographical area) that occur along the route and their significance with regards to conservation value, vulnerability and biodiversity.

8.11.2 Flora

This section of the study describes the main types of vegetation and flora along the proposed pipeline corridor. A 500m wide route corridor has been considered for the botanical assessment and was found to include the following phytogeographical units (areas characterised by the similar floristic composition):

- Semi-arid foothills and plain of Eastern Georgia
- Eastern slopes of Javakheti upland towards the Kvemo Kartli Plain
- Javakheti volcanic upland
- Tskhratskaro-Tsikhisjvari-Akhaltsikhe region

In addition to the literature review report (Nakhutsrishvili 2000), a series of field surveys were undertaken (Loria and Kikodze 2001; Nakhutsrishvili 2001) to better evaluate and document the current botanical value of areas identified as potentially sensitive through the preliminary desk based review.

The detailed findings of the Phase I botanical survey of the overall route are summarised in Section 8.11.2.1. The detailed findings of the Phase II site specific surveys carried out in the most sensitive areas along the proposed pipeline route are summarised in Section 8.11.2.2.

8.11.2.1 Botanical description of the route

8.11.2.1.1 Semi-arid foothills and plain of Eastern Georgia (KP0 to KP 54)

The first section of the area of search stretches from the Georgia-Azerbaijan border to Akhali Samgori and is mostly represented by halophilous vegetation (plants that require above average salt concentrations for growth and completion of life cycle) with wormwood and beard-grass dominated communities present only in fragments. The dominant species in the halophilous vegetation are: *Salsola dendroides, S. ericoides, Suaeda microphylla*. In addition to these species, communities of *Kochia prostrata* are widespread.

The scrub of the section is mainly comprised of Christ's thorn *Paliurus spina-christi*, bridewort *Spiraea hypericifolia,* almond *Amygdalus communis*, buckthorn *Rhamnus pallasii*, pears *Pyrus salicifolia, P. demetrii*, etc.

An endemic species to Georgia and Azerbaijan *Iris iberica* - is associated with scrub and wormwood dominated semi-deserts communities. This plant is included into the Red Data Book of Georgia as it is nearly extinct. Initial steps have been taken to conserve *Iris iberica ex-situ* in Tbilisi Central Botanical Garden. A detailed survey of the proposed pipeline route has not, however, revealed the presence of *Iris iberica.*

The next section of the area of search starts in the vicinity of Rustavi and ends in the vicinity of the villages of Karatavla and Aghtagla. These areas mostly comprise agricultural fields. Only small fragments of natural vegetation represented by the vegetation of steppes and semi-deserts are present. The dominant species in the steppes is beard-grass *Bothriochloa ischaemum*. A number of endemic species of the Caucasus and Georgia occur in the beard-grass communities: *Alcea sosnowskyi, Bellevalia wilhelmsii, Onobrychis kachetica, O. cyri, Thymus tiflisiensis*, etc. Patches of halophilous vegetation are also found in this section.

The third section is characterised by more diversity in terms of phytolandscapes and comprises semi-deserts, fragments of beard-grass vegetation and remnants of forest and scrub.

Semi-deserts are dominated by wormwood *Artemisia fragrans*, and occur in lowlands and foothills within this area, for example the Ialghuja Mountain.

According to available literature, *Tulipa biebersteiniana* occurs in this section in the vicinity of the Trialeti Range. *Tulipa biebersteiniana* is a rare species on the verge of extinction and is included in the Red Data Book of Georgia. A survey for *Tulipa* was undertaken in May 2001. Populations of these species were not found to occur within the proposed pipeline ROW at the time of survey. It is not likely that the *Tulipa* plants grow within the impact zone of current route.

There is hardly any forest vegetation in this section. Small fragments survive only on shaded slopes. The following forest species are present as relicts: *Celtis caucasica, Acer iberica, Pyrus salicifolia, Quercus iberica*. Hemixerophylous scrub (semi-arid vegetation) is well-developed and includes *Juniperus oblonga, Cotinus coggygria, Paliuris spina-christi*, and *Spiraea hypericifolia*.

All sections are insufficiently investigated with regard to mushrooms and only few edible mushroom species are known to occur in this area.

The Flora of Spore-Bearing Plants of Georgia (1986) does not list lichens or bryophytes (mosses and liverworts) in any of the sections.

8.11.2.1.2 Eastern slopes of Javakheti upland (KPs 54 to 93)

The study area borders on almost treeless uplands to the west and east. Owing to climatic factors and anthropogenic impact the vertical distribution of forest has been reduced and the occurrence of more or less well-preserved forests is restricted to the rocks and steep slopes.

Forest remnants, which differ in floristic composition from the original woods, occur in the contact zone with the vegetation of the Kvemo Kartli plain; these include remnants of Georgian oak and oriental hornbeam forests, which were once widely distributed throughout East Georgia, mostly in places where there was no agricultural activity. Owing to intensive logging, Georgian oak forest is substituted almost everywhere by hornbeam and oriental hornbeam. Fragments of these oakwoods are distributed throughout the area under consideration. In a number of areas, fragments of more or less well-preserved oak dominated communities occupying limited territories may be found. At higher altitudes Georgian oak is substituted by high-mountainous oak, which forms extensive woods and in general, is less disturbed. At the edge of its vertical distribution, dense forests of high-mountainous oak are replaced by thinned park-like communities. Typical fragments of oakwood and the extent of oak forests are shown in Plates 8-32 and 8-33.

Communities dominated by pine *Pinus kochiana (=P. sylvestris)* occur on stony and rocky slopes. It is still possible to find hazelnut *Corylus iberica*, maple *Acer ibericum*, Hyrcanian maple *Acer hyrcanum*, and elliptic elm *Ulmus elliptica* in remote areas. The following species growing in this area are included in the Red Data Book of Georgia: hazelnut *Corylus iberica*, wych elm *Ulmus glabra*, elliptic elm *U. elliptica*, high-mountain oak *Quercus macranthera*, maple *Acer ibericum*.

Figure 8-32 Oak forest

Figure 8-33 Aerial photo of oak forest shown in Figure above

A number of rare mushrooms are found within the study area: *Cucurbitaria solitaria, Tricholoma virgatum.* The following rare lichens are known to occur within the proposed pipeline corridor: *Leptogium tenuissimon* and *Parmelia ulophylodes.* Rare bryophytes are *Riccia sorocarpa, Polytrichum norvegium, Barbula vinealis, Tortella inermis* and *T. obtusifolia.*

With the exception of detailed studies undertaken within the proposed pipeline ROW, this region is generally poorly studied in both floristic and geobotanical terms.

8.11.2.1.3 Javakheti volcanic upland (KPs 93 to 176)

The flora of this section is characterised by the presence of several rare and endemic species including *Scorzonera kozlowskyi, S. djawakhetica, Asphodeline troitzkii, Campanula crispa, Erysimum krynitzkii, and Crepis sedelmeyeriana.* Common species dominating the vegetation include *Stipa*, *Bromopsis*, *Poa,* and *Agrostis,* none of which have RDB or IUCN conservation status.

There are a number of lakes on Javakheti upland. The vegetation around them is composed of wet meadows dominated by bent *Agrostis alba.* At higher altitudes the wet meadows are substituted by mountain steppes and mesophilous and xeromesophilous (vegetation developed under moderate and moderately dry climatic conditions) meadows.

Limited areas are occupied by *Stipa* steppes where the dominant species are *Stipa pontica* and *S. tirsa*. *Stipa tirsa* is a mesophilous plant, which is often accompanied by *Polygonum carneum, Sanguisorba officinalis, Aetheopappus pulcherrimus, Scabiosa caucasica, Erigeron pulchellus, Campanula trautvetterii, Trifolium trichocephalum.* All these plants are highly decorative. *Stipa tirsa* is very sensitive to grazing and it becomes extinct in areas where intensive grazing takes place. Therefore, the *Stipa* communities have declined and been substituted by drier variants of steppes or arable land.

Steppe vegetation is substituted by sub-alpine meadows at altitudes of 2,300-2,400m. The sub-alpine meadows are very rich in species.

The proposed route crosses a number of meadows characterised by abundant growth of species palatable to grazing animals. The southern slopes are populated by dry grassland with a greater proportion of xerophytes.

Pastures and hay meadows are found in flat areas in the valleys. The main components of hay meadows are *Bromopsis variegata, Bromus erectus, Koeleria caucasica* with the admixture of *Plantago saxatilis, Trifolium ambiguum, Myosotis alpestris,* and *Thymus sp*. An interesting variant of sub-alpine meadow is that dominated by *Poa alpina*. These meadows are characterised by the presence of the rare plant *Bromus adjaricus*.

Flat areas are covered with *Nardus stricta* communities. The species diversity of this community is relatively poor. Areas with skeletal and stony soil cover are populated by variegated fescue *Festuca varia* meadows. These communities are relatively rich floristically.

The dry slopes of the Javakheti upland are densely populated by sedge *Carex humilis (=C. buischiorum)* dominated communities. *Carex humilis* is one example of a plant species widely distributed after the postglacial period.

In Javakheti, the proposed route corridor crosses areas with a high dominance of legumes.

The meadows of the Javakheti upland are of particular interest as they are extremely diverse and contain a number of rare species including *Bromus adjaricus, Erysimum lazistanicum* and *Primula ruprechtii*

The following plant species occurring in the Javakheti upland are included in the Red Data Book of Georgia: *Anchonium elychrysifolium, Papaver pseudo-orientale, Gladiolus djavakheticus, Asphodeline taurica and Corydalis erdelii.*

Rare mushrooms are also found in this area of search (*Guignardia lini, Mycosphaerella implexae var. amplexicola, Tricholoma virgatum*). Rare lichens are represented by *Umbilicaria proboscidea*. Examples of rare bryophytes are *Eucalypta rhabdocarpa, E. vulgaris, Barbula spadicea* and *Grimmia alpestris.*

Owing to intensive grazing, the vegetation on the banks of Lake Tabatskuri is degraded. The common vegetation type comprises meadow dominated by the species of *Sibbaldia* and *Agrostis* with abundant growth of weedy thistle.

With the exception of detailed studies undertaken within the proposed pipeline corridor (Section 8.11.2), the flora and vegetation of the Javakheti upland is relatively poorly investigated. In order to gain a more thorough understanding of species composition in the area there is a need to compile an inventory of rare and endemic plant species and communities requiring protection.

8.11.2.1.4 Tskhratskaro-Tsikhisjvari-Akhaltsikhe region (KP 176 to KP 247.79)

This section comprises two zones:

- Tskhratskaro to Tsikhisjvari (KP 176 to 185)
- Tsikhisjvari to Akhaltsikhe Area (KP 185 to 247.79)

Tskhratskaro to Tsikhisjvari (KP 176 to 185)

The vegetation of this zone is extremely diverse and comprises alpine meadows, sub-alpine tall herbaceous communities, near timberline vegetation and fragments of high-mountain forests.

The alpine vegetation is seriously impoverished owing to overgrazing. The most common plant communities are *Alchemiletum caucasici, Sibbaldietum semiglabrae, Cirsiumetum obvallatae* and, *Festucetum supinae*, all of which are developed in flat areas with mountain-meadow soils. Vegetation cover is approximately 80-90%.

Near timberline vegetation, heavily impacted by human activity and only present as fragments, is the most species-rich vegetation unit in the high mountains. Near timberline forests are composed of birch *Betula litwinowii*, high-mountainous maple *Acer trautvetteri*, rowan *Sorbus caucasigena* and goat willow *Salix caprea*. These plants grow at an altitude of approximately 2,400m. Solitary individuals of pine occur 200m lower. High-mountainous oak is characteristic of the southern slopes at the same elevation.

Sub-alpine forests are patchy in their distribution owing to the heavy human impact that reduces regeneration and limits the distribution area of these fragile plant communities. In many areas solitary individuals of sub-alpine forest forming trees such as birch, rowan or high-mountainous maple can be found. Continuous sub-alpine forests occupy very limited territories as shown on Figure 8-35. Sub-alpine communities dominated by rowan with a mixture of high-mountainous maple is shown on Figure 8-34.

Figure 8-34 Rowan Crook-Stem Forest

Figure 8-35 Aerial photograph of crook stem forest on Kodiana pass

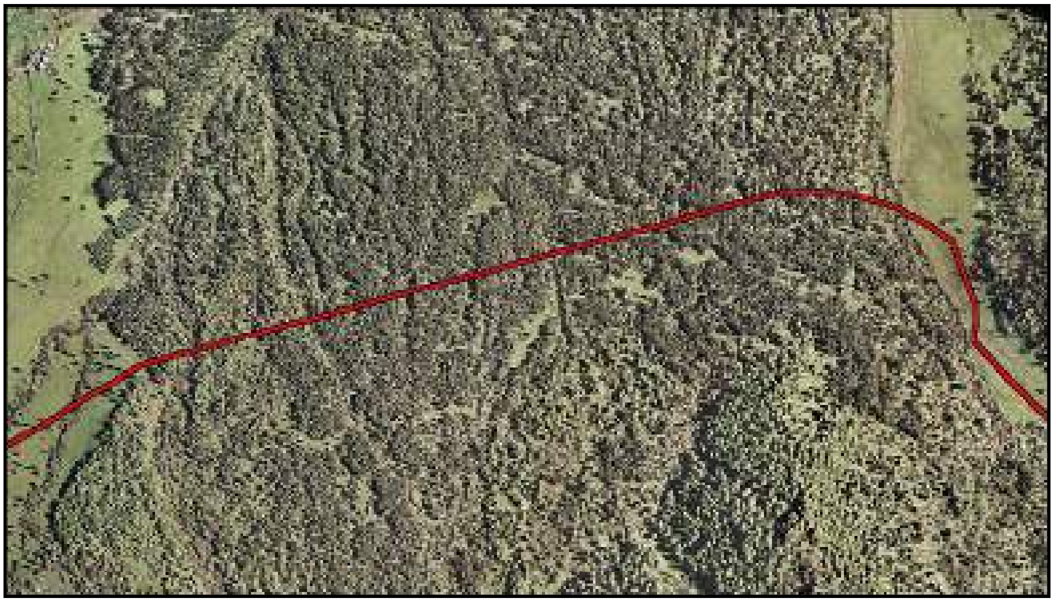
Sub-alpine tall herbaceous vegetation is well-developed in this section of the area of search. This type of vegetation is quite common in the Caucasus. Tall herbaceous vegetation includes the rare and endemic plants *Heracleum pastinacifolium, H. wilchelmsii, Senecio propinquus, S. rhombifolius* and *Grossheimia macrocephala.*

The species composition of sub-alpine meadows within the corridor is diverse. So-called broad-leaved meadows are dominated by *Anemone fasciculata, Betonica macrantha,* and *Trollius patulus.* These communities are very rich floristically. Species present include *Primula ruprechtii, Scilla rosenii, Merendera raddeana, Allium karsianum, Scabiosa caucasica, Psephellus somcheticus, P. transcaucasicus, Doronicum macrophyllum, Senecio caucasigenus* and *S. subfloccosus.*

There are a number of communities dominated by grasses including *Bromopsietum variegatae, Calamagrostid etum arundinaceae and Bromopsietum adjaricus.*

Figure 8-36 Spruce Forest

Figure 8-37 Aerial Photo of Spruce Forest



Beechwoods are well represented in the study area. Their optimal distribution zone is at altitudes ranging from 1,000m to 1,450m. Beechwoods are represented by both, monodominant variants with absolute dominance of beech and, those where beech is accompanied by other woody species. Beech is often accompanied by fir in the Caucasus and west Europe, forming fairly dense forests. Beech-fir forests are more common in West Georgia, while beech-spruce forests are most common in the study area. Spruce forests are represented in both continuous variants occupying larger areas and rather isolated patches with obvious signs of human destruction. Typical fragment of spruce forest and aerial photograph showing the extent of spruce dominated forest communities are shown on Plates 8-36 and 8-37 respectively.

Slopes with a southerly exposure are populated by high-mountainous oak, often accompanied by Caucasian pear *Pyrus caucasica*, maples *Acer campestre, A. pseudoplatanus*, and sometimes *Ostrya carpinifolia.*

Primary forests of spruce, beech, and beech-spruce are well developed in the vicinity of the village of Tsikhisjvari. Considerable areas are occupied by tall herbaceous vegetation.

The following species occurring in this area are included in the Red Data Book of Georgia: Ketskhoveli carnation *Dianthus ketzkhoveli*, ragworts *Senecio rhombifolius, S. massagetovii*, *Pseudopodospermum leptophyllum*, *Ostrya carpinifolia*, high-mountainous oaks *Quercus macranthera*, *Quercus pedunculifolia*, elliptic elm, wych elm, *Iridodictyum winogradowii*, and *Tragopogon meskheticus.*

The following rare mushrooms occur in the study area: *Guignardia durmitorensis, Laestadia millepunctata, Leptosphaeria agnita, L. carpogena, Lophiostoma caulinum, Suillus variegatus, Hygrophorus erubescens, Clitocybe tornata, Calocybe onychina, Mycena capillarus, Amanita inaurata, Cortinarius flexipes, Lactarius ichoratus, L. rufus, Collybia retigera, Monochaetia depazeoides, Phoma landelii* and *Lophiostoma caulinum.*

Lichens in the study area are represented by *Baeomyces rufus, Biatora symmiata, Buellia microcarpa, Calicium sphaerocephalum, Chaenoteca brunneola, Collema limosum, Diploschistes cretaceus, Hypogimnia bitteri, Lecidea hypoptella, Menegazia pertusa, Ochrolechia arborea, Opegrapha lithizga, Peltigera oleginii, Pertusaria coronata, Ramalina baltica, R. angustissima, Usnea caucasica, U. microcarpoides* and U. *perplexans*.

Common mosses in this section are: *Calipogeia media, Amphidium mongeotii, Leucobryum glaucum*, and *Barbula revoluta*.

Owing to intensive logging and invasion of bark beetle 40-50 years ago, forested areas have drastically decreased in the Tsikhisjvari surroundings over the recent years.

The flora of the region as a whole is poorly studied. With the exception of the detailed studies undertaken within the pipeline corridor, there is very little accurate data on the distribution of rare and endemic species within the region.

Tsikhisjvari to Akhaltsikhe Area (KP 185 to 247.79)

This section of the proposed route corridor goes from Tsikhisjvari towards Sakire, crosses the Akhaltsikhe region in the direction of Tiseli and continues on the left bank of the River Mtkvari, ending at the Georgia-Turkey border. The vegetation cover of this section is distributed from 900m to 1,800m.

Three vertical belts of vegetation are distinguished on the slopes of the mountains surrounding Akhaltsikhe. The lower forest belt is composed of oak-hornbeam and oak-oriental hornbeam forests; the middle belt is represented by spruce forests with a mixture of pine and beech and fragments of fir-spruce and beech-fir forests; and the upper forest belt, which used to be occupied by sub-alpine crook-stem forests, are now substituted by secondary meadows owing to logging and grazing which has supressed the natural regeneration of the forest. Pine forests are developed at lower altitudes occupying dry and stony sites. The proposed pipeline route crosses all these vegetation types and goes down to the xerophytic phytolandscapes of the Akhaltsikhe depression. Xerophytic plant communities of Akhaltsikhe contain local endemic species including *Dianthus azkurensis, Astragalus argillosus, A. meskheticus, A. kozlovskyi, Campanula raddeana, Tripleurospermum rupestre, Jurinea carthaliniana* and *Psephellus meskheticus.*

Figure 8-38 Alpine Meadow

Figure 8-39 Aerial Photo Alpine Meadow

On Kodiana pass highly diverse alpine vegetation is developed including a number of species of high conservation value such as rare and endemic taxa. Plates 8-38 and 8-39 show a typical fragment of alpine meadow and associated aerial photograph.

The Red Data Book species *Nitraria schoberi*, genetically related to desert flora, is of special importance in this area.

As for other endemic species, the following are likely to be present in the study area: *Cerastium argenteum, Onobrychis meskhetica, Helianthemum georgicum, Reaumuria kusnetzovii, Salvia compar* and *Scrophularia diffusa*.

The following lichens occur in the Akhakltsikhe area: *Endocarpon pussilum, Peltigera malacea, Physcia tribacia, Aspicilia caesiocinerea, Placolecanora radiosa* and *Xanthoria polycarpa.*

With the exception of detailed botanical studies undertaken along the route, there has been no detailed ecological-geobotanical research conducted in this region.

8.11.2.2 Detailed botanical assessments

Detailed botanical assessments were carried out in several areas along the route that, on a preliminary basis, had been deemed particularly sensitive to anthropogenic activities. The surveys were undertaken in April-May and September 2001. The limitations of the surveys were a limited number of days in the field to undertake comprehensive floral inventory; and as the flowering/fructification period of many species varies greatly from January to late November, it is impossible to catch all species in the phase when their identification is possible.

In three of the areas studied, (Tetritskaro, Narianis Veli and Tori) the pipeline has been re-routed because of the high conservation value and therefore the findings of the assessments have become irrelevant to this study. A summary of these assessments and a description of the process that culminated in re-routing are enclosed in *Section 4 - Project Alternatives.*

A key objective of the flora research in areas of botanical interest was to identify and collect quantitative data on plant communities and species of high conservation value that occur immediately or in the close vicinity of the proposed pipeline ROW. Another main objective was to recommend adequate mitigation measures to compensate potential loss of populations of individual species and destruction of important habitats.

In assessments of the botanically important and sensitive areas, internationally recognised standard methodology has been used. Sample plots to study important vegetation units along the proposed route in sensitive areas were determined by selective sampling. This involved subjective selection of the sampling points identified to be representative of a community type or contain a special feature such as species of high conservation value. Sizes of the sample plots in forest, scrub and meadows were determined according to the recommendations of Tüxen (1970). Minimal sample plot area is 400m^2 for deciduous forests, 100m^2 for scrub and 10m^2 for meadows. Preference was given to the square shape of the sample plots. As the pipeline route goes through various types of forests and meadows, it was divided into sections each crossing more or less uniform forest / meadow. GPS (Global Positioning System) co-ordinates of the start and end, points of sections were recorded and the length of each section was measured using GIS (Geographical Information System).

Cover (%) was estimated as the percentage of ground occupied by a perpendicular projection of the aerial parts of the species. Cover was measured by the method of a visual estimation. A 10-point Domin scale of cover-abundance (see Table 8-25 below) was used to avoid underestimation of the importance of species with scattered individuals (Morris & Therrivel, 1995).

Table 8-25: Domin scale of cover-abundance

Points	Cover-Abundance
+	One individual, reduced vigor
1	Rare
2	Sparse
3	<4%, frequent
4	5-10%
5	11-25%
6	26-33%
7	34-50%
8	51-75%
9	76-90%
10	91-100%

The criteria recommended by Morris & Therivel (1995) were used when assessing the importance of various forest communities (refer to Table 8-26). Additionally, primary forests, which were thought to be remnants of primeval forests, were given a high conservation value.

Table 8-26: Summary of criteria recommended by Morris & Therivel

Conservation Value			
Criterion	**High**	**Medium**	**Low**
Species richness	High species richness noted or likely to occur. Endemic or threatened species included in the Georgian Red Data Book and/or IUCN Red List recorded or likely to be present	Medium species diversity. Few rare or threatened species	Very low species diversity and almost no threatened species that may be affected
Naturalness and level of modification	Natural or slightly modified habitats	Moderately modified habitats eg those which can still support characteristic species assemblages	Heavily modified habitats
Human disturbance	Very little or no human disturbance	Little human disturbance	High human disturbance (heavy grazing, forest felling, etc)
Rarity and geographical location of habitat	Rare or endangered habitat in the country or region.	Not so common habitat in the region	Common habitat. Areas near human settlements

The areas of high botanical interest which, are still part of the proposed pipeline corridor, are described below. These areas are shown on Figure: Map 8-11a-e.

8.11.2.2.1 Tetritskaro re-route

General Information on Study Area

The study area includes a section of the proposed pipeline route in the Tetritskaro administrative district from the village Duget-Khachini to the southern edge of Bedeni plateau (KP 74-94). The pipeline route section crosses agricultural fields, scattered scrub, forest margins, various types of forests and mountain meadows. The altitudes range from 800 to 1700m AMSL. The total length of the pipeline route section from the start point at the proposed River Geti crossing location to the edge of Bedeni plateau is approximately 20km.

Results

Forests are the most important habitats of high conservation value in the study area. Although all forests and woodlands are sensitive to construction activities, the primary forests developed on the southern slope of Bedeni Ridge and the park-like forests developed from the south-east of Cherepanovka Lake to the southern edge of Bedeni Plateau are of particularly high conservation value. These forests are mostly dominated by high-mountainous oak, included in the Red Data Book of Georgia (GRDB). The forests of high-mountainous oak used to be widespread in Georgia, but are declining now owing to heavy human impact. The regeneration rate is very low, and almost no saplings and seedlings were observed in these forests during the survey. Important forest communities are those dominated by beech (Sites 9,18). A small fragment of beech forest was discovered approximately 200m west of the proposed ROW (Site 21). Pure beechwoods are very rare in Tetritskaro region. Therefore, the above fragments are of high conservation value owing to rarity on a regional level. The forests developed along the route section from the Geti crossing to the Chiv-chavi crossing are of secondary origin, developed on the areas once occupied by primary forests of Georgian oak. Grazing, logging and tree cutting for firewood heavily impact these communities, as they are located in the close vicinity of settlements.

Table 8-27 below provides a list of the forest types studied and their conservation values.

Table 8- 27: Forest types and conservation value

Site	Community Type	Conservation Value
1	Degraded Georgian Oak Forest with abundant growth of shrubs	Low to Medium
2	Degraded/Secondary Georgian Oak Forest	Low to Medium
3	Secondary Georgian Oak Forest with Oriental Hornbeam	Low to Medium
4	Secondary Georgian Oak Forest with admixture of High-Mountainous Oak	Low to Medium
5	Secondary Georgian Oak Forest with admixture of High-Mountainous Oak	Low to Medium
6	Primary Georgian Oak Forest with Admixture of High-Mountainous Oak	High
7	Fragment of Riparian Forest	High
8	Secondary Caucasian Hornbeam Forest with Admixture of Oaks	Low to Medium
9	Beechwood	High
10	Secondary Caucasian Hornbeam Forest with Admixture of High-Mountainous Oak	Medium

Site	Community Type	Conservation Value
11	Primary High-Mountainous Oak-Caucasian Hornbeam Forest	High
12	Secondary Caucasian Hornbeam-High Mountainous Oak Forest	Medium
13	Secondary High-Mountainous Oak Forest	Medium
14	Secondary Thinned High-Mountainous Oak Forest	Low to Medium
16	Secondary High-Mountainous Oak Forest	Medium
17	Primary High Mountainous Oak-Caucasian Hornbeam Forest	High
18	Beechwood	High
19	Thinned High-Mountainous Oak Forest	Low to Medium
20	Thinned High-Mountainous Oak Forest	Low to Medium
21	Fragment of Beech Forest with Caucasian Hornbeam	High
22	Park-Like High-Mountainous Oak Forest	High
23	Park-Like High-Mountainous Oak Forest	High

Although the re-route developed in July 2001 avoids the site where the population of Georgian endemic pasqueflower (*Pulsatilla georgica*) has been recorded during the spring survey, it still goes through a similar habitat (Figure 8-40). Owing to the late season, it was not possible to identify pasqueflower individuals within the proposed ROW that crosses through the meadow community, but based on the similarity of conditions and proximity to the pasqueflower occurrence it is anticipated that the changed route will still have an impact on the fragile populations. *Pulsatilla georgica* is a dwarf herbaceous plant up to 10cm in height with densely pubescent leaves, stems and petals. Pasqueflower is regarded as locally endemic as it is known to grow only in three localities in Georgia, all within the Trialeti area.

Figure 8-40 *Pulsatilla georgica* in flowers

Mountain Tavkvetili Wetlands (KP 152.4)

General Information on Study Area

Study area comprises a 200-300m section of the proposed pipeline route at the base of Tavkvetili mountain. The pipeline route section crosses the high mountain habitat dominated by meadow vegetation with a patchy distribution of wetland communities.

Results

During the survey of the study area, two small isolated wetland patches have been found on the eastern base of Tavkvetili mountains each occupying an area of approximately 5,000m^2. Parts of these wetlands are located within the ROW. Floristic survey and phytosociological analysis of the wetland communities showed that both wetlands are dominated by sedge *Carex inflata* and have similar floristic composition. The limited number of herbaceous species has been developed on the substrata with the high ratio of turf accumulation. The moss layer is represented by Hypnum-like bryophytes that are indicating the process of turf accumulation. The wetlands are fed both by groundwater and surface water flows and developed on the bottom of a dried lake.

A number of types of wetland communities dominated by *Carex inflata* are found in both the Greater and Lesser Caucasus (Kimeridze, 1963), although the vegetation dominated by this species never occupies waste areas owing to its patchy distribution. As a result of changes in the groundwater table level, decrease of precipitation level and drying up of the wetlands by man, sedge dominated high-mountain wetlands are becoming extinct or floristically impoverished in many areas of Georgia. Any fragment of wetland vegetation that is developed in the sub-alpine belt falls under the category of high conservation value owing to rarity, heavy anthropogenic pressure and low restoration potential.

Figure 8-41 Tavkvetili Wetlands

8.11.2.2.2 Tskhratskaro Pass – Kodiana Pass (KP 176-193)

Generali information on study area

The study area comprises a section of the proposed pipeline route from Tskhratskaro Pass to Kodiana Pass, approximately 7km north-west of village Tsikhisjvari. The pipeline route section crosses alpine meadows, various types of primary forests and scrub. The altitudes range from 1,700 to 2,500m. A total length of the pipeline route section surveyed is approximately 17km.

Results

In total, sixteen representative plots of various plant communities were surveyed. Eight sites (NN 2, 5, 10, 12, 13, 14, 15 and 16) were classified as being of high conservation value as they comprise primary crook-stem birch forests, beech forests with pine and species rich alpine communities.

The community of crook-stem birch forest is typical for the sub-alpine belt. However, it is almost entirely destroyed on a country level. The dominant species of the tree layer birch *Betula litwinowii* and the shrub layer *Rhododendron caucasicum* are endemic species of the Caucasus. Two areas of crook-stem birch forest (Sites 2 and 5) are located within the proposed ROW while one (Site 14) is approximately 145m south of the current route.

The other three sites (10,12 and 13) comprise a forest where two ecologically different species, namely beech *Fagus orientalis* and pine *Pinus sylvestris* prevail in the tree layer. In addition, there is a small population of an endemic species of the Caucasus – *Scilla rosenii* on Site 12. *Scilla rosenii* (family Liliaceae) is a decorative bulbous plant that grows in the sub-alpine meadows and upper mountainous belt. It reaches 7 to 10 cm in height. The flowering period is May. The total length of sites of high conservation value to be crossed by the proposed route is approximately 4,830m.

A thinned primary pine forest with high-mountainous maple (Site 7) was classed as being of medium to high value. It supports a small population of snowdrop *Galanthus caucasicus* which is a rare species of Georgia and endemic of the Caucasus. It is proposed for inclusion into a new edition of the Georgian Red Data Book. *Galanthus caucasicus* (family Amaryllidaceae) is a decorative bulbous plant (geophyte) with narrow elongated greyish leaves. It reaches 10 – 15 cm in height. The flowering period is March-April. It occurs in forests, scrub and forest margins. Three sites (8, 9 and 11) comprising well-developed primary pine forests, though disturbed to various degrees, were also classified as being of medium to high conservation value. The total length of sites of medium to high conservation value crossed by the proposed route is approximately 2,800m.

Sites 15 and 16 comprise alpine meadows supporting populations of the following Caucasian endemic species: (a) Site 15 – *Scilla rosenii*, and (b) Site 16 - *Scilla rosenii* and *Gentiana angulosa*.

Figure 8-42 *Gentiana angulosa*

Gentiana angulosa is a decorative plant reaching only 5cm in height. It grows in alpine meadows of the Great and Minor Caucasus. The flowering period is May.

Some of alpine meadows located within and adjacent to the proposed pipeline route are overgrazed and used intensively as hay meadows. As a result, they do not have high conservation value in floristic terms.

Table 8-28 below provides a list of the vegetation types studied and their conservation values.

Table 8-28: Types of plant communities surveyed and conservation value

Site	Community Type	Conservation Value
1	Overgrazed Alpine Meadow	Low
2	Crook-Stem Birch Forest	High
3	Variegated Fescue Meadow	Medium
4	*Rhododendron caucasicum* scrub	Medium
5	Crook-Stem Birch Forest	High
6	Hay Meadow	Low
7	Thinned Pine Forest with High-Mountain Maple	Medium to High
8	Thinned Pine Forest	Medium to High
9	Pine Forest	Medium to High
10	Beech Forest with Pine	High
11	Thinned Pine Forest	Medium to High
12	Beech Forest with Pine	High
13	Beech Forest with Pine	High
14	Crook-Stem Birch Forest	High
15	Alpine Meadow	High
16	Alpine Meadow	High

8.11.2.2.3 Sakire – Potskhovi Crossing Area (KP 199-243)

General information on study area

The pipeline route in the study area crosses agricultural fields, scattered scrub, forest margins, various types of forests and mountain meadows. Altitude ranges from 980 to 1,950m. The total length of the pipeline route section from the start point in the surroundings of the village Sakire to the west bank of the River Potskhovi is approximately 44km.

Results

As the sensitive sites are located along the various sections of the route, the study area was subdivided into two zones:

- Area from Sakire surroundings to Tkemlana village
- Areas in the vicinity of the Mtkvari and Potskhovi crossings

Zone 1

Eleven sites were studied within this zone representing various types of both coniferous and broad-leaved forests and scrub dominated by the sea buckthorn. Four sites were classified as being of high conservation value as they represent primary coniferous forests with high regeneration rate and high coverage of tree layer.

The other sites are disturbed and there is a clear evidence of destructive human activities, such as logging and cutting for firewood. These have resulted in thinned tree layer and increased number of meadow and weedy elements of flora in the herbaceous layer. However, these sites were still given medium to high conservation value status owing to the following:

- High restoration potential based on the fairly dense growth of saplings in the understorey
- The presence of Red Data Book species
    - high-mountain oak *Quercus macranthera* - Sites 9 and 10
    - sea buckthorn *Hipopphaë rhamnoides* - Site 11

Community types surveyed in Zone 1 and corresponding conservation values are given in Table 8-29.

Table 8-29: Community types surveyed within Zone 1 and conservation value

Site No.	Community Type	Conservation Value
1	Thinned Spruce-Pine Forest	Medium to High
2	Spruce Forest	High
3	Spruce Forest	High
4	Thinned Spruce Forest	Medium to High
5	Thinned Spruce Forest	Medium to High
6	Spruce Forest	High
7	Thinned Spruce-Fir Forest	Medium to High
8	Spruce-Fir Forest	High
9	Fragment of High-Mountainous Oak Forest	Medium to High
10	Fragment of High-Mountainous Oak Forest	Medium to High
11	Sea buckthorn dominated shrubwood	Medium to High

Zone 2

Four sites (12, 13, 14, and 15) were studied within this zone comprising riparian forests developed on the banks of the Rivers Mtkvari and Potskhovi and a dry hill 400 south of the proposed Potskhovi crossing where *Nitraria schoberi* (GRDB) was likely to grow according to preliminary information.

Riparian forest developed on the western bank of the River Mtkvari (Site 12) in the vicinity of the proposed crossing is a remnant of a primary forest intensively disturbed as a result of human activities. Cutting of poplars to clear land for agricultural activities has resulted in a low coverage of the tree layer, and a high ratio of weedy herbaceous species in the herb layer that suppresses natural regeneration.

Riparian forests on both banks of the River Potskhovi, in the vicinity of the proposed crossing (refer to Plates 8-43 and 8-44), are of a primary origin (Sites 13, 14), though degraded owing to human interference. A considerable part of the natural forest has been cleared for agricultural purposes on the southern bank of the River Potskhovi (Site 14). Despite the obvious signs of destructive human activities, the riparian forest fragments are of medium to high conservation value as this habitat type hasdeclined significantly throughout the country and it is important to conserve even small and degraded fragments as a basis for further restoration.

No individuals or populations of *Nitraria schoberi* were found to occur in the area despite thorough surveys along the route section that crosses the dry hill 400m south of the River Potskhovi.

However, another Red Data Book species – *Globularia trichosantha* (family Globulariaceae) was found to grow on a limited area of 1,500m^2, approximately 150m west of the pipeline ROW (Site 15). This plant (Figure 8-45) was not known before to occur in southern Georgia (Flora of Georgia, 1999). *Globularia trichosantha* is a herbaceous plant reaching 30cm in height. It forms small populations in dry areas at forest margins, screes and open meadows. Although the habitat itself is common throughout Georgia, it was classified as having high conservation value owing to the presence of a rare Red Data Book species.

Table 8-30: Community types surveyed within Zone 2 and conservation value

Site No.	Community Type	Conservation Value
12	Thinned Riparian Forest of Black Poplar	Medium to High
13	Riparian Forest of Black Poplar	Medium to High
14	Riparian Forest of Willow	Medium to High
15	Shibljiak / Open Meadow	High

Figure 8-43 Riparian Forest at Potskhovi river crossing

Figure 8-44 Aerial Photo of riparian forest at Potshkovi crossing

Figure 8-45 ***Globularia trichosantha***

8.11.3 Fauna

8.11.3.1 Introduction

The proposed route corridor passes through three zoogeographical areas: Caucasus, Kartli-Kakheti Plain and Meskhet-Javakheti. These areas are further divided into five zones in zoological terms:

1. Lower Kartli
2. Trialeti Mountain Range (section between the village of Matsevani and Tsalka)
3. Tsalka -Tskhratskaro Pass
4. Tskhratskaro Pass to Akhaltsikhe Structural Basin
5. Akhaltsikhe Structural Basin

A literature review (Butkhuzi *et al* 2001) has identified information on each of these geographic sections for mammal, bird, reptile, amphibian and invertebrate categories. The literature review is summarised in the following sections. Sensitive wildlife habitats are shown in Figure: Map 8-12a-c.

Detailed faunal assessments were also carried out in the field (Macharashvili 2001; Darchiashvili 2001; Natradze 2001; Lortkipanidze 2001; Javakhishvili 2001; Pichkhadze and Kokosadze 2001) at six specific locations where the preliminary evaluation highlighted potential significant issues with regard to the faunal distribution. These locations were:

- Marshes South-West of Kesalo (no longer along proposed route and described in Section 4 *Project Alternatives*)
- Tetritskaro Area
- Eastern Part of Tsalka Reservoir and Lake Aligel
- Narianis Veli Wetlands, Ktsia wetlands and Tavkvetili mountain
- Tskhratskaro – Tiseli Area
- Riparian Areas at Mtkvari and Potskhovi Crossings

Summaries of the findings of these detailed assessments are enclosed in Section 8.11.3.6.

The following abbreviations are used in the tables included in this section:

IG – Information Gap
GRDB – Species included in the Georgian Red Data Book
EN – Endangered according to the IUCN Red List Categories
CR – Critically Endangered according to the IUCN Red List Categories
LR – Low Risk according to the IUCN Red List Categories
VU – Vulnerable according to the IUCN Red List Categories
CE – Caucasian Endemic
NT – Near Threatened
DD – Data Deficient

8.11.3.2 Mammals

Table 8-31 below summarises the rare and endangered species of mammals that can be found along the proposed pipeline route.

Table 8- 31: Mammal species and conservation status

Species Present in Area (common names)	Species Present in Area	Current Numbers and Trends	Breeding Season	Migratory Routes	Draft Georgian Conserva-tion Status	IUCN Conserva-tion Status	Habitats
Golden jackal	*Canis aureus*	Not evaluated/ Stable	Winter-Spring	Entire Trialeti Range	LR	-	Every-typical species
Red Deer	*Cervus elaphus*	Extremely rare/ Decreasing	Autumn	IG	CR	-	Riparian forests
Wild cat	*Felis silvestris*	Not evaluated/ Stable	Winter-Spring	IG	LR	-	Forests, bush
Marten	*Martes spp.*	Not evaluated/ Stable	Mostly spring	Entire Trialeti Range	LR	-	Forests
Brown bear	*Ursus arctos*	Rare/ Decreasing	Winter	Entire Trialeti Range	CR	-	Every-typical species
Lynx	*Lynx lynx*	Extremely rare/ Decreasing	Winter-Spring	Entire Trialeti Range	CR	-	Forests
Roe deer	*Capreolus capreolus*	Abundant/Stable	Autumn	Entire Trialeti Range	LR	-	Every-typical species
Wolf	*Canis lupus*	Common/ Stable	Winter-Spring	Entire Trialeti Range	LR	-	Every-typical species
Otter	*Lutra lutra*	Extremely rare	Any time of year	IG	CR	VU	Rivers, fresh water reservoirs
Jungle cat	*Felis chaus*	Extremely rare	Winter-Spring	IG	CR	-	River flood plains, reed beds
Persian squirrel	*Sciurus anomalus*	Not evaluated/ Decreasing	Any time of year	IG	CE	LR/NT	Forests

Small mammals of the area are less studied in terms of abundance, fluctuation rate and migration routes. The sections below describe the faunal units along the route.

8.11.3.2.1 Lower Kartli

The zone consists of a large area of alluvial floodplain with a complex system of canals. The areas around the proposed major river crossings are areas of high significance (Khrami, which is beyond the impact zone of the currently proposed route and Algeti, KP 53 – KP 54) and are known to support endangered species, including otter, red deer, wolf, jungle cat and wild-cat.

The impacts of human activity and disturbance facilitate an ongoing tendency for the populations of these species to decline.

8.11.3.2.2 Trialeti mountain range (Section between Village of Matsevani and Tsalka)

The section is very important from a zoological point of view. It connects the Great Caucasian Ridge (GCR) with the Lesser Caucasus (CM) and acts as a corridor between the two for the migration routes of those species, which have populations on the GCR and CM. It is crucial that this corridor is maintained to prevent the extinction of isolated populations and maintain their high genetic diversity and spatial structure. These two criteria are most important in determining population viability and a self-supporting population.

The following species have been recorded in the GCR and CM: brown bear, lynx, roe deer, wolf, wild cat and Persian squirrel.

The area also has a complex network of springs and rivers, which support the critically endangered river otter and some other species directly dependent on freshwater habitats.

8.11.3.2.3 Tsalka - Tskhratskaro Pass

Natural and artificial waterbodies are present in this section, which are unique in biodiversity terms. The IUCN and Georgia list a number of species, directly dependent on the wetlands, as threatened, for example otter. From the zoological point of view the lakes / reservoirs and adjacent sites should be regarded as entire "sub-habitats". As a result, there is a "set" of important sites, such as lake Tabatskhuri and the Tsalka reservoir, which support a number of different mammal populations.

8.11.3.2.4 Tskhratskaro Pass to Akhaltsikhe structural basin

This section is a connecting point between the Meskheti and Trialeti mountain ranges and, as such, is significant in faunal terms. The River Mtkvari and a highway traverse these ranges. However, neither is a serious obstacle for inter-migration of large mammals between the ranges. Therefore, it is a vital area that enables gene flow between animal populations of both ranges. Rare/engendered species recorded in this zone are: golden jackal, red deer, wild cat, hare, marten, wild boar, fox, brown bear, lynx, roe deer and wolf.

8.11.3.2.5 Akhaltsikhe structural basin

Although adjacent to the previous section, the two differ significantly in landscape, and subsequently, in species composition. The section is quite poor in ungulates, which are mainly represented by wild boar and roe deer, but rich in small mammals and representatives of

Chiropters (bats). Carnivorous species are generally the same as those present in the previous section.

8.11.3.3 Avian fauna

The route of the proposed pipeline crosses a number of areas, which are extremely rich in avian fauna. The sections below provide a brief description of the avian habitats encountered in the five main geographic districts of Georgia. A comprehensive list of the potentially endangered species that are believed to be present along the proposed route corridor and adjacent areas, based on literature sources, is presented in Table 8-32. The table also lists the conservation status of the different species. The species recorded during the Phase II surveys and the detailed faunal assessments are given in Section 8.11.3.6.

Table 8-32: Bird species of conservation concern (included in the IUCN Red List of Threatened Species or Georgian Red Data Book - GRDB)

Species Present in the Area					
English Name	**Scientific Name**	**Breeding Season**	**Georgian Conservation Status**	**IUCN Conservation Status**	**Habitats**
Caucasian Black grouse	*Tetrao mlokosiewiczi*	Second half of May	GRDB	DD	Sub-alpine meadows
Grey partridge	*Perdix perdix*	Second half of April	GRDB	-	Slopes of low mountains and hills with tall grass and sparse shrub
Purple gallinule	*Porphirio porphirio*	First half of April	GRDB	-	Still inner waters and slow rivers with reeds and other aquatic vegetation
Corncrake	*Crex crex*	Beginning of May	VU	VU	Wet meadows with high grass and bushes
Common crane	*Grus grus*	April	GRDB	-	Reed banks of marshes and Lakes
Sociable plover	*Chettusia gregaria*	Beginning of June	VU	-	Dry, open areas and saline lands with poor vegetation
Great snipe	*Gallinago media*	End of May	LR:NT	LR/NT	Marshes and damp meadows with sparse bush
Black stork	*Ciconia nigra*	Second half of April	GRDB	-	Dense forests near water, marshes
Peregrine falcon	*Falco peregrinus*	Second half of March	GRDB	-	Forests surrounded by open fields and meadows
Lanner falcon	*Falco cherrug*	End of April	GRDB	-	Deciduous, or mixed forests with large open areas
Lesser kestrel	*Falco naumanni*	Second half of May	VU	VU	Open areas, dry river beds and semideserts
White-tailed eagle	*Haliaetus albicilla*	First half of March	LR:NT	LR/NT	Shores of reservoirs rich in fish, with high trees suitable for nesting
Griffon vulture	*Gyps fulvus*	Beginning of April	GRDB	-	Dry, open areas in mountains and lowlands with suitable nesting sites such as rocks, hills, etc
Black vulture	*Aegypius monachus*	Beginning of March	LR:NT	LR/NT	Main habitat is mountains
Bearded vulture	*Gypaetus barbatus*	End of December, beginning of January	GRDB	-	Rocky places of sub-alpine and alpine zones
Golden eagle	*Aquila chrysaetos*	March	GRDB	-	Mountains
Imperial eagle	*Aquila heliaca*	April	VU	VU	Woodlands in large open areas, riparian forests
Greater spotted eagle	*Aquila clanga*	May	VU	VU	Light forests near water reservoirs, marshes and flood plain forests
Short-toed eagle	*Circaetus gallicus*	Second half of April, beginning of May	GRDB	-	Dry habitats that are rich in reptiles
Osprey	*Pandion haliaetus*	End of April, beginning of May	GRDB	-	Forests at reservoirs that are rich in fish

Species Present in the Area					
English Name	**Scientific Name**	**Breeding Season**	**Georgian Conservation Status**	**IUCN Conservation Status**	**Habitats**
Great rosefinch	*Carpodacus rubicilla*	End of may, beginning of June	GRDB	-	High mountains, alpine zone up to nival belt (ie the upper zone of the mountains under permanent snow cover).
Woodchat shrike	*Lanius senator*	May	GRDB	-	Sparse forest, scrub, orchards mainly in lowland dry areas
Firecrest	*Regulus ignicapillus*	first half of may and end of June	GRDB	-	Coniferous forest, mixed forest with shrub undergrowth, juniper forests

NB: breeding season implies the start of the breeding season. For majority of species the breeding season finishes by the end of August.

8.11.3.3.1 Lower Kartli

The proposed route corridor mostly passes through Gardabani district in Lower Kartli. The relief is mainly hilly with open plains in a number of areas. The majority of the area is used for agricultural activities, namely as arable land and / or pastures. Common type of vegetation is shibliak scrub. Marshy meadows occur along the banks of minor rivers and streams. There is a lack of detailed ornithological information in the literature. In total, eighteen (18) bird species are described in this area. This number is nowhere near to total number of bird species that occur here. The following rare species are described for this area: Sociable plover (*Chettusia gregaria*) and Saker falcon (*Falco cherrug*).

Table 8- 33: List of bird species described in the literature for the Lower Kartli region

Common Name	Scientific Name
Quail	*Coturnix coturnix*
Coot	*Fulica atra*
Purple gallinula	*Porphirio porphirio*
Dotterel	*Charadrius morinellus*
Sociable plover	*Chettusia gregaria*
Red-necked grebe	*Podiceps grisegena*
Glossy ibis	*Plegadis falcinellus*
White stork	*Ciconia ciconia*
Purple heron	*Ardea purpurea*
Saker falcon	*Falco cherrug*
Eagle owl	*Bubo bubo*
Starling	*Sturnus vulgaris*
Chaffinch	*Fringilla coelebs*
House sparrow	*Passer domesticus*
Yellowhammer	*Emberiza citrinella*
Black-headed bunting	*Emberiza melanocephala*
Meadow pipit	*Anthus pratensis*
Rock nuthatch	*Sitta neumayer*

8.11.3.3.2 Trialeti Mountain Range (Section from Village of Matsevani to Village of Tsalka)

The forested mountains in the vicinity of Tetritskaro include an area of ornithological interest. The altitudes of mountains reach 1,500m AMSL. Dominant tree species are high-mountain oak and beech. There is no understorey in the forests. Blackthorn, hawthorn and dog-rose scrub is found in areas between forests. Berries of these shrubs seem to attract large number of birds. Areas in the vicinity of Tetritskaro are fairly well studied in ornithological terms. In total, one hundred and thirty-seven (137) bird species are described for this area in literature sources. The following species are rare: Corncrake (*Crex crex);* Great snipe *(Gallinago media);* Black stork *(Ciconia nigra);* Peregrine falcon *(Falco peregrinus);* Griffon vulture *(Gyps fulvus);* Black vulture *(Aegypius monachus);* Golden eagle *(Aquila chrysaetos);* Imperial eagle *(Aquila heliaca);* Greater spotted eagle *(Aquila clanga)*; Short-toed eagle *(Circaetus gallicus)* and Woodchat shrike (*Lanius senator*).

Table 8- 34: List of bird species described in the literature for the Trialeti Mountain Range

Common Name	Scientific Name		
Quail	*Coturnix coturnix*	Bullfinch	*Pyrrhula pyrrhula*
Turtle dove	*Streptopelia turtur*	Common rosefinch	*Carpodacus erythrinus*
Coot	*Fulica atra*	Chaffinch	*Fringilla coelebs*
Corncrake	*Crex crex*	House sparrow	*Passer domesticus*
Little crake	*Porzana parva*	Tree sparrow	*Passer montanus*
Green sandpiper	*Tringa ochropus*	Corn bunting	*Miliaria calandra*
Common sandpiper	*Actitis hypoleucos*	Ortolan	*Emberiza hortulana*
Woodcock	*Scolopax rusticola*	Rock bunting	*Emberiza cia*
Snipe	*Gallinago gallinago*	Reed bunting	*Emberiza schoeniclus*
Jack snipe	*Lymnocryptes minimus*	Woodlark	*Lullula arborea*
Great snipe	*Gallinago media*	Crested lark	*Galerida cristata*
White-winged black tern	*Chlidonias leucopterus*	Shore lark	*Eremophila alpestris*
Black-necked grebe	*Podiceps nigricollis*	White wagtail	*Motacilla alba*
Little grebe	*Tachybaptus ruficollis*	Grey wagtail	*Motacilla cinerea*
Greylag goose	*Anser anser*	Yellow wagtail	*Motacilla flava*
Ruddy shelduck	*Tadorna ferruginea*	Tawny pipit	*Anthus campestris*
Mallard	*Anas platyrhynchos*	Tree pipit	*Anthus trivialis*
Garganey	*Anas querquedula*	Water pipit	*Anthus spinoletta*
Shoveler	*Anas clipeata*	Wallcreeper	*Tichodroma muraria*
Black stork	*Ciconia nigra*	Treecreeper	*Certhia familiaris*
White stork	*Ciconia ciconia*	Nathatch	*Sitta europaea*
Grey heron	*Ardea cinerea*	Rock nathatch	*Sitta neumayer*
Bittern	*Botaurus stellaris*	Great tit	*Parus major*
Peregrine falcon	*Falco peregrinus*	Blue tit	*Parus caeruleus*
Hobby	*Falco subbuteo*	Coal tit	*Parus ater*
Kestrel	*Falco tinnunculus*	Long-tailed tit	*Aegithalos caudatus*
Goshawk	*Accipiter gentilis*	Red-backed shrike	*Lanius collurio*
Sparrow hawk	*Accipiter nisus*	Great-grey shrike	*Lanius excubitor*
Marsh harrier	*Circus aeruginosus*	Lesser grey shrike	*Lanius minor*
Egyptian vulture	*Neophron percnopterus*	Woodchat shrike	*Lanius senator*
Griffon vulture	*Gyps fulvus*	Spotted flycatcher	*Muscicapa striata*
Black vulture	*Aegypius monachus*	Collared flycatcher	*Ficedula albicollis*
Golden eagle	*Aquila chrysaetos*	Red-breasted flycatcher	*Ficedula parva*
Imperial eagle	*Aquila heliaca*	Goldcrest	*Regulus regulus*
Spotted eagle	*Aquila clanga*	Willow warbler	*Phylloscopus trochilus*
Lesser spotted eagle	*Aquila pomarina*	Caucasian chiffchaff	*Phylloscopus lorenzii*
Booted eagle	*Hieraetus pennatus*	Greenish warbler	*Phylloscopus trochiloides*
Rough-legged buzzard	*Buteo lagopus*	Grasshopper warbler	*Locustella naevia*
Honey buzzard	*Pernis apivorus*	Great reed warbler	*Acrocephalus arundinaceus*
Short-toed eagle	*Circaetus gallicus*	Marsh warbler	*Acrocephalus palustris*
Scops owl	*Otus scops*	Sedge warbler	*Acrocephalus shoenobaenus*

Common Name	**Scientific Name**		
Long-eared owl	*Asio otus*	Barred warbler	*Sylvia nisoria*
Short-eared owl	*Asio flammeus*	Orphean warbler	*Sylvia hortensis*
Tenglam`s owl	*Aegolius funereus*	Garden warbler	*Sylvia borin*
Little owl	*Athene noctua*	Blackcap	*Sylvia atricapilla*
Tawny ows	*Strix aluco*	Whitethroat	*Sylvia communis*
Cuckoo	*Cuculus canorus*	Lesser whitethroat	*Sylvia curruca*
Nightjar	*Caprimulgus europaeus*	Fieldfare	*Turdus pilaris*
Roller	*Coracias garrulus*	Mistle thrush	*Turdus viscivorus*
Kingfisher	*Alcedo atthis*	Song thrush	*Turdus philomelos*
Black woodpecker	*Dryocopus martius*	Black-throated thrush	*Turdus ruficollis*
Green wodpecker	*Picus viridis*	Redwing	*Turdus iliacus*
Great spotted woodpecker	*Dendrocopos major*	Ring ouzel	*Turdus torquatus*
White-becked woodpecker	*Dendrocopos leucotos*	Blackbird	*Turdus merula*
Middle spotted woodpecker	*Dendrocopos medius*	Blue rock thrush	*Monticola solitarius*
Lesser spotted woodpecker	*Dendrocopos minor*	Black-eared wheatear	*Oenanthe hispanica*
Wryneck	*Jinx torquilla*	Whinchat	*Saxicola rubetra*
Swift	*Apus apus*	Stonechat	*Saxicola torquata*
Raven	*Corvus corax*	Redstart	*Phoenicurus phoenicurus*
Hooded crow	*Corvus corone*	Black redstart	*Phoenicurus ochruros*
Magpie	*Pica pica*	Nightingale	*Luscinia megarhynchos*
Jay	*Garrulus glandarius*	Robin	*Erythacus rubecula*
Starling	*Sturnus vulgaris*	White-throated robin	*Irania gutturalis*
Golden oriol	*Oriolus oriolus*	Dunnock	*Prunella modularis*
Hawfinch	*Coccothraustes coccothraustes*	Wren	*Troglodytes troglodytes*
Greenfinch	*Carduelis chloris*	Dipper	*Cinclus cinclus*
Goldfinch	*Carduelis carduelis*	Swallow	*Hirundo rustica*
Redpoll	*Carduelis cannabina*	House martin	*Delichon urbica*
Twite	*Carduelis flavirostris*		

8.11.3.3.3 Tsalka - Tskhratskaro Pass

Altitudes are above 1,500m AMSL in this region. The region mainly comprises sub-alpine meadows with artificial coniferous plantations on a number of slopes. There are a number of lakes and water reservoirs with the largest being Tabatskuri Lake and Tsalka Reservoir. These two water bodies attract a number of waterfowl and birds. The following rare bird species occur in the region: Common crane (*Grus grus*); Great snipe (*Gallinago media*) and Black stork (*Ciconia nigra*). The endemic species of Caucasus from Galiformes Caucasian black grouse (*Tetrao mlokosiewiczi*) is described. As regards raptors, the literature describes Golden eagle (*Aquila chrysaetos*) and Short-toed eagle (*Circaetus gallicus*).

Table 8-35: List of bird species described in the literature for the Tsalka-Tskhratskaro Region

Common Name	Scientific Name
Quail	*Coturnix coturnix*
Caucasian black grouse	*Tetrao mlokosiewiczi*
Coot	*Fulica atra*
Common crane	*Grus grus*
Lapwing	*Vanellus vanellus*
Redshank	*Tringa tetanus*
Snipe	*Gallinago gallinago*
Great snipe	*Gallinago media*
Red-necked grebe	*Podiceps grisegena*
Velvet scoter	*Melanitta fusca*
Black stork	*Ciconia nigra*
Bittern	*Botaurus stellaris*
Hobby	*Falco subbuteo*
Golden eagle	*Aquila chrysaetos*
Short-toed eagle	*Circaetus gallicus*
Long-eared owl	*Asio otus*
Raven	*Corvus corax*
Hooded crow	*Corvus corone*
Jay	*Garrulus glandarius*
Chough	*Pyrrhocorax pyrrhocorax*
Alpine chough	*Pyrrhocorax graculus*
Chaffinch	*Fringilla coelebs*
House sparrow	*Passer domesticus*
Skylark	*Alauda arvensis*
Shore lark	*Eremophila alpestris*
Water pipit	*Anthus spinoletta*
Blue tit	*Parus caeruleus*
Ring ouzel	*Turdus torquatus*
Isabelline wheatear	*Oenanthe isabellina*
Whinchat	*Saxicola rubetra*
Black redstart	*Phoenicurus ochruros*

8.11.3.3.4 Section from Tskhratskaro Pass to Akhaltsikhe Structural Basin

This region includes forest zones represented by pine forests and sub-alpine zones where rhododendron scrub is well preserved. Mountain Kodiana is highest in the region (2,688m AMSL). In total, thirty-four (34) bird species are recorded in this region according to literature sources. The following rare bird species should be noted: Short-toed eagle (*Circaetus gallicus*) and Great rosefinch (*Carpodacus rubecula*).

Table 8- 36: List of bird species described in the literature for the Tskhratskaro to Akhaltsike section

Common Name	Scientific Name
Hobby	*Falco subbuteo*
Long legged buzzard	*Buteo rufinus*
Short-toed eagle	*Circaetus gallicus*
Raven	*Corvus corax*
Hooded crow	*Corvus corone*
Magpie	*Pica pica*
Jay	*Garrulus glandarius*
Alpine chough	*Pyrrhocorax graculus*
Starling	*Sturnus vulgaris*
Goldfinch	*Carduelis carduelis*
Redpoll	*Carduelis cannabina*
Bullfinch	*Pyrrhula pyrrhula*
Great rosefinch	*Carpodacus rubicilla*
Common rosefinch	*Carpodacus erythrinus*
Chaffinch	*Fringilla coelebs*
Rock sparrow	*Petronia petronia*
House sparrow	*Passer domesticus*
Crested lark	*Galerida cristata*
Grey wagtail	*Motacilla cinerea*
Tree pipit	*Anthus trivialis*
Treecreeper	*Certhia familiaris*
Nathatch	*Sitta europaea*
Coal tit	*Parus ater*
Marsh tit	*Parus palustris*
Goldcrest	*Regulus regulus*
Greenish warbler	*Phylloscopus trochiloides*
Whitethroat	*Sylvia communis*
Song thrush	*Turdus philomelos*
Ring ouzel	*Turdus torquatus*
Whinchat	*Saxicola rubetra*
Redstart	*Phoenicurus phoenicurus*
Robin	*Erythacus rubecula*
White-throated robin	*Irania gutturalis*
Dipper	*Cinclus cinclus*

8.11.3.3.5 Akhaltsikhe Structural Basin

Areas of ornithological interest comprise Mtkvari and Potskhovi valleys. Banks of these rivers mostly comprise orchards and arable land. Only small fragments of riparian forests survive in a number of places. In total, ninety-eight (98) bird species are recorded in literature. Rare species occurring in the area include: Caucasian black grouse *(Tetrao mlokosiewiczi);* Corncrake *(Crex crex)* White-tailed eagle *(Haliaetus albicilla)* Golden eagle *(Aquila chrysaetos);* Lesser kestrel (*Falco naumanni*); Imperial eagle *(Aquila heliaca);* Bearded vulture *(Gypaetus barbatus);* Short-toed eagle *(Circaetus gallicus);* Osprey *(Pandion haliaetus)*; Woodchat shrike *(Lanius senator)* and Firecrest *(Regulus ignicapillus)*.

Table 8- 37: List of bird species described in the literature for the Akhaltsike Structural basin

Common Name	Scientific Name	Common Name	Scientific Name
Caucasian black grouse	*Tetrao mlokosiewiczi*	Goldfinch	*Carduelis carduelis*
Woodcock	*Scolopax rusticola*	Redpoll	*Carduelis cannabina*
Hen harrier	*Circus cyaneus*	Twite	*Carduelis flavirostris*
White-tailed eagle	*Haliaetus albicilla*	Common rosefinch	*Carpodacus erythrinus*
Golden eagle	*Aquila chrysaetos*	Chaffinch	*Fringilla coelebs*
Long legged buzzard	*Buteo rufinus*	Brambling	*Fringilla montifringilla*
Cuckoo	*Cuculus canorus*	Rock sparrow	*Petronia petronia*
Roller	*Coracias garrulus*	House sparrow	*Passer domesticus*
Hoopoe	*Upupa epops*	Spanish sparrow	*Passer hispaniolensis*
Black woodpecker	*Dryocopus martius*	Tree sparrow	*Passer montanus*
Great spotted woodpecker	*Dendrocopos major*	Corn bunting	*Miliaria calandra*
Quail	*Coturnix coturnix*	Yellowhammer	*Emberiza citrinella*
Chukar	*Alectoris chukar*	Black-headed bunting	*Emberiza melanocephala*
Grey partridge	*Perdix perdix*	Cirl bunting	*Emberiza cireus*
Rock dove	*Columba livia*	Ortolan	*Emberiza hortulana*
Woodpigeon	*Columba palumbus*	Rock bunting	*Emberiza cia*
Corncrace	*Crex crex*	Reed bunting	*Emberiza schoeniclus*
Spotted crake	*Porzana porzana*	Skylark	*Alauda arvensis*
Ringed plover	*Charadrius hiaticula*	Crested lark	*Galerida cristata*
Little ringed plover	*Charadrius dubius*	Calandra lark	*Melanocorypha calandra*
Common sandpiper	*Actitis hypoleucos*	Shore lark	*Eremophila alpestris*
Red-breasted merganser	*Mergus serrator*	White wagtail	*Motacilla alba*
Grey heron	*Ardea cinerea*	Grey wagtail	*Motacilla cinerea*
Hobby	*Falco subbuteo*	Yellow wagtail	*Motacilla flava*
Kestrel	*Falco tinnunculus*	Tawny pipit	*Anthus campestris*
Lesser kestrel	*Falco naumanni*	Meadow pipit	*Anthus pratensis*
Goshawk	*Accipiter gentilis*	Treecreeper	*Certhia familiaris*
Hen harrier	*Circus cyaneus*	Kruper`s nathatch	*Sitta kruperi*
Bearded vulture	*Gypaetus barbatus*	Rock nathatch	*Sitta neumayer*
Imperial eagle	*Aquila heliaca*	Great tit	*Parus major*
Buzzard	*Buteo buteo*	Woodchat shrike	*Lanius senator*
Long legged buzzard	*Buteo rufinus*	Spotted flycatcher	*Muscicapa striata*

Common Name	Scientific Name	Common Name	Scientific Name
Short-toed eagle	*Circaetus gallicus*	Collared flycatcher	*Ficedula albicollis*
Osprey	*Pandion haliaetus*	Firecrest	*Regulus ignicapillus*
Scops owl	*Otus scops*	Cetti`s warbler	*Cettia cetti*
Little owl	*Athene noctua*	Barred warbler	*Sylvia nisoria*
Tawny owl	*Strix aluco*	Blackcap	*Sylvia atricapilla*
Cuckoo	*Cuculus canorus*	Whitethroat	*Sylvia communis*
Bee-eater	*Merops apiaster*	Lesser whitethroat	*Sylvia curruca*
Kingfisher	*Alcedo atthis*	Ring ouzel	*Turdus torquatus*
Hoopoe	*Upupa epops*	Blue rock thrush	*Monticola solitarius*
Great spotted woodpecker	*Dendrocopos major*	Black-eared wheatear	*Oenanthe hispanica*
Swift	*Apus apus*	Isabelline wheatear	*Oenanthe isabellina*
Hooded crow	*Corvus corone*	Stonechat	*Saxicola torquata*
Jackdaw	*Corvus monedula*	Redstart	*Phoenicurus phoenicurus*
Magpie	*Pica pica*	Black redstart	*Phoenicurus ochruros*
Jay	*Garrulus glandarius*	Nightingale	*Luscinia megarhynchos*
Starling	*Sturnus vulgaris*	Wren	*Troglodytes troglodytes*
Golden oriol	*Oriolus oriolus*	Dipper	*Cinclus cinclus*

8.11.3.4 Reptiles, amphibians and invertebrates

8.11.3.4.1 Reptiles

There are 52 reptile species recorded in Georgia. Approximately 30 species are likely to occur in the study area. Four species are included in the Georgian Red Data Book and three in the IUCN Red List. Table 8-38 below shows the potential occurrence of these species in the five zoological zones listed in Section 8.11.3.1.

Table 8- 38: Occurrence of Red Data Book and Red List Reptiles in Georgia

Scientific Name	Common Name	1*	2	3	4	5	Habitats	GRDB	IUCN Red List
Emys orbicularis	Swamp turtle		+				Semiarid, swampy banks		LR
Eumeces schneideri	Schneider's (gold) skink	+					Dry lands and bushes	+	
Testudo graeca	Greek tortoise	+					Arid and semiarid	+	VU
Vipera ammodites	Sand viper			+	+	+	Forests, rocky habitats	+	
Vipera kaznakovi	Caucasus (Kaznakov's) viper				+		Forests, rocky habitats	+	EN

*Note * (The numbers denote the study regions as listed in Section 8.11.3.1)*

The first section of the proposed route (Lower Kartli) is the most important from the standpoint of reptiles' distribution, as it is a link area for genes migration from the Sahara Gobi and Iranian Turanian province.

8.11.3.4.2 Amphibians

There are thirteen amphibian species recorded in Georgia. Approximately eleven species are likely to occur in the study area. Three out of the eleven are included in the Georgian Red Data Book and two in the IUCN Red List.

The fourth section (Tskhratskaro Pass - Akhaltsikhe Structural Basin) is the most important as it supports a high diversity of amphibian species, including threatened and endemic ones. The first section (Lower Kartli) is also a significant area where *Pelobates syriacus*, a Caucasian endemic and threatened species may occur.

Table 8- 39: Occurrence of Red Data Book and Red List Amphibians in Georgia

Species	1*	2	3	4	5	Abundance	Habitats	GRDB	IUCN Red List
Hyla arborea		+		+		Normal	Agrobiocenoses, Water reservoirs		LR
Mertensiella caucasica				+		Normal	Forest, rivers and springs	+	LR

Species	1*	2	3	4	5	Abundance	Habitats	GRDB	IUCN Red List
Pelobates syricus	+					Low	Arid habitats	+	
Triturus vittatus				+		Low	Forest, natural water reservoirs	+	

*Note * (The numbers denote the study regions as listed in Section 8.11.3.1)*

8.11.3.5 Invertebrates

The following species included in the USSR Red Data Book and IUCN Red List inhabit the study area: *Cerambyx cerdo, Rosalia alpina, Parnassius apollo, Saga pedo.* However, these species are not included in the Georgian Red Data Book. In addition, some of these species are endemic: *Parnassius nordmanni, and Carabus ibericus.*

8.11.3.5.1 Constraints and limitations

The available literature does not include any verified or recent data concerning the current densities of populations and their fluctuation rates. To fully evaluate the presence of species in specific areas, detailed faunal assessments were undertaken.

8.11.3.6 Detailed faunal assessments

8.11.3.6.1 Tetritskaro Area

Background

The Phase I Environmental Baseline Surveys carried out along the proposed pipeline route corridor identified a forested area in Tetritskaro district as one of the sensitive sites. Both findings of the Phase I studies and literature review indicated the need for more detailed assessment.

The study area comprises part of a larger forest massif and is characterized by a mosaic of diverse forest structure and richness in plant food (fruits, nuts and berries). Therefore, the area was considered to support a high diversity of fauna, including large and medium-sized mammals. The study area is comprised of two sites:

- A small section of a woodland north of Daget-Khachini
- A larger forested area north-west of Tetritskaro

Despite a number of minor route re-alignments developed later, the proposed pipeline corridor largely remains within the same forest massif. However, the smaller section at Daget-Khachini became non-applicable for the Phase II survey. The present study area includes the section located north-west of Tetritskaro up to Bedeni Plateau as shown in Figure: Map 8-12b.

The aim of the Phase II survey was assess the importance of the site as a wildlife habitat through collection of qualitative and quantitative data, and to propose relevant mitigation measures to minimise potential impact of pipeline construction and operation activities on the wildlife.

Objectives

Specific objectives were as follows:

- To identify species composition
- To assess the abundances of large mammals and birds
- To assess the status of the habitats
- To identify likely migration routes of large mammals

General information on Study Area

The study area comprises a forested section along the proposed pipeline route North and North-West of Tetritskaro to Bedeni Plateau with a total area of approximately 40km^2. The altitudes range from 1,000 to 1,700m. The total length of the pipeline route corridor crossing the study area is approximately 13km.

The forests are dominated by oak, hornbeam and beech and are characterised by diverse microhabitats such as small openings in the forest, forest edges, meadows, as well as woods of various structure and density including plots of beech communities with little or no undergrowth, mixed beech and oak communities with under forest developed at various levels. In addition, there is a small lake called Cherepanovskoe in the north of the study area.

Methodology

Standard line transect counts were applied in accordance to the methodology described by Caughley (1977). Transect count is a widely used method (Rudran & Foster 1996, Lancia *et al.* 1996, Rudran *et al.* 1996), which has the following advantages:

- This method minimises the probability of recording the same individual / other object more than once
- It increases the probability of recording every animal / other object on the transect
- It is least invasive and disturbing to animals

During line transect counts, an observer walks along transect, defined in advance, and records all target animals on both sides also, at the same time recording perpendicular distances from the object to the transect line. Transect sampling can be applied to both live animals and other identifiable objects such as nests, faeces, foot prints, and marks.

Special forms were used for field data collection. One form was completed on each transect. Five transects were completed, covering a total length of 40km. Field data were analysed using the computer program Distance 3.5 to determine the densities of selected species. A special habitat assessment form was designed and used throughout the survey. Habitat assessment forms were completed at 2km intervals. In addition, bird species were identified and recorded.

Study Area as Wildlife Habitat

The terrain in the study area varies from flat to moderate slope with occasional gullies and rock formations. Forest structure is mostly simple with more or less developed undergrowth and occasional openings, which contribute to the mosaic of local habitats. Water is available throughout the area in the form of streams or natural springs. There is also a small lake. Disturbance level varies from low to moderate and includes cattle grazing, domestic pig feeding, fuel wood collection and camping. Forestry operations appear to be minimal. The forest is extremely rich in various berries and mast producing species such as oak and beech. In general, the site is in good condition and provides for a perfect habitat for breeding birds and mammals including large mammals.

In addition, the site can be considered as a bridge between two larger forested areas located to the north and west of Tetritskaro. A section located between villages Jigrasheni and Ivanovka appears to be particularly important for the integrity of the whole ecosystem and in particular, large mammal populations.

Contrary to expectations, no birds were observed on the Lake Cherepanovskoe (Figure 8-46) during both Phase I and II surveys. This can be accounted for by the noise disturbance generated by a nearby stonemasonry. Unfortunately, there is no data to assess the importance of the lake as a wildlife habitat.

Figure 8-46 Lake Cherepanovskoe

Species

In total, twenty-three (23) bird species were recorded during the survey. A list of bird species observed during the fieldwork is given in Table 8-40.

Table 8- 40: Bird species recorded in the study area

No.	Common Name	Scientific Name
1.	Skylark	*Alauda arvensis*
2.	Buzzard	*Buteo buteo*
3.	Rough-legged buzzard	*Buteo lagopus*
4.	Greenfinch	*Carduelis chloris*
5.	Treecreeper	*Certhia sp.*
6.	Wood pigeon	*Columba palumbus*
7.	Raven	*Corvus corax*
8.	Hooded crow	*Corvus corone*

No.	Common Name	Scientific Name
9.	Great spotted woodpecker	*Dendrocopos major*
10.	Rock bunting	*Emberiza cia*
11.	Chaffinch	*Fringilla coelebs*
12.	Jay	*Garrulus glandarius*
13.	Coal tit	*Parus ater*
14.	Great tit	*Parus major*
15.	Blue tit	*Parus caeruleus*
16.	Green woodpecker	*Picus viridis*
17.	Stonechat	*Saxicola torquata*
18.	Woodcock	*Scolopax rusticola*
19.	Nuthatch	*Sitta europaea*
20.	Ruddy shelduck	*Tadorna ferruginea*
21.	Blackbird	*Turdus merula*
22.	Song thrush	*Turdus philomelos*
23.	Mistle thrush	*Turdus viscivorus*

The following large and medium-sized mammals were detected by footprints, scat or other marks: Wolf (*Canis lupus)*; Brown bear (*Ursus arctos)*; Fox (*Vulpes vulpes)*; Hare (*Lepus europaeus),* Badger (*Meles meles)*; Marten (*Martes sp*.). Estimated densities of these species are shown in Table 8-41. The presence of Wild cat (*Felis silvestris)*, Lynx (*Felis (Lynx) lynx),* Roe deer (*Capreolus capreolus)* and Wild boar (*Sus scrofa*) was also detected, although the data obtained during this survey was not sufficient to estimate their densities.

Table 8-41: Estimated densities of selected mammal species

Species	Density per 10km^2
Brown bear	0.4
Wolf	3
Fox	33
Marten	26
Badger	18

Conclusions

The results presented above clearly demonstrate that the site comprises an important wildlife habitat. Apart from bear, the densities of all species appear to be normal for such habitats. Woodlands of such productivity could in theory support more bears. It should be mentioned that animal densities in this particular area are likely to change according to seasons and this could also apply to bears. It was not possible to obtain direct evidence of the area being used as a migration corridor by large mammals (this would require much more time and effort) based on the surveys carried out or this study. However, because the site serves as a bridge between larger forest massifs, it is likely to also act as a migration corridor including altitudinal migration.

In general, the forest is surprisingly well preserved and overall disturbance is low considering its proximity to human settlements.

Phase I and Phase II surveys did not reveal the presence of any species to suggest the lake is a significant wildlife habitat. The low species count could however have been owing to localised noise intrusion adjacent to the lake during the time of survey.

8.11.3.6.2 Eastern Part of Tsalka Reservoir and Lake Aligel

Background

The eastern part of Tsalka Reservoir and the small Lake Aligel (located north of Tsalka reservoir, in the vicinity of Santa village) were identified as sensitive areas during the Phase I Environmental Baseline Surveys carried out along the proposed pipeline route corridor in Summer-Autumn 2000. The presence of water birds including the Georgian Red Data Book species at Tsalka Reservoir clearly indicated the need for more detailed studies during the bird migration season. Lake Aligel was dry at the time of the Phase I surveys (the summer 2000 was extremely dry in Georgia). Therefore, it was recommended to check the potential importance of this seasonal wetland for migratory birds.

Objectives

Specific objectives of the survey were as follows:

- To identify bird and other species composition
- To assess the abundances of bird species
- To assess the status of the habitat

General information on Study Area

The study area includes Tsalka Reservoir and Lake Aligel. The Tsalka Reservoir is located at the elevation of about 1,500m. The total surface area of the reservoir is approximately 30km^2 at its maximum. The Aligel is a small, apparently seasonal lake located half-way between the reservoir and village Santa. The study area is shown in Figure: Map 8-12b.

Methodology

A method of point counts was applied during the survey. This technique involves conducting animal counts from a fixed location for a fixed time period (Sutherland 1997) and is commonly used for bird surveys, especially in open areas.

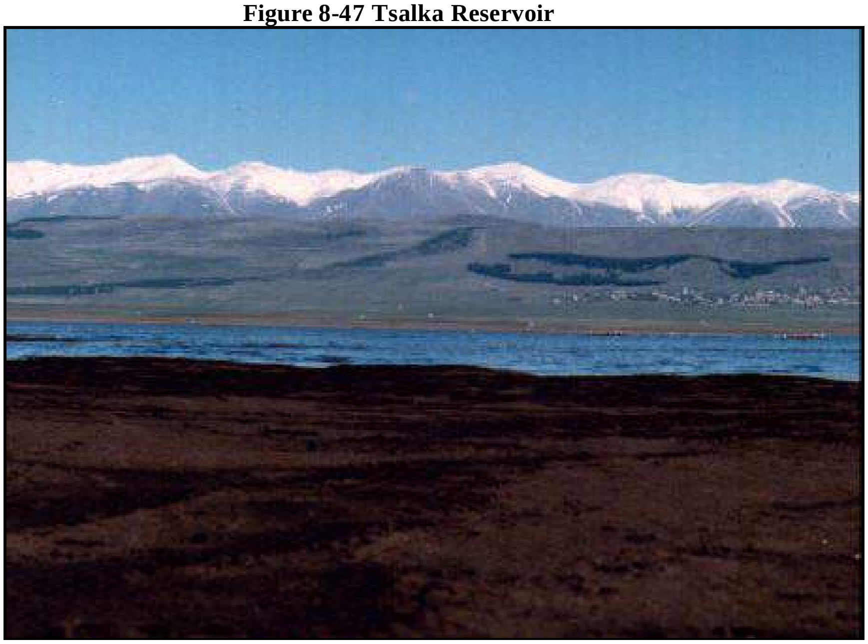
The site was studied twice between March and mid April, in order to collect as much information as possible on migratory water birds, which tend to arrive at different times. The surveys covered the entire lake and its shores to obtain an overall picture of the habitat and its importance for water birds.

All bird species present on the reservoir and its shores were identified and recorded with the aid of a telescope. Information was collected to assess habitat status in terms of suitability for migratory water birds and overall disturbance.

Study Area as Wildlife Habitat

The shores of Tsalka Reservoir (Figure 8-47) have practically no vegetation. Hence there are no suitable nesting sites, except for volcanic rock formations and large rocks on the southern shores where Ruddy shelducks (*Tadorna ferruginea*) may nest. Therefore, the reservoir has a limited importance as a nesting habitat for waterfowl. Its significance is much higher for migratory birds and as a feeding ground for water birds that breed elsewhere. In March the water level was very low and the lake was divided into several parts surrounded by mudflats where various waders were feeding. Several species including black storks were also observed to feed on mudflats during the Summer Phase I surveys.

Figure 8-47 Tsalka Reservoir



Lake Aligel was dry at the time of the Phase II survey.

Species

In total, twenty-eight (28) bird species were recorded on Tsalka Reservoir including the critically endangered Black stork (*Ciconia nigra*) and the endangered Great white heron (*Egretta alba*), both of which are in the Georgian Red Data Book . White storks nest in the adjacent areas and feed on the reservoir. *Charadriiformes* species were abundant on mudflats. It should be noted that Grey herons (*Ardea cinerea),* Black storks (*Ciconia nigra*) and Marsh harriers (*Circus aeruginosus)* were present at Tsalka reservoir during the Phase I surveys in 2000.

A list of bird species observed during the fieldwork is given in Table 8-42 below.

Table 8- 42: Birds species recorded in the study area

No.	Common Name	Scientific Name	Migratory	Breeding in Georgia
1	Common sandpiper	*Actitis hypoleucos*		+
2	Wigeon	*Anas penelope*	+	+
3	Mallard	*Anas platyrhynchos*	+	+
4	Shoveler	*Anas clypeata*	+	
5	Grey heron	*Ardea cinerea*		+
6	Pochard	*Aythya ferina*	+	+
7	Tufted duck	*Aythya fuligula*	+	+
8	Buzzard	*Buteo buteo*	+	+
9	Rough-legged buzzard	*Buteo lagopus*	+	
10	Linnet	*Carduelis cannabina*		+
11	Little ringed plover	*Charadrius dubius*		+

No.	Common Name	Scientific Name	Migratory	Breeding in Georgia
12	Black stork	*Ciconia nigra*	+	+
13	Raven	*Corvus corax*		+
14	Hooded crow	*Corvus corone*		+
15	Jackdaw	*Corvus monedula*		+
16	Great white egret	*Egretta alba*		+
17	Coot	*Fulica atra*	+	+
18	Yellow-legged gull	*Larus cachinnans*		+
19	Black-headed gull	*Larus ridibundus*		+
20	Great black-headed gull	*Larus ychthyaetus*	?	?
21	White wagtail	*Motacilla alba*		+
22	Cormorant	*Phalacrocorax carbo*	+	+
23	Ruff	*Philomachus pugnax*	+	
24	Spoonbill	*Platalea leucorodia*	+	
25	Great crested grebe	*Podiceps cristatus*	+	+
26	Starling	*Sturnus vulgaris*		+
27	Ruddy shelduck	*Tadorna ferruginea*		+
28	Shelduck	*Tadorna tadorna*	+	+

The highest numbers of birds were observed in April when the spring migration season was anticipated to be at its peak. Estimated numbers of selected species are indicated in Table 8-43 below.

Table 8- 43: Estimated numbers of birds present on Tsalka Reservoir during Migration

Common Name	Scientific Name	March	April
Common sandpiper	*Actitis hypoleucos*	-	20
Wigeon	*Anas penelope*	60	-
Mallard	*Anas platyrhynchos*	100	190
Shoveler	*Anas clypeata*	100	-
Grey heron	*Ardea cinerea*	30	270
Tufted duck	*Aythya fuligula*	-	240
Little ringed plover	*Charadrius dubius*	-	160
Great white egret	*Egretta alba*	-	180
Yellow-legged gull	*Larus cachinnans*	-	60
Black-headed gull	*Larus ridibundus*	25	2000
Great black-headed gull	*Larus ychthyaetus*	-	160
Cormorant	*Phalarocorax carbo*	35	-
Ruff	*Philomachus pugnax*	-	2400
Spoonbill	*Platalea leucoridia*	50	-
Great crested grebe	*Podiceps cristatus*	70	2300
Ruddy shelduck	*Tadorna ferruginea*	30	100
Shelduck	*Tadorna tadorna*	-	160

Figure 8-48 Black Stork at Tsalka Reservoir (Summer, 2000)

Conclusions

Tsalka Reservoir is mainly important for migratory water birds. The highest numbers of birds were observed in April. However, mudflats in the easternmost part provide feeding grounds for a number of water birds (including the Georgian Red Data Book species - Black stork) not only during migration but also in summer. This particular site is located in the immediate vicinity of the proposed route corridor.

It is difficult to assess the conservation value of the small Lake Aligel as this transitory wetland was completely dry during both Phase I and Phase II surveys.

8.11.3.6.3 Narianis Veli Wetland, Ktsia Basin Wetlands and Mountain Tavkvetili

Background

The Phase I Environmental Baseline Surveys carried out along the proposed pipeline route corridor in Summer-Autumn 2000 identified Narianis Veli, Ktsia Crossing and adjacent sub-alpine meadows on the northern slopes of mountain Tavkvetili, as sensitive areas requiring further detailed studies. It was recommended to survey the high altitude wetlands of Narianis Veli during the bird migration season. For practicality reasons it was also decided to assess the adjacent sub-alpine meadows during the same survey. The study area and current route are shown in Figure: Map 8-12b.

Phase II surveys were conducted in spring 2001 followed by an autumn survey, which consisted of early morning ROW transects, migration watch, and habitat specific assessment.

Objectives

Spring Survey

Specific objectives of the survey were as follows:

- To identify bird and mammal species composition
- To assess the abundances of important species
- To assess the status of the habitats

Autumn Survey

Specific objectives of the survey were as follows:

- To determine significant avian use of the pipeline construction zone
- To evaluate the potential effectiveness of limiting the construction season to mitigate impacts on resident and migrant bird species
- To sample resident and migrant bird use of the pipeline right of way and construction zone, including potential high-use areas

General Information on the Study Area

Narianis Veli includes part of the Ktsia River valley. It is located north of Lake Tabatskuri, at an elevation of approximately 2,050m. Among the surrounding mountains, Mt. Tavkvetili is the highest (2,582m). The valley used to be covered with marshes, most of which have been drained owing to the construction of a network of canals. At present only small fragments of these marshes survive, with the majority becoming dry in summer.

The sub-alpine meadows are located east of Narianis Veli and include the northern slopes of mountain Tavkvetili. The altitude ranges between 2,580 - 2,300m. The total length of the pipeline corridor crossing the study area is approximately 15km.

Methodology

Spring Survey

Five transects were completed, covering a total length of 35km. One form was completed on each transect. Field data were analysed using the computer program Distance 3.5 to determine the densities of selected species. In addition, visual observations were conducted using a telescope. A special Habitat Assessment Form was used to assess habitat status in terms of suitability for migratory water birds and overall disturbance.

Autumn Survey

The survey included three main components:

- Early morning ROW transects
- Migration watch
- Habitat specific surveys

In addition the present status of habitats (in particular the wetland) was evaluated.

<u>Early Morning ROW Transects (First Light)</u>

- The survey route would commence at the highest point on the ROW, approximately 2km south of the wetlands (Mountain Mshrali Mta, altitude of 2481m) and extended all along the ROW to the highest point in the south-east (eastern flank of Tavkvetili Mountain, altitude of 2582m). The survey route length comprised approximately 14km

- Two team members would space themselves 40m apart (20m on either side of the centerline) and walk slowly through the vegetation, noting numbers and species of all birds that flushed or flew within 100m. All precautions were made to avoid double-counting of the same individual birds

Migration Watch

- The focus of this survey was day-migrants, including various water birds and raptors
- The survey was conducted from an elevated point with a clear view of the surrounding area
- Each member covered a pre-determined portion of the sky, agreeing beforehand on convenient dividing lines
- The count period was divided into three blocks of continuous observation for 45min each with a 15min break in between
- At the start of each block, observers recorded the time, location, and weather. For each bird observation data sheet included species, number, direction of flight (N, NE, E, SE, S, SW, W, NW), and habitat type if the bird(s) went to land

Habitat Specific

- This survey was expected to provide a more intensive measure of bird use in two main habitat types represented along the ROW. These habitats were the wetland and the rhododendron scrub. Each of them was surveyed twice
- The first task was to establish an observation route within each distinctive habitat type. Each route was roughly rectangular in shape, 450m x 300m. There were 10 observation stations along each route, each separated by 150m. These stations were flagged and numbered and the GPS coordinates were recorded. Bird observations were made on subsequent days
- On survey days, observers stood at each station for 10min and recorded all birds seen or heard within 50m. After 10min they moved on to the next station

Study Area as a Wildlife Habitat

Narianis Veli

Narianis Veli must have been an extensive area of highland marshes before modification by draining. Owing to construction of a network of canals, most of the wetland has disappeared. In addition, roads have been built. At present major forms of human disturbance include livestock (both sheep and cattle) grazing, grass cutting, hunting and fishing. Livestock grazing starts in late May and lasts until midsummer. Signs of erosion are evident on the surrounding hills. The grass cutting season starts in August and continues for 2-3 weeks. Fowling takes place during bird migration seasons and apparently represents one of the most important limiting factors for the wildlife.

Figure 8-49 Nariani Veli and the Ktsia River

During the autumn surveys some late migrants were still present. However, it was clear that the migration season was ending. Therefore, this survey failed to fully determine the importance of the site for autumn migrants including water birds and raptors. It may be true, however, that the wetlands are generally dry in autumn since all water is effectively discharged through the system of channels dug throughout the area. Therefore, Narianis Veli may have less significance for migratory waterfowl in autumn as opposed to the spring migration. Nevertheless the presence of the IUCN Red List species, Great snipe and some mallards indicate that the area may still be quite important. Species diversity was higher on Tabatskuri Lake, which is another indication that autumn migrants may find Narianis Veli unsuitable owing to lack of water.

Ktsia Wetlands

The Ktsia River crossing largely resembles Narianis Veli. However, human impact is even greater at this site, because it is closer to the village and both human and livestock presence is more intrusive.

Northern Slopes of Mountain Tavkvetili

Unlike Narianis Veli, the sub-alpine meadows in the vicinity of mountain Tavkvetili represent a totally intact area with large patches of rhododendron scrub (*Rhododendron caucasicum*), which is the habitat of the Caucasian Black Grouse, an endemic species included in GRDB. No roads are present. The only potential human disturbance is black grouse hunting.

Figure 8-50 View of Mountain Tavkvetili

The autumn survey findings at the mountain Tavkvetili area indicate that Caucasian black grouse are present all the year round. The frequency of sightings in autumn was higher (two individuals were recorded on each day) than during the spring survey, which may be accounted for either by seasonal redistribution of the birds' density within the area or it was simply by chance that fewer birds were recorded in spring. Regardless of absolute density of this bird species, it is apparent that black grouse are present on Tavkvetili slopes throughout the year ie this is a resident population and their presence cannot be attributed to random vagrancy. Black grouse have been previously recorded only on the Great Caucasus and Lesser Caucasus in two isolated populations. Considering this and the fact that this species is bound to rhododendron scrub, it is possible that the Tavkvetili population is an important intermediary linkage between the two larger populations. Therefore, the site is likely to serve as a critical 'stepping stone' linking the Greater Caucasus and Lesser Caucasus black grouse habitats. If this is the case, interruption of this link will threaten primarily the Lesser Caucasus black grouse population increasing the degree of its isolation.

In addition, grey partridge was also recorded on the slopes of mountain Tavkvetili. This is rather surprising as no available literature indicates the presence of this species at such high altitudes. Because this area is hardly ever disturbed, it is possible that it is an important refuge site for this rare species. In this case this site should be considered to support a core sub-population which is very important for the maintenance of the whole population in the area.

Species

Narianis Veli

The following mammal species were recorded during the spring survey: Weasel (*Mustela nivalis*), Fox (*Vulpes vulpes*), Brown bear (*Ursus arctos*) (proposed conservation status: Endangered), Badger (*Meles meles*) and Wolf (*Canis lupus*) (proposed conservation status: Low Risk). It appears that bears are attracted by new grass on Narianis Veli in spring. Foxes are especially abundant.

Figure 8-51 Foxes are numerous on Narianis Veli and do not seem to be much concerned of human presence

Wolves were present in minimum numbers during the spring survey. Like bears, they also come down to Nariani for food and at night take refuge in the forests to the north. The presence of wolves was also observed during the Phase I surveys. It is likely that wolf density increases in summer, especially during livestock grazing. Although the area around Narianis Veli would appear suitable for both otters (*Lutra lutra*) and marbled polecats (both of which are critically endangered Red Data Book species), neither were identified. The rarity of these species in Georgia may account for this.

In total, twenty-nine (29) bird species were recorded at Nariani during the spring survey. A list of bird species observed during the fieldwork is included in Table 8-44. Mallard (*Anas platyrhynchos*) and Shoveler (*Anas clypeata*) were most numerous. Obtained results allow estimation of numbers of some of the species recorded during the survey (Table 8-45). Unfortunately for other species data do not allow statistical analysis.

Important bird species observed during the spring survey at Narianis Veli include: Georgian Red Data Book species - Grey partridge (*Perdix perdix*) (also IUCN listed), populations of which are in decline throughout the country; Another Georgian Red Data Book species - Common crane (*Grus grus*); and Corncrake (*Crex crex*), which is included in the IUCN Red List as globally threatened species. In addition all of the migratory waterfowl recorded on the site are protected by AEWA (Afro-Eurasian Waterbird Agreement) of the Bonn Convention. It should be noted that breeding common cranes (Critically Endangered according to GRDB) were also recorded during the Phase I surveys in Summer, 2000.

Figure 8-52 Grey Patridges

Table 8-44: Birds species recorded at Narianis Veli in spring

No.	Species (recorded in spring)		Migratory	Breeding in Georgia*	Protected species
	Scientific name	Common name			
	Anas platyrhynchos	Mallard	+	+	AEWA
1.	*Actitis hypoleucos*	Common sandpiper		+	
2.	*Alauda arvensis*	Skylark		+	
3.	*Anas clypeata*	Shoveler	+		AEWA
4.	*Anas querquedula*	Garganey	+		AEWA
5.	*Aquila pomarina*	Lesser spotted eagle	+		
6.	*Ardea cinerea*	Grey heron		+	
7.	*Buteo buteo*	Common buzzard	+	+	
8.	*Buteo rufinus*	Long-legged buzzard	+	+	
9.	*Carduelis cannabina*	Linnet		+	
10	*Carduelis flavirostris*	Twite		+	
11	*Circus aeruginosus*	Marsh harrier	+	+	
12	*Corvus corax*	Raven		+	
13	*Corvus corone*	Hooded crow		+	
14	*Crex crex*	Corncrake	+	+	IUCN

(1) * These species are known to breed in Georgia. However it was impossible to check whether they breed specifically on the study area since the survey was done during the non-breeding season

No.	Species (recorded in spring)		Migratory	Breeding in Georgia*	Protected species
	Scientific name	Common name			
					(VU)
15	*Gallinago gallinago*	Common snipe	+	+	AEWA
16	*Grus grus*	Common crane	+	+	AEWA, GRDB
17	*Hieraetus pennatus*	Booted eagle	+	+	
18	*Hirundo rustica*	Swallow	+	+	
19	*Motacilla citreola*	Citrine wagtail	+	+	
20	*Motacilla flava*	Yellow wagtail	+	+	
21	*Perdix perdix*	Grey partridge		+	IUCN (VU) GRDB
22	*Pica pica*	Magpie		+	
23	*Tadorna ferruginea*	Ruddy shelduck		+	AEWA
24	*Vanellus vanellus*	Lapwing		+	AEWA

Table 8-45: Estimated densities of selected bird species (spring survey)

Species	Numbers
Mallard	80
Ruddy shelduck	5
Grey heron	10
Marsh harrier	5
Shoveler	50
Garganey	30

Narianis Veli was almost dry during the autumn survey. Water remained only in deeper channels, where only few birds were recorded, including one IUCN Red List species, Great snipe (*Gallinago media*) and small flocks (10-20 individuals in each group) of Mallard (*Anas platyrhynchos*). Other species, noted single or several individuals, are: Snipe *(Gallinago gallinago)* Common buzzard (*Buteo buteo*), Long-legged buzzard (*Buteo rufinus*), Spotted eagle (*Aquila clanga*), Sparrowhawk (*Accipiter nisus*) Goshawk (*Accipiter gentilis*).

Northern Slopes of Mountain Tavkvetili

During the spring survey Caucasian black grouse (*Tetrao mlokosiewiczi*) was recorded in the sub-alpine meadows on the northern slopes of mountain Tavkvetili. This species is an endemic of the Caucasus that inhabits rhododendron scrubs and crooked-stem forests in sub-alpine areas. It is also included in the Georgian Red Data Book and IUCN Red List.

In addition to Caucasian black grouse, Grey partridge (*Perdix perdix*) was recorded during the autumn survey in the Tavkvetili area. It is also included in the Georgian Red Data Book and IUCN Red List.

Conclusions

Narianis Veli and the Ktsia wetland to a lesser degree support a high diversity of migratory avian fauna. Among the birds species observed on the sites, many have international importance and are protected by AEWA, or are included in IUCN Red List or GRDB. In addition the site is also important for breeding birds. Common cranes have been observed to breed on the slopes (south) at Nariani and other birds may also be breeding there.

The site is also important as feeding grounds for large mammals, including brown bears.

The sub-alpine meadows are totally intact natural habitats with endemic rhododendron supporting endemic black grouse and another GRDB species – Grey Partidge. Therefore, it has high conservation value.

8.11.3.6.4 Tskhratskaro – Tiseli Area

The Phase I Environmental Baseline Surveys carried out along the proposed pipeline route corridor in Summer-Autumn 2000 identified the forested area from Tskhratskaro to Tiseli as one of the sensitive sites requiring further studies as it apparently supported rich wildlife. The study area and current route are shown on Figure: Map 8-12c.

Objectives

Specific objectives of the survey were to:

- Identify species composition
- Assess the abundance's of large mammals
- Assess the status of the habitats
- Identify likely migration routes of large mammals

General information on study area

The study area covers high mountain forests and sub-alpine areas. The total length of the pipeline route crossing the site is about 30km. A number of forest types are present, including: beech, beech and pine, fir and pine, mixed forests as well as pure fir forest. There are a number of lakes, with Lake Kakhisi being the largest. Highest points on the study area are mountain Kodiana, 2,688m, and Tskhratskaro Pass at the altitude of 2,454m.

Methodology

Standard line transect counts were used for mammal counts as described by Caughley (1977). Line transect sampling is suitable for populations with relatively low density. During line transect counts, an observer walks along a transect, defined in advance, and records all target animals on both sides, at the same time recording perpendicular distances from the object to the transect line. Transect sampling can be applied to both live animals and other identifiable objects such as nests, faeces, foot prints, marks, etc.

Ten transects were completed, covering a total length of 90km. Field data were analysed using the computer program Distance 3.5 to determine the densities of selected species. A special Habitat Assessment Form was designed and used throughout the survey. Habitat assessment forms were completed at 2km intervals. In addition, bird species were identified and recorded.

Study area as wildlife habitat

The study area is part of an extensive forest massif with sub-alpine areas. Most of the forests are mature communities, which are important refuges for many animal species. Human impact is high owing to tree felling on some of the sites, especially where terrain is accessible. However, natural regeneration appears to be high in a number of places. The whole area abounds in streams, rivers and small ponds, which are important for amphibians. The terrain is quite rugged with frequent steep slopes and deep gorges. Mature old forests provide shelter for large mammals, such as bear, wolf, and lynx. Occasional openings and meadows, as well as forest type and structure and terrain diversity, create a mosaic of microhabitats. The forests are remarkably rich in wild fruits, various nuts and berries throughout the study area.

Figure 8-53 Beech Forest

Forestry operation is a major human factor in the area, which causes severe disturbance and habitat destruction. Hunting, including poaching, is another important negative factor. According to locals, chamois have become extremely rare owing to illegal hunting. Cattle-breeding is well-developed in the region. Alpine and sub-alpine meadows are used for livestock grazing. Erosion is evident in some places, which is apparently caused by grazing.

Being the westernmost part of the Trialeti range, the study area is likely to comprise part of extensive migration routes for large mammals through which gene exchange may take place between populations. However, neither this survey nor available information allows identification of specific biological corridors.

Species

The following large and medium-sized mammals were recorded by footprints, scat or other marks: Wolf (*Canis lupus)*; Brown bear (*Ursus arctos)*; Fox (*Vulpes vulpes)*; Hare (*Lepus europaeus)*; Marten (*Martes sp*.). Estimated densities of these species are given in Table 8-46 below. The presence of Wild cat (*Felis silvestris)*, Lynx (*Felis (Lynx) lynx)* and Roe deer (*Capreolus capreolus)* was also detected, however, the data obtained during this survey is not sufficient to estimate their densities. Lynx are generally extremely rare and very secretive. Wild boars (*Sus scrofa*) are very rare in the study area. According to locals, they mainly occur in autumn, apparently moving from the adjacent areas for food, which must be abundant in these forests.

Table 8-46: Estimated densities of selected mammal species

Species	Density per 10km^2
Brown bear	1.2
Wolf	5
Fox	41
Marten	32

Taking into account current levels of disturbance and damage to the habitats, the above results of species densities should be regarded as normal. However, there could be some underestimation owing to bad weather - heavy rains complicated animal census, the more so that counts of large mammals mainly rely on the detection by foot print and scat. While rains washed out tracks, scat identification was sometimes impossible. In addition, species abundances are likely to vary according to season. For example, bear density as well as that of wild boar and wolf may increase in autumn when these animals may be attracted by abundant food, both plant food and prey.

In total, twenty-five (25) bird species were recorded on the study area including Corncrake (*Crex crex*), a globally threatened species and black grouse (*Tetrao mlokosiewiczi*) - endemic of the Caucasus. A list of bird species observed during the fieldwork is given in Table 8-47.

Figure 8-54 Sub-alpine rhododendron scrub – habitat of black grouse

Table 8-47: Birds species recorded in the study area

No.	Common Name	Scientific Name
1.	Skylark	*Alauda arvensis*
2.	Buzzard	*Buteo buteo*
3.	Rough-legged buzzard	*Buteo lagopus*
4.	Greenfinch	*Carduelis chloris*
5.	Treecreeper	*Certhia sp.*
6.	Wood pigeon	*Columba palumbus*
7.	Raven	*Corvus corax*

No.	Common Name	Scientific Name
8.	Hooded crow	*Corvus corone*
9.	Corncrake	*Crex Crex*
10.	Great spotted woodpecker	*Dendrocopos major*
11.	Rock bunting	*Emberiza cia*
12.	Chaffinch	*Fringilla coelebs*
13.	Jay	*Garrulus glandarius*
14.	Coal tit	*Parus ater*
15.	Great tit	*Parus major*
16.	Blue tit	*Parus caeruleus*
17.	Green woodpecker	*Picus viridis*
18.	Stonechat	*Saxicola torquata*
19.	Woodcock	*Scolopax rusticola*
20.	Nuthatch	*Sitta europaea*
21.	Ruddy shelduck	*Tadorna ferruginea*
22.	Black grouse	*Tetrao mlokosiewiczi*
23.	Blackbird	*Turdus merula*
24.	Song thrush	*Turdus philomelos*
25.	Mistle thrush	*Turdus viscivorus*

In addition, there are a number of important species that are present in this area which are cited in the literature, but have not been recorded during the Phase II survey. These include:

- Endemic Caucasian salamander (*Mertensiella caucasica)*, which is included in the Georgian Red Data Book and IUCN Red List
- Banded newt (*Triturus vittatus)*, which is included in the Georgian Red Data Book
- Endemic toad *(Bufo verrucosissimus)*
- Viper (*Vipera kaznakovi*) - endemic species of the Caucasus, which is included in the Georgian Red Data Book and IUCN Red List

The invertebrate fauna includes some IUCN Red List species, such as *Cerambyx cerdo, Rosalia alpina, Parnassius apollo,* as well as endemic species included in the USSR Red Data Book: *Parnassius nordmanni, Carabus caucasicus, Colias caucasica, and Helix buchi.*

Conclusions

Despite human disturbance and habitat degradation evident in a number of places, on the whole the study area is of high conservation value for various groups of fauna ranging from large mammals to amphibians and invertebrates.

8.11.3.6.5 Riparian areas at Mtkvari and Potskhovi Crossings

Riparian areas at the Mtkvari 2 and Potskhovi 1 River crossings were identified as potentially sensitive sites during the Phase I Environmental Baseline Surveys carried out along the proposed pipeline route corridor in Summer-Autumn 2000. Riparian forests are one of the most endangered habitats in Georgia. They are important as breeding sites, shelters or as ‘stepping stones’ for dispersal and migration of birds and mammals. Therefore, further detailed studies were recommended to assess the value of these sites. The study area and current route are shown in Figure: Map 8-12c.

Objectives

Specific objectives of the survey were to:

- Identify bird species composition
- Assess the abundances of bird species
- Assess the status of the habitat

General information on study area

The study area is comprised of two sites at proposed Mtkvari 2 and Potskhovi 1 River crossings with a total area of 5km^2.

Methodology

Standard line transect counts were applied as described in the previous section. Two transects were completed, covering a total length of 5km. A special Habitat Assessment Form was used to assess habitat status in terms of suitability for migratory and breeding birds and overall disturbance.

Study area as wildlife habitat

Riparian areas are heavily modified in the vicinity of the proposed Mtkvari crossing 2 owing to agricultural activities. The riverbed is wide, approximately 30 – 40m, at the proposed crossing location. Sparse scrub has developed on the left bank, while the right bank is hilly and intensively used for livestock grazing.

Like the areas in the vicinity of the proposed Mtkvari 2 crossing, areas in the vicinity of the proposed Potskhovi 1 crossing have also been heavily impacted by human activities. In the past, the entire area was apparently covered by riparian forests, which now survive only in small fragments or single trees. Most flat areas near the water are by now transformed into orchards, while adjacent slopes are used for livestock grazing.

Species

<u>Mtkvari west crossing</u>
In total, ten (10) bird species were recorded on this site. All of them breed in Georgia except for Garganey (*Anas querquedula*). Only two of them (Garganey and Little-ringed plover) are internationally important migratory water birds protected by AEWA.

A list of bird species observed during the fieldwork is given in Table 8-48. Data obtained in the course of the survey do not lend to statistical analysis. However, two species, Garganey (*Anas querquedula*) and yellow-legged gulls (*Larus cachinnans*) appear to be most abundant. According to rough estimates, thirty (30) garganeys and seventy (70) yellow-legged gulls were present on the site.

Table 8-48: Birds species recorded in the vicinity of Mtkvari Crossing

No.	Species Recorded	
	Scientific Name	**Common Name**
1	*Alcedo atthis*	Kingfisher
2	*Anas querquedula*	Garganey
3	*Ardea cinerea*	Grey heron
4	*Buteo buteo*	Common buzzard
5	*Carduelis cannabina*	Linnet
6	*Charadrius dubius*	Little-ringed plover
7	*Circaetus gallicus*	Short-toed eagle
8	*Larus cachinnans*	Yellow-legged gull
9	*Motacilla alba*	White wagtail
10	*Passer montanus*	Tree sparrow

Potskhovi north crossing

In total, twenty-seven (27) species of birds were recorded (refer to Table 8-49 below). All these species breed in Georgia. Only two of them (Little-ringed plover and Green sandpiper) are internationally significant species covered by AEWA, while most of them are species that are typical for the countryside and agricultural lands. The data collected do not allow statistical analysis to determine species densities. However, it is clear that each of these species is present in numbers that are typical for such habitats.

The presence of bats was noted in abandoned buildings on the left bank. There was a raptor's (possibly *Buteo rufinus*) nest on a nearby clay cliff. The nest was not occupied at the survey time. As regards large and medium-sized mammals, only fox (*Vulpes vulpes*) was noted.

Table 8-49: Birds species recorded in the vicinity of Potskhovi Crossing

No.	Species	
	Scientific Name	**Common Name**
1	*Accipiter gentiles*	Goshawk
2	*Accipiter nisus*	Sparrowhawk
3	*Anthus trivialis*	Tree pipit
4	*Apus apus*	Swift
5	*Buteo buteo*	Common buzzard
6	*Carduelis cannabina*	Linnet
7	*Carduelis carduelis*	Goldfinch
8	*Carduelis chloris*	Greenfinch
9	*Charadrius dubius*	Little-ringed plover
10	*Cinclus cinclus*	Dipper
11	*Corvus corone*	Hooded crow
12	*Dendrocopos major*	Great spotted woodpecker
13	*Garrulus glandarius*	Jay
14	*Hieraetus pennatus*	Booted eagle
15	*Hirundo rustica*	Swallow
16	*Jinx torquilla*	Wryneck
17	*Motacilla alba*	White wagtail
18	*Motacilla cinerea*	Grey wagtail
19	*Neophron percnopterus*	Egyptian vulture
20	*Oenanthe oenanthe*	Wheatear
21	*Parus major*	Great tit
22	*Passer montanus*	Tree sparrow
23	*Pica pica*	Magpie

No.	Species	
	Scientific Name	**Common Name**
24	Saxicola torquata	Stonechat
25	*Tringa ochropus*	Green sandpiper
26	*Turdus merula*	Blackbird
27	*Upupa epops*	Hoopoe

Conclusions

Both the Potskhovi north and the Mtkvari west crossing areas comprise modified landscapes. The Mtkvari site has minimum importance for birds and/or large and medium-sized mammals. The Potskhovi crossing, however, is quite rich in biodiversity, which is generally characteristic for agricultural lands. In addition to the species that are connected to the water, this site appears to be important for breeding birds.

8.11.3.6.6 Fish and fisheries

Fish occurrence along the pipeline corridor has been studied on the basis of the available literature. The following sections describe the fish species present in the main rivers crossed by the proposed pipeline and in major waterbodies adjacent to the pipeline route. In addition, a section on commercial fisheries is enclosed.

8.11.3.6.7 Fish species

River Mtkvari (Tbilisi - Rustavi Section)

The River Mtkvari is an important river in terms of commercial fishing in Eastern Georgia. The river is divided into isolated sections by a number of dams. The proposed pipeline route crosses the River Mtkvari north of Rustavi, ie the lower part of river Section IV (from the dam of Ortachala Hydropower Station to that of Rustavi Power Station). This section has a high value in terms of commercial fishing of Common Khramuli and other species such as barbel murtsa, Mtkvari barbel, Caucasian chub and barbel chanari. The following fish species, including non-commercial fish, can be found in this section:

- Common Khramuli - Varicorhinus capoeta
- Mtkvari Barbel – Barbus lacerta
- Caucasian Chub – Leuciscus cephalus
- Barbel Chanari – Barbus capito
- Barbel murtsa – Barbus mursa
- Mtkvari undermouth – Chondrostoma cyri
- Black Brow – Acanthalburnus microlepis
- Mtkvari bleak – Alburnus filippi
- Mtkvari stone loach – Nemachilus brandti
- Riffle minnow – Alburnoides bipunctatus
- Spiny loach – Cobitis taenia
- Golden spiny loach – Cobitis aurata
- Mtkvari Gudgeon – Gobio persus
- Ginger gobi – Neogobius cephalarges
- Amur bitterling – Rhodeus sericeus
- Mosquito fish – Gambusia affinis

River Algeti

Resident fish are represented by 18 species in the River Algeti. Thirteen species occur in the area where the pipeline will cross the river.

1. Caucasian chub - *Leuciscus cephalus*
2. Mtkvari undermouth – *Chondrostoma cyri*, endemic species of Eastern Georgia
3. Mtkvari gudgeon - *Gobio persus*
4. Common khramuli - *Varicorhinus capoeta*
5. Mtkvari barbel - *Barbus lacerta*
6. Barbel chanari - *Barbus capito* (conservation status)
7. Barbel murtsa - *Barbus mursa*, endemic species of Eastern Georgia
8. Mtkvari bleak - *Alburnus filippi*, endemic species of Eastern Georgia
9. Black brow - *Acanthalburnus microlepis*, endemic species of Eastern Georgia
10. Riffle minnow - *Alburnoides bipunctatus*
11. Mtkvari stone loach - *Noemachilus brandti*, endemic species of Eastern Georgia
12. Golden spiny loach - *Cobitis aurata*
13. Mushroom gobi - *Gobius cephalarges*

Five species, namely species 2, 4, 8, 9, 11 are endemic species of the Eastern Transcaucasia.

River Geti

The proposed crossing is located in the lower reaches of the Geti River, right tributary of the Khrami. In total, six fish species are recorded in the Geti. Only five species occur in the area of the proposed crossing:

1. Caucasian chub - *Leuciscus cephalus*
2. Common khramuli - *Variocorhinus capoeta*
3. Mtkvari barbel - *Barbus lacerta*
4. Barbel murtsa - *Barbus mursa* - Eastern Transcaucasian endemic
5. Riffle minnow - *Alburnoides bipunctatus*

River Chiv-Chavi

The proposed crossing is located in the middle reaches of the River Chiv-Chavi, left tributary of the Khrami. Five fish species are found within the impact zone of the proposed crossing.

1. Caucasian chub - *Leuciscus cephalus*
2. Common khramuli - *Variocorhinus capoeta*
3. Mtkvari barbel - *Barbus lacerta*
4. Barbel murtsa - *Barbus mursa* - Eastern Transcaucasian endemic
5. Riffle minnow - *Alburnoides bipunctatus*

Lake Cherepanovskoe, Rivers Korsuchai and Chil-Chil

The proposed route corridor passes close to the eastern shore of the lake Cherepanovskoe, continues onto the Bedeni plateau, turns to the Gyuldag mountain range to the south and crosses the seasonal River Korsuchai and River Chil-Chil. Freshwater fauna of the latter is not sufficiently studied. The status and hydrological regime of the Korsuchai requires verification within the impact zone of the proposed crossing.

Tsalka Reservoir

The proposed route corridor passes along the ridge to the north of Tsalka reservoir.

In total, ten species occur in the Tsalka reservoir. Nine species can be found during feeding and spawning seasons:

1. Caucasian chub - *Leuciscus cephalus*
2. Mtkvari Barbel - *Barbus lacerta*
3. Riffle minnow - *Alburnoides bipunctatus*
4. European mirror carp - *Cyprinos carpio*
5. Crucian carp - *Carassius carassius*
6. Common khramuli - *Variocorhinus capoeta*
7. European cisco - *Coregonus albula*
8. Syrok - *Coregonus peled*
9. Whitefish Ludoga - *Coregonus lavaretus ludoga*

The spawning and feeding grounds of the Common khramuli and European mirror carp are located in Tsalka reservoir, adjacent to the villages of Beshtasheni, Santa, Tsintskaro and Gunyakala. European mirror carp gather in large numbers at the estuaries of the Rivers Ktsia-Khrami and Agrichai and adjacent areas. It is also numerous in the northern and southern-western parts of the reservoir.

The spawning grounds of Caucasian chub and Mtkvari barbel are located on the northern shore of the reservoir. European cisco, syrok and whitefish ludoga spawn at a depth of 0.5 – 1m, near the shores in autumn-winter.

River Gumbati

The proposed route then crosses the River Gumbati, left tributary of the River Khrami. The ichthyofauna includes of four fish species in area of the proposed crossing:

1. Caucasian chub - *Leuciscus cephalus*
2. Mtkvari Barbel - *Barbus lacerta*
3. Riffle minnow - *Alburnoides bipunctatus*
4. Gil trout - *Salmo fario*

River Ktsia

The ichthyofauna includes four fish species in the area of the proposed crossings on the River Ktsia:

1. Gil trout - *Salmo fario*
2. Caucasian chub - *Leuciscus cephalus*
3. Mtkvari Barbel - *Barbus lacerta*
4. Riffle minnow - *Alburnoides bipunctatus*

River Kumiska

From Tskhratskaro pass, the proposed pipeline route passes through mountains, descends towards Tsikhisjvari village and crosses the upper reaches of the River Kumiska, left tributary of the River Borjomka. In total, five fish species occur in the vicinity of the proposed crossing:

1. Gil trout - *Salmo fario*
2. Caucasian chub - *Leuciscus cephalus*
3. Mtkvari Barbel - *Barbus lacerta*
4. Barbel murtsa - *Barbus mursa* - Eastern Transcaucasian endemic
5. Riffle minnow - *Alburnoides bipunctatus*

River Oshora

After Kumiska crossing, the proposed route crosses the River Oshora, tributary of the River Kumiska, west of village Tsikhisjvari. The ichthyofauna includes four fish species within the area of the proposed crossing:

1. Gil trout - *Salmo fario*
2. Caucasian chub - *Leuciscus cephalus*
3. Mtkvari Barbel - *Barbus lacerta*
4. Riffle minnow - *Alburnoides bipunctatus*

Rivers Sakiristskali and Dviri

The proposed route corridor proceeds towards village Sakire where it crosses the Rivers Sakirula and its tributary Dviri south-east and south-west of the village. Four fish species have been recorded in the Sakirula, however, only three occur in the area of the proposed crossing:

1. Caucasian chub - *Leuciscus cephalus*
2. Mtkvari Barbel - *Barbus lacerta*
3. Riffle minnow - *Alburnoides bipunctatus*

The ichthyofauna of the River Dviri, left tributary of the River Mtkvari, is more diverse – in total, ten species are recorded, however, only six are likely to occur in the area of the proposed crossing:

1. Gil trout - *Salmo fario*
2. Caucasian chub - *Leuciscus cephalus*
3. Common khramuli - *Variocorhinus capoeta*
4. Mtkvari Barbel - *Barbus lacerta*
5. Barbel murtsa - *Barbus mursa* - Eastern Transcaucasian endemic
6. Riffle minnow - *Alburnoides bipunctatus*

Rivers Tiseli and Guslevis Tskali

The proposed route proceeds from village Sakire to village Tiseli, passes through mountains, coniferous and deciduous forests and passes through an area with numerous water-courses. It crosses the River Tiseli Ghele north of village Tiseli and then, the River Guslevis Tskali, right tributary of the Mtkvari, south-east of village Atskuri.

The ichthyofauna of the Tiselis Ghele consists of 7 fish species. Three of them occur in the section of the river where the proposed crossing is planned.

1. Gil trout - *Salmo fario*
2. Mtkvari Barbel - *Barbus lacerta*
3. Riffle minnow - *Alburnoides bipunctatus*

Seven fish species have been recorded in the Guslevis Tskali. However, only three species are likely to occur in the impact zone of the proposed crossing:

1. Gil trout - *Salmo fario*
2. Mtkvari Barbel - *Barbus lacerta*
3. Riffle minnow - *Alburnoides bipunctatus*

River Mtkvari – Proposed Crossing 2

After crossing the Small Elisi, the proposed route proceeds onto the terrace of a depression comprised of mountain steppes with phyganoid vegetation and crosses the river and its left tributary - Chvinti Ghele.

The river bed at the proposed Mtkvari crossing is wide. The dry bed located in the active zone of the river is also wide and slightly sloping. It is comprised of pebbles, sands and silts. The river flow is slow here. The local biocenosis is rich in zoobenthos and periphyton. The zoobenthos is mostly comprised of insect and worm biomass, such as Ephemeroptera, Plecoptera, chyronomidaes (Midge larvae), etc. In addition, considerable quantity of low setaceous worm biomass is present in this area. Pebbly-sandy biotope is an ideal environment for the majority of Mtkvari fish species in terms of spawning, feeding and growth. In total, fourteen fish species are present in this section of the river, however, only thirteen occur in the impact zone of the proposed crossing:

1. Common khramuli - *Variocorhinus capoeta*
2. Mtkvari Barbel - *Barbus lacerta*
3. Caucasian chub - *Leuciscus cephalus*
4. Barbel murtsa - *Barbus mursa* - Eastern Georgian endemic
5. Mtkvari bleak – *Alburnus filippi* - Eastern Georgian endemic
6. Mtkvari Gudgeon – *Gobio persus*
7. Ginger gobi – *Neogobius cephalarges*
8. Mtkvari stone loach – *Nemachilus brandti* - Eastern Georgian endemic
9. Golden spiny loach – *Cobitis aurata*
10. Spiny loach – *Cobitis taenia*
11. Black Brow – *Acanthalburnus microlepis* - Eastern Georgian endemic
12. Riffle minnow - *Alburnoides bipunctatus*

Four species, namely species 4, 5, 8 and 11, are endemic of the Eastern Transcaucasus. All species listed above spawn and feed in the vicinity of the proposed crossing.

River Potskhovi

The proposed route crosses the River Potskhovi at two locations. The Potskhovi ichthyofauna consists of thirteen species of fish. However, twelve species occur in the impact zone of the first proposed crossing:

1. Caucasian chub - *Leuciscus cephalus*
2. Mtkvari undermouth – *Chondrostoma cyri* - Eastern Georgian endemic
3. Mtkvari Gudgeon – *Gobio persusi*
4. Common khramuli - *Variocorhinus capoeta*
5. Mtkvari Barbel - *Barbus lacerta*
6. Barbel murtsa - *Barbus mursa* - Eastern Georgian endemic
7. Mtkvari bleak – *Alburnus filippi* - Eastern Georgian endemic
8. Black Brow – *Acanthalburnus microlepis* - Eastern Georgian endemic
9. Riffle minnow - *Alburnoides bipunctatus*
10. Mtkvari stone loach – *Nemachilus brandti* - Eastern Georgian endemic
11. Golden spiny loach – *Cobitis aurata*
12. Ginger gobi – *Neogobius cephalarges*

As regards the proposed second Potskhovi crossing, Gil trout *Salmo fario* occurs in addition to the species listed above. Five species, namely species 2, 6, 7, 8, 10, are endemic to Georgia.

Constraints and Limitations

There is no available data source on the ichthyofauna of the following rivers:

1. Korsuchai
2. Chil-Chil
3. Tkemlanis Ghele
4. Sakunis Ghele
5. Chahrohi Ghele
6. Kara Chahrohi Ghele
7. Tsinubani Ghele
8. Patara Elisi
9. Chvinti Ghele, left tributary of the River Mtkvari

8.11.3.6.8 Fisheries

Jandari Lake Fish Breeding Farm

Jandari lake is mostly used for melioration and fish breeding. The following species of high commercial value occur naturally: common khramuli, European mirror carp, Mtkvari Barbel. In addition, filtrator (silver carp and spotted silver carp) and phytophag (grass carp) species are artificially bred at the farm as these species do not naturally propagate in Georgia. The farm also has a small incubation plant. Jandari Lake fishery is in working condition at present.

Kumisi Lake Fish Breeding Farm

The fish farm breeds silver carp, spotted silver carp, grass carp and European mirror carp. The European mirror carp breeds naturally though in small numbers. Therefore, they are artificially bred together with other carp in a small incubation plant located on the lake. The capacity of the incubation plant is 2 million juveniles/year. The lake is eutrophic.

Tsalka Reservoir Fish Breeding Farm

The Tsalka reservoir is naturally inhabited by the fish species from the River Ktsia-Khrami, namely: Gil trout, Mtkvari barbel and Caucasian chub. Approximately 64% of catch is comprised of trout, 28% - chub and 18% - barbel. Total productivity reaches 20 - 30 tons. The following species have been introduced into the reservoir to increase productivity: European mirror carp, Sevan khramuli, syrok, European cisco, Whitefish ludoga and Crucian carp. The introduced species breed naturally though in insufficient numbers. Therefore, the fish farm uses an incubation plant to produce juveniles of European cisco, syrok (peled) and whitefish to increase productivity. The annual capacity of the plant is approximately 2.5 – 3 million juvenile fish. European mirror carp is also artificially bred at the plant, approximately 1.2 million juvenile fish per year. The infrastructure includes a number of ponds for juvenile fish, with total area of 61 ha.

Beshtasheni Fish Breeding Farm

The fish farm comprises an incubator and ponds for juvenile fish. The following species are bred at the incubator: European cisco, syrok, whitefish and European mirror carp. The annual capacity is 2 – 2.5 million juvenile fish. European cisco, syrok, whitefish are bred for introduction into the Tsalka reservoir while European mirror carp is grown at ponds. The total area occupied by the ponds is 80ha.

Tabatskuri Fish Breeding Farm

The farm infrastructure is simple. The lake is used for feeding and growing juvenile fish. The farm has a small incubator. The following species are artificially bred at the incubator: trout, cisco, and whitefish. The juveniles are then introduced into the lake. The farm uses natural springs for water supply. Total capacity of the plant is 2 million trout and 5 million cisco and whitefish juveniles per year.

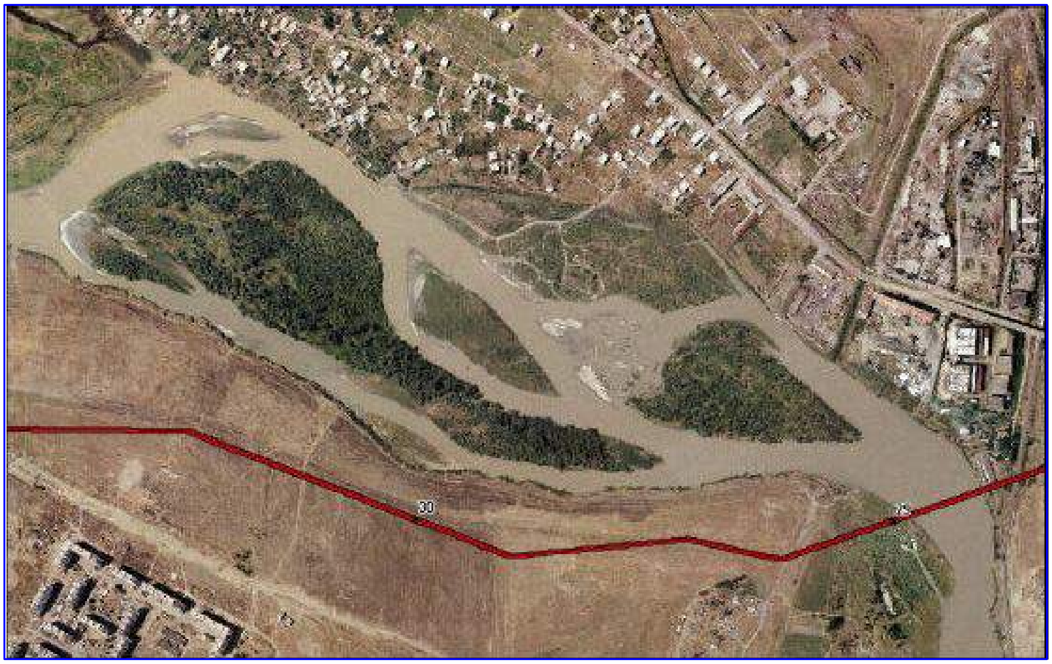
8.11.4 Habitats

The previous sections have described the botanical and faunal characteristics along the proposed pipeline corridor. In this section, the sensitive habitats that occur as a result of floral or faunal characteristics are discussed and considerations are made with regard to habitat extent, degree of fragmentation, supported biodiversity and ultimately conservation value. Only habitats with rare, endangered, endemic species or associations are described below.

8.11.4.1 Riparian islands on Mtkvari River KP 29-31

The riparian islands in this section of the River Mtkvari are densely vegetated with tugay forest species that include willows and poplars with an understorey of tamarisk and other herbaceous species. The tugay forest has high conservation status due do its gradual disappearance from the Mtkvari alluvial plain, especially in Georgia. The fragments on the riparian islands are relatively undisturbed and therefore highly representative of this type of habitat.

Figure 8-55 Riparian Islands on Mtkvari River



The tugay forest is a habitat for mammals, including endangered species such as otter, red deer, wolf, jungle cat and wild cat although there is no specific evidence of occurrence of these species on the islands. On the islands there is a known population of black stork that is listed in the Georgian red data book. This population appears to be the only nesting population of black stork in eastern Georgia.

The riparian habitats on the islands do not support a significant biodiversity and are surrounded by degraded habitats: the industrial outskirts of Rustavi to the north and agricultural fields to the south.

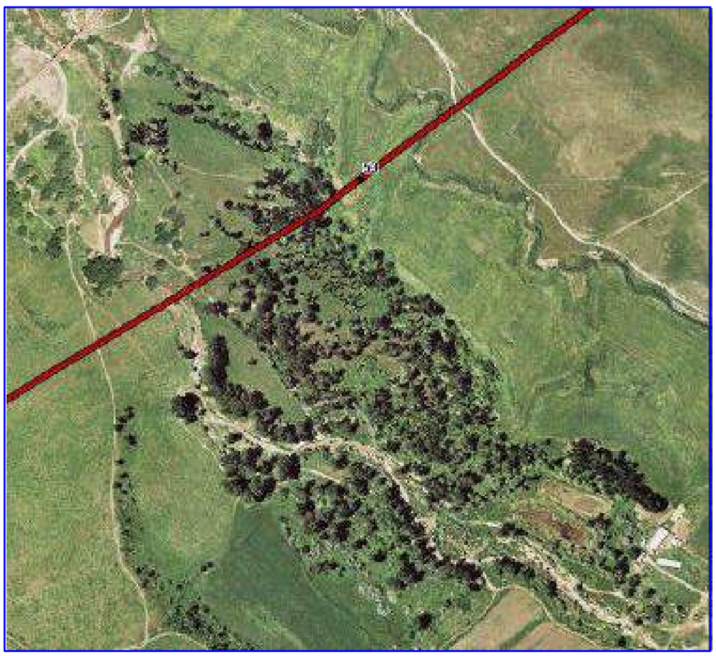
The habitat has a high conservation value owing to the occurrence of the nesting population of black stork and owing to the degree of integrity of the tugay forest fragments that occur on the islands.

8.11.4.2 Algeti river crossing KP 53

The Algeti river crossing is another example of riparian habitat with a relict fragment of tugay forest. The habitat is significantly degraded as a result of the removal of trees and owing to its proximity to anthropogenic activities. The vegetation, consisting primarily of willows, poplar and tamarisk is often sparse and large trees are gradually being cut, presumably for use as firewood.

As mentioned in the previous section, the tugay forest is a habitat for mammals and birds, including endangered and endemic species. However here is no specific evidence of extensive faunal use in this fragment.

Figure 8-56 Algeti River Crossing and fragment of relict riparian forest



The fragment of relict forest in this section of the pipeline route is significantly degraded, however it has a medium conservation value owing to the rarity of similar habitats in the general area. The fragment does not support significant wildlife or biodiversity owing to its isolation from similar habitats.

8.11.4.3 Tetritskharo forest (KP 84 to KP 92)

The Tetritskharo forest is a collection of contiguous fragments of primary and secondary forest with a predominant composition of high mountain oak and localised dominance of beech, Georgian oak or hornbeam. The forest regeneration rate is very low, and almost no saplings and seedlings were observed in these forests during the surveys carried out. Important forest communities are those dominated by beech, as pure beechwods are very rare in the Tetritskaro region. In addition, the high mountain oak is a red data book species and several populations of endangered or endemic herbaceous species were noted in the general area.

From a botanical standpoint the fragments that will be encroached by the proposed pipeline represent the most degraded forest fragments within the overall forest habitat. Most of the degradation is the result of tree logging accompanied by limited natural regeneration. The subject area is particularly prone to timber logging owing to easy access via the dirt tracks that follow the railway line. The forest is rich in various berries and mast producing species such as oak and beech thus creating suitable conditions for breeding birds and mammals including large mammals.

This section is also very important from a zoological point of view because it connects the Great Caucasian Ridge with the Lesser Caucasus and acts as a corridor between the two for the migration of mammal species thus playing a key factor for the conservation of biodiversity. The following endangered species have been recorded in the Great Caucasian Ridge and the Lesser Caucasus: brown bear, lynx, roe deer, wolf, wild cat and Persian squirrel. During the detailed faunal surveys carried out along the proposed pipeline route observations of footprints, scat or other marks indicated evidence of wolf, brown bear, fox, hare, badger, marten, wild cat, lynx, roe deer and wild boar.

The area of forest along the proposed pipeline route is extensively fragmented and divides two large and relatively undisturbed forest habitats. The overall extension of the forests linked by the subject area is approximately 55,000 ha. Although continuous links through the two large forests did exist until recent times, the construction of the railway and the road that largely follows the railway have created a linear interruption in the canopy and therefore fragmentation of the habitat. The clearings are not however considered insurmountable barriers for the larger animals and therefore large-scale migration of species is unlikely to have been significantly affected.

Figure: Map 8.12d-e shows the satellite image of the overall area and highlights the forest habitats mentioned above. The images below show details of the forest fragments crossed by the proposed pipeline that currently ensure the habitats' spatial continuity.

Figure 8-57 Existing linear fragmentation of habitat link (KP 84.5-86.5)

Figure 8-58 Existing linear fragmentation of habitat link (KP 90)

Figure 8-59 Existing linear fragmentation of habitat link (KP 91.2-92)

The overall conservation value of the habitat is very high owing to the abundance of floral species supported and because of the importance of the region as a migratory link for terrestrial species over a vast geographical area. The habitat is vulnerable to fragmentation and on a large scale, this could lead to the interruption of the migratory link and progressive impoverishment of the faunal genetic pool throughout the region.

8.11.4.4 Mt Taukvetili (KP 150.5-154)

Mt Taukvetili is a relict volcano characterised by high altitude, a predominantly boulder covered surface with virtual absence of topsoil on its slopes and a vegetated plateau on its north-eastern flank hosting a system of ephemeral wetlands. Part of the plateau and the slopes are colonised by rhododendron shrub that provide shelter for nesting birds, in particular black grouse. It is the black grouse population and the presence of the two very rare alpine wetlands with related botanical associations that confer ecological imortance of this area.

Figure 8-60 Aerial photo of Mt. Taukvetili

The species is resident in the Greater and Lesser Caucasus mountains of Russia (30,000-60,000 individuals), Georgia (>6,000 individuals), Turkey (1,000 pairs), Armenia (150 individuals), Azerbaijan (perhaps 1,500 individuals) and Iran (110-200 individuals). In 1987, a total of 70,000 birds were estimated in the Greater Caucasus and in 1974, 500 birds in the Lesser Caucasus. Political unrest has prevented the collection of more recent data on either populations or the threats to them. It is found in sub-alpine and alpine meadows, slopes with rhododendron and juniper, and on the edge of birch forest in spring and winter, at elevations of 1,500-3,300 m, but at lower altitudes in winter. Habitat loss and deterioration are likely to be the major threats with 40% of sub-alpine meadows within its range suffering from intensive grazing. Meadows used for hay production are important for breeding birds. Illegal sport hunting is an increasing threat, particularly in the Lesser Caucasus.

Figure 8-61 Slopes of Mt. Taukvetili with rhododenron scrub, habitat of the black grouse

The wetlands are dominated by sedge *Carex inflata* and have similar floristic composition. In both wetlands a well developed moss layer indicates the process of turf accumulation. The wetlands are fed both by groundwater and surface water and are located at the bottom of a dried lake.

Figure 8-62 Carex Inflata

Various types of wetland communities dominated by *Carex inflata* are found in both Greater and Lesser Caucasus but are becoming extinct or floristically impoverished in many areas of Georgia. These wetlands are therefore considered of high conservation value owing to rarity, vulnerability and low restoration potential.

In addition to the characteristics discussed above, the habitat is virtually undisturbed and therefore supports a variety of additional wildlife, ranging from predatory and migratory birds to small mammals, reptiles and invertebrates.

In summary, the habitat on Mt Taukvetili is considered of high conservation value owing to its floral and faunal characteristics, its rarity and its high vulnerability. The wetland component of the habitat is most vulnerable to changes in surface and ground water regimes. With regard to the black grouse, the habitat is most vulnerable to the loss of rhododendron scrub and to prolonged noise disturbance. Although the grouse is a protected species it has an abundant population in Georgia and the habitat on Mt Taukvetili is well represented in the general surroundings.

8.11.4.5 Narianis Veli (KP 155-159) and Ktsia (KP 164) wetlands

The Narianis Veli and Ktsia wetlands are areas of flat topography within the upper Ktsia valley that have developed into sub-alpine wetlands after the last glacial age. In the last few decades, the wetlands have been degraded by human activity including the drainage of the area to facilitate cultivation of hay, grazing and general disturbance to wildlife through hunting and vehicle movements.

Figure 8-63 Ktsia wetland (KP164)

The habitat was studied in detail as part of the baseline assessments and was found to have a high botanical conservation value, of being an important site for migratory birds and of being an important spring feeding site for mammals, including brown bears.

The botanical value is owing to the presence of several endemic species such as primrose (*Primula luteola)*, gentian (*Gentiana angulosa)*, *Scilla rosenii*, *Thymus grossheimii* and orchid (*Dactylorhiza euxina)* and owing to the rarity of this type of wet meadows associations at sub-alpine altitudes.

The wetland also provides an ideal habitat for migratory birds. Conditions are suitable for species that migrate from different altitudes within a local range. Important bird species observed at Narianis Veli include grey partridge (GRDB and IUCN lsted), common crane (GRDB species) and corncrake, which is included in the IUCN Red List as a globally threatened species. In addition all of the migratory waterfowl recorded on the site are protected by AEWA (Afro-Eurasian Waterbird Agreement) of the Bonn Convention.

Among the numerous terrestrial species recorded at the site the most noteworthy was the endangered brown bear. The habitat is also suitable for the critically endangered otter although no individuals were recorded during the surveys.

The habitat, together with Mt Taukvetili, discussed previously, is part of a protected area under the Georgian protected areas system and is classified as a "managed reserve". No management plan has however been developed or implemented in this area.

The habitat owes its conservation status to the abundance of wildlife and the rarity of wetland associations at these altitudes. It is also an important conservation site in view of the existing threat of degradation owing to anthropogenic activities. As such the area is not particularly vulnerable to new development although additional disturbance would contribute to the overall degradation in the absence of a habitat management and restoration plan.

8.11.4.6 Tsikisjvari-Kodiana-Sakire forest (KP 180-202)

The area coincides with the northern slopes of the Trialeti mountain range where this is disected by the Mtkvari valley. In general the area is a mixture of sub-alpine forests and meadows with occasional presence of mountain villages and agricultural land in their immediate surroundings.

The forest is mainly of primary origin and is locally dominated by pine, crook stem birch and beech. The sub-alpine meadows support endemic and endangered floral species such as *Gentiana angulosa and Scilla Roseenii.*

Most of the forests are mature communities, which are important refuges for many animal species. Human impact is high owing to tree felling on some of the sites, especially where terrain is accessible. However, natural regeneration appears to be high in a number of places. The whole area abounds in streams, rivers and small ponds, which are important for amphibians. The terrain is quite rugged with frequent steep slopes and deep gorges. Mature old forests provide shelter for large mammals, such as bear, wolf, marten and lynx, all recorded during the sites surveys with the exception of the lynx. Occasional openings and meadows, as well as forest type and structure and terrain diversity, create a mosaic of microhabitats. The forests are remarkably rich in wild fruits, various nuts and berries throughout the study area. The area is also part of the migration corridor between the Greater and the Lesser Caucasus and thus it plays an important role in the conservation of genetic diversity among faunal populations.

Endangered bird species including Corncrake, a globally threatened species and black grouse have been recorded in this area. In addition endangered amphibians and reptiles are also known to occur in this area.

From KP 180 to 189 the proposed pipeline route skirts along the southern edge of a large forest massif that extends generally un-fragmented over an area of approximately 10,000 ha. The route encroaches only two continuous fragments of forest (from KP 180 to 182; and KP 185-188 see Plates 8-64 and 8-65 below) but is generally outside the core of the habitat.

Figure 8-64 Continuous forest fragment along pipeline route

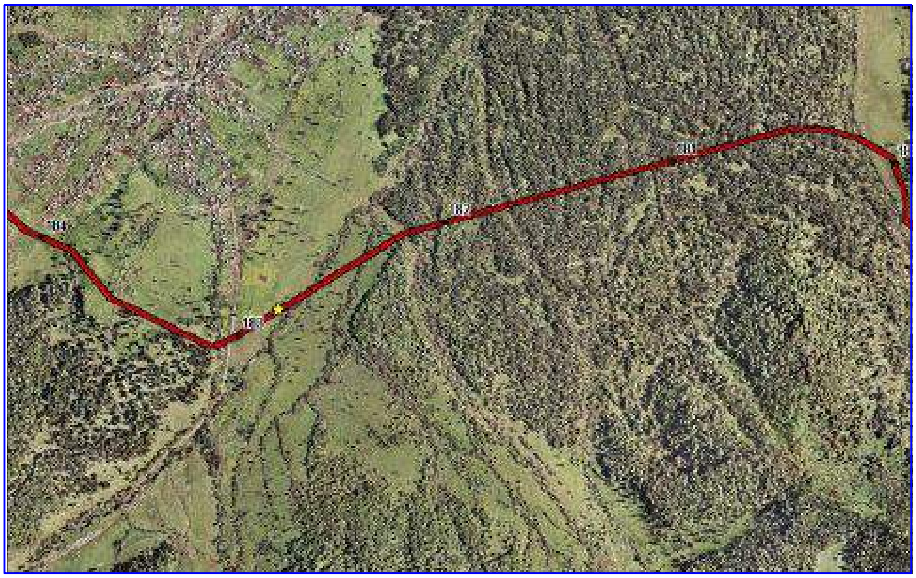


Figure 8-65 Continuous forest fragment along pipeline route

From KP 189 to 194 the proposed route encroaches sub-alpine meadows and from KP 194 to 202 it follows clearings within a heavily fragmented forested area. In the latter section the habitat encroached by the proposed route is generally at the margins of the forest and therefore less pristine in floral and faunal characteristics. Figure 8-66, Figure 8-67 and Figure: Map 8-13a-b show the extent of the forest habitat in relation to the pipeline route.

Figure 8-66 Fragmented forest encroached by the proposed pipeline route

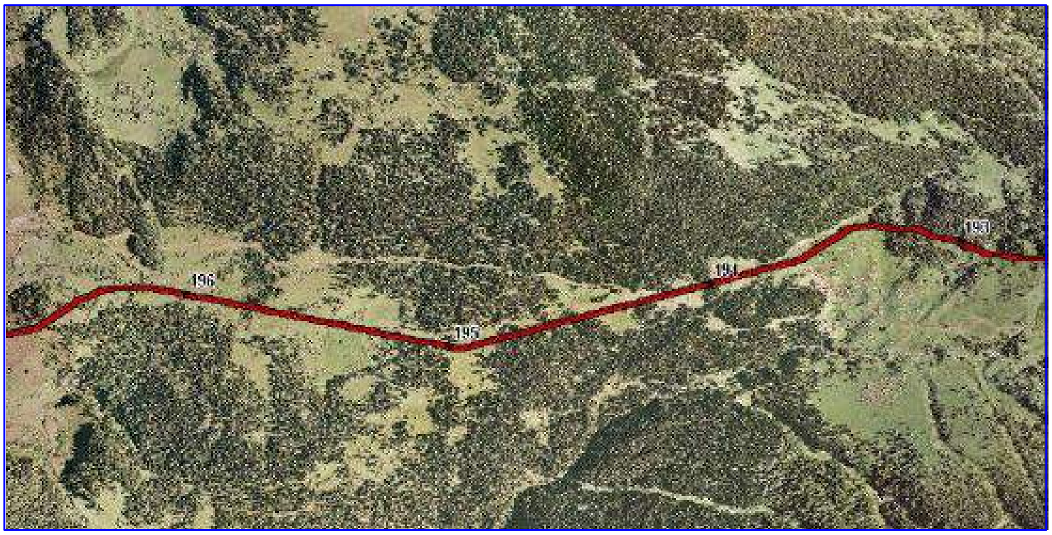


Figure 8-67 Fragmented forest encroached by the proposed pipeline route

In summary, the forest and meadow habitats in this section are of high conservation status and support diverse floral associations and wildlife, including endangered and critically endangered species. The habitat is more vulnerable in the eastern section where the proposed pipeline route encroaches continuous fragments of forest. In the west, the sub-habitats along the route are more fragmented and generally more disturbed by anthropogenic activities and therefore less vulnerable. In both cases, (more or less fragmented forest) the habitat is at the margins of a much larger continuous habitat and therefore the overall habitat vulnerability from a fragmentation standpoint is reduced.

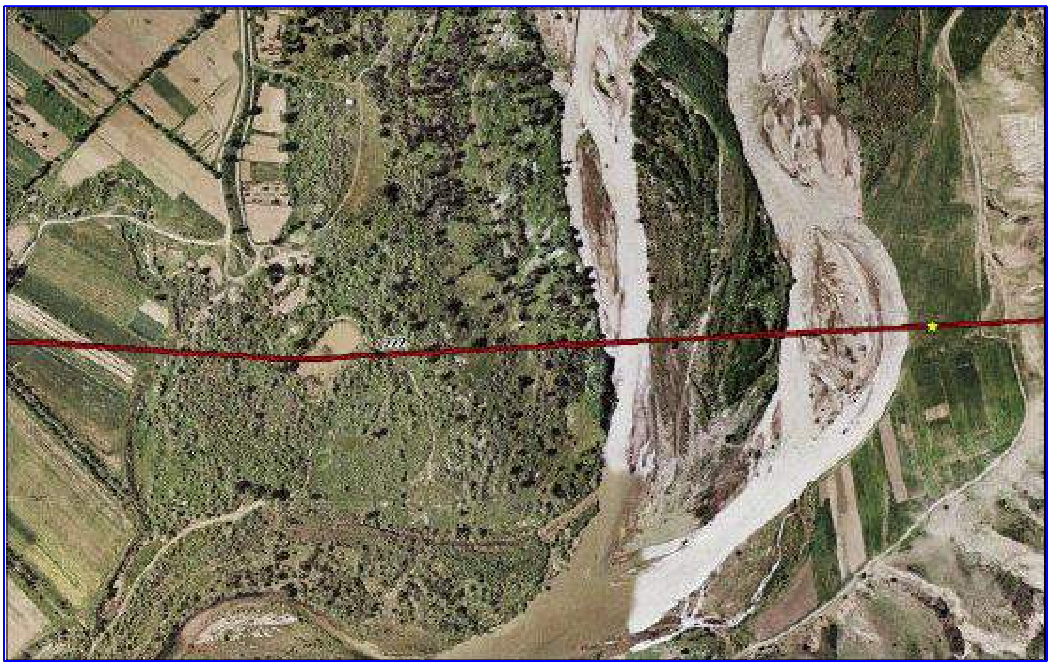
8.11.4.7 Mtkvari west crossing KP 221.5

The habitat at the river crossing is characterised by relict tugay forest with botanical and faunal associations of medium conservation value.

The Mtkvari River crossing encroaches a degraded fragment of primary tugay forest on the west banks of the river and agricultural land on the east banks of the river.

The riparian forest in this area supports primarily avian fauna and surveys of the site recorded two internationally important migratory water birds (Garganey and Little-ringed plover) protected by AEWA.

Figure 8-68 Mtkvari crossing and extent of riparian forest



The site has medium conservation value owing to the presence of migratory and breeding birds and owing to the tendency of riparian forest to become extinct. It is however significantly degraded and is not particularly vulnerable to anthropogenic activities given the existing level of disturbance. The site does not show significant vulnerability to fragmentation since the overall habitat is already significantly fragmented and because the proposed route encroaches a marginal fragment of the habitat.

8.11.4.8 Potskhovi crossings (KP 228.5)

The proposed pipeline crosses the River Potskhovi at two locations, the first of which is a remnant fragment of a primary riparian forest. The tugay forest in this area is extensively fragmented and does not constitute a continuous habitat. In addition large areas of forest have been cleared to make room for orchard or agricultural crops.

The site was found to be rich in avian diversity and two of the recorded species (ringed plover and Green sandpiper) are internationally significant species covered by AEWA, while all others were common in species with no particular conservation status.

Figure 8-69 Potshkovi river crossing at KP 228.5

In summary the habitat has a low conservation value and low vulnerability owing to generally degraded conditions and owing to its existing high degree of fragmentation.

8.12 PROTECTED AREAS

The proposed ROW passes through two designated conservation areas: the Ktsia-Tabatskuri Managed Reserve and the Support Zone of the Borjomi-Kharagauli National Park (Table 8-50). In addition, a number of protected areas of various categories and designations are present within the general geographic area of the ROW (Figure: Map 8.14). This section of the baseline report describes the characteristics of the Ktsia-Tabatskuri Managed Reserve and the Support Zone of the Borjomi-Kharagauli National Park. In addition, a brief datasheet is enclosed for all other reserves that are not directly present on the route.

Table 8-50: Summary of designated conservation areas crossed by proposed route

Name	Start_KP	End_KP	Length, km
Ktsia-Tabatskuri Managed Reserve	153.9	175.1	21.2
Support Zone of the Borjomi-Kharagauli National Park	175.1	213.6	38.5

8.12.1 Ktsia-Tabatskuri managed reserve

The Ktsia valley, Lake Tabatskuri and the associated wetlands are all part of the proposed Ktsia-Tabatskuri Managed Reserve. The Reserve was proposed in 1995 under the Cabinet of Ministers Resolution No. 447 *On Creating Borjomi-Kharagauli National Park & Measures Facilitating Establishment of Protected Areas System*. A definition for a Managed Reserve and additional details covering issues such as management plans and activities in protected areas were provided in the 1996 *Law of Georgia on the Protected Areas System.*

Activities permitted within Managed Reserves comprise manipulative management to maintain or improve the value. Non-permissible activities are: those that negatively alter the environment; exploitation of natural resources; damage via contamination; introduction of exotic species; transporting explosive or toxic material into the area and any other activities prohibited by the Management Plan. Under the law, different zones can be designated within a Managed Reserve but there is nothing specific to state what these may be or the aim.

There has been some debate as to the status of the site. The State Department of Protected Areas, Reserves & Hunting Farms and the World Wide Fund for Nature (WWF) believe that it is proposed and not yet formally designated. A representative from the World Bank funded Georgia Protected Areas Programme, who previously worked for WWF and was involved in drafting the legislation, believes that the site is designated. The Georgian legal view is that the Managed Reserve is designated but with temporary boundaries. The development of a management plan is awaited.

Under the Law on Protected Area Systems, designated Managed Reserves are taken to correspond to IUCN Category IV Habitat/Species Management Areas: protected area managed mainly for conservation through management intervention. The site is currently not listed on the IUCN international list of protected areas. The Ministry of the Environment (MoE) in Georgia state that it is the intent that the site would be formally notified for inclusion on the IUCN list at some point although there is no timetable for this.

No part of the site is designated or proposed as a Ramsar site under the Ramsar Convention, but as a signatory to the Convention, Georgia has an obligation to protect wetlands in it's territory and to ensure their wise use. Lake Tabatskuri is not noted on the international list of Important Bird Sites (IBS) developed by Birdlife. A number of the species recorded for the site are noted on the Red Lists of endangered/rare species of IUCN and Georgia.

Resolution No. 447 allowed for the definition of temporary boundaries for the proposed Reserve with the expectation that the boundary would be formally defined following the elaboration of a Management Plan. The proposed area covers 22,000 hectares and includes high-mountainous wetlands in the vicinity of Lake Tabatskuri (Narianis Veli wetlands) and sources of the Ktsia River (Ktsia valley wetlands) at altitudes of 2,050 – 2,080 metres (m) above sea level (AMSL). Georgian environmental groups consider the Narianis Veli wetlands to be important an migratory bird staging post. Lake Tabatskuri, situated at an altitude of 1,991m AMSL, is the largest waterbody in the area with an area of 14.2km^2. It is understood that the management objectives for the site are:

1. Protection of unique high-mountainous wetlands located in the vicinity of the River Ktsia sources
2. Protection of Tabatskuri lake fresh water ecosystem providing refuge to migratory birds
3. Protection of bird species *(Ciconia nigra, Ciconia ciconia, Grus grus, Cygnus olor, Cygnus cygnus, Egretta alba)* and their habitats

Currently there is no active management for conservation and agricultural activities are ongoing. This includes a canal system in Narianis Veli wetland, believed to have been excavated in the 1950s to drain the wetland and permit a hay crop to be taken.

8.12.2 Borjomi-Kharagauli National Park

The Borjomi-Kharagauli National Park was designated in 1995 under Resolution No. 447 of the Cabinet of Ministers. The main purpose of the designation is the conservation of existing ecosystems; restoration of degraded areas; facilitation and control of sustainable use of renewable resources; awareness / educational activities and ecotourism.

According to the Park Management Plan compiled by WWF, the Park is divided into a number of zones: core zone (strict nature protection zone); wilderness zone; traditional use zone; recuperation zone and support zone (covering the five Districts that share a common boundary with the Park). The National Park extends to 50,400 hectares, having been extended in 2000. It covers primary forest and sub-alpine meadows typical of the central region of the Lesser Caucasus. The Park supports a good variety of flora and fauna including several rare and endangered species, relic species and species endemic to the central Caucasus region. The Support Zone covers 150,000 hectares and consisting of various land uses including agriculture, industry, infra-structure and areas of natural and semi-natural habitat. The rationale for the establishment of the Support Zone is to secure the support of park neighbours for the sustainable protection of the park. This is achieved through the economic support and assistance to Park neighbours in recognition of sacrifices made in giving up certain user rights for areas converted to a National Park and by involving Park neighbours in the planning and Park management process. Land and resource use in the Support Zone should be compatible with the conservation objectives for the Park. The development of the Support Zone should be based on a well designed, Regional Development Plan aimed at sustainable economic development for the benefit of Support Zone Communities and biodiversity conservation. The Support Zone does not correspond to an IUCN category and as such is not listed on the IUCN international list of protected areas.

In December 1998, the governments of Germany and Georgia signed a bilateral agreement regarding financial co-operation for the project concerning 'Environment and Protection of Natural Resources Borjomi-Kharagauli National Park'. Further details of the co-operation are provided in the Decree of the President of Georgia (13th July 2001) on '*Co-ordinated Planning and Implementation of Ongoing and Prospective Programs of Borjomi-Kharagauli National Park and It's Support* Zone'. The German government provides funds for three programmes in the Park - implementation of infrastructure; training/education and a Support Zone development programme.

8.12.3 Other protected areas outside the ROW

Algeti State Nature Reserve

Area	6,400ha
Date of Establishment	1965
Purpose	Protection of the easternmost habitat of natural forests of spruce and fir, conservation of rare floral and faunal species
Activity	Protection and conservation, scientific research, monitoring, awareness / educational activities
Management	State Department of Protected Areas, Nature Reserves and Hunting Economies
Level of Designation	National
IUCN Category	Equivalent to IUCN Category I 'Strict Nature Reserve / Wilderness Area'

Borjomi State Nature Reserve:

Area	17,948ha
Date of Establishment	1929
Purpose	Protection of large areas of pure fir and pine groves in Caucasus, conservation of natural complexes including rare and endangered plant and animal species
Activity	Protection / conservation, scientific research, monitoring, awareness / educational activities
Management	State Department of Protected Areas, Nature Reserves and Hunting Economies
Level of Designation	National

IUCN Category	Equivalent to IUCN Category I 'Strict Nature Reserve / Wilderness Area'

Expansion of Borjomi-Kharagauli National Park

Area	10,846ha
Legal Basis	Law of Georgia on Protected Areas, Agreement on 'Financial Co-operation within the Project "Protection of Environment / Borjomi-Kharagauli National Park' between Georgia and Germany, approved by Resolution of Cabinet of Ministers of Georgia No. 447, dated 28/07/1995, 'On Activities Facilitating Formation of System of Protected Areas and Establishment of Borjomi-Kharagauli National Park'
Transitional Management	Adigeni district authorities, State Department of Land Management and Adigeni Forestry of State department of Forestry.
IUCN Category	Equivalent to IUCN Category II

Tetrobi Managed Reserve

Area	3,100ha
Date of Establishment	1995
Purpose	Protection and restoration of unique plant species and their biodiversity, protection of unique Tetrobi forest
Activity	Protection / conservation, restoration, monitoring, restricted tourism;
Management	State Department of Protected Areas, Nature Reserves and Hunting Economies
Level of Designation	National
IUCN Category	Equivalent to IUCN Category IV 'Habitat / Species Management Area'

8.13 SITES OFF THE PIPELINE ROUTE

8.13.1 Introduction

This section of the environmental baseline addresses the sites located outside the pipeline route where construction related activities will take place. The activities identified are as follows:

- Establishment of a supply base at the port(s) used for shipping materials into Georgia
- Establishment of pipe storage yards and camps for construction workers
- Development of borrow pits and inert material disposal sites
- Development of waste disposal site
- Transportation of equipment, materials and people

The sections below describe baseline conditions for each of the above sites or activities.

8.13.2 Supply base at ports

Pipe sections, construction and operational equipment, will be imported to Georgia via either Poti or Batumi Port. BP have inspected both ports.

8.13.2.1 Poti Port

Poti Port (Figure 8-70) is located on the eastern coast of the Black Sea and occupies a total area of approximately 49 hectares. A visit was made to the port in order to undertake a site survey to establish the environmental baseline (Figure: Map 8-15a). All information contained in this report was obtained during the site visit on the 12th February 2002 and through meetings with representatives from the Construction Department and the Environmental Department from Poti Port.

Figure 8-70 Poti Port

8.13.2.1.1 Port facilities

Currently the port has 14 berths with a total frontage of 2,650m. Eleven berths are equipped with portal cranes each with a capacity of between six and 40 tonnes. These berths are also linked to railroad spurs.

The port has its own fleet of tugboats, pilot boats, oil and waste collecting boats and two floating cranes with a maximum capacity of 50 tonnes and 75 tonnes. A wide variety of cargoes can be handled including bulk cargo (ore, grain, scrap metal, bauxite and coke), containers (20ft and 40ft), and liquid (oil and petroleum).

Vessels up to 250m length, 32m beam, and a maximum draft of 10.8m can be accepted by the port. The largest vessel worked in Poti was 226m in length and was carrying a cargo of coated pipe joints for the Western Route Export Pipeline. Total cargo weight was 15,000 tonnes.

8.13.2.1.2 Berthing facilities

Berth 1

Berth 1 is 200m in length and has a depth of 12.5m. It is currently used for handling liquid petroleum products. Petroleum products arrive at the port by train. The wagons are emptied into tanks and pumped directly onto the awaiting ship.

Berth 2

Berth 2 is 185m in length and has a depth of 12.5m. It is currently used as a ferry terminal. There is a proposal to upgrade Berths 1 and 2 to create an expanded petroleum handling facility with associated storage facilities.

Berths 3, 4, 5 and 6

Berths 3 to 6 have a combined length of 762m and have a maximum depth of 9.7m. They are currently used to handle general bulk cargo, in particular scrap metal.

Berth 7

Berth 7 is 170m in length and has a total depth of 8.5m. It is used primarily for the handling of 20ft and 40ft containers.

Berths 8, 9, 10 and 11

Berths 8 to 11 have a combined length of 760m and a maximum depth of 8.7m. They are currently used for handling general bulk cargo. A new warehouse comprising 2,600 square metres of storage space adjacent to Berth 10 was completed in January 2002. There is a proposal to build a second storage facility adjacent to Berth 9.

Berths 12 and 13

Berths 12 and 13 have a combined length of 317m and a maximum depth of 8.5m. They currently comprise the Ro-Ro and Passenger Ferry Terminal.

Berths 14 and 15

Length and depth unconfirmed. This area is used for the berthing of fishing vessels.

8.13.2.1.3 Fuelling facilities

Fuelling of ships is done only by a specialised fuelling vessel. This vessel is fuelled at Berth 1 by a pipeline which is fed by fuel arriving by rail to the port. The fuelling vessel can carry a maximum of 1,000 tonnes of fuel. Once full it can re-fuel vessels either whilst berthed or at any location within the harbour area. According to Port representatives, normally only ships owned by the port are fuelled by the port. However, the port can offer re-fuelling facilities to other vessels on request.

8.13.2.1.4 Rail spurs

Eleven of the fourteen shipping berths are served by rail spurs and associated sidings. The railspurs enter the port at two separate locations both on the eastern boundary. They are connected to the national rail network at Poti Station. Cargo can be loaded directly from ships onto parked wagons. There are ample sidings and shunting facilities to allow full cargoes to be unloaded immediately. The port has three diesel powered locomotives for shunting within the port. Poti station has five diesel locomotives for use in forming trains and shunting operations.

8.13.2.1.5 Workshops and laboratory

There are two workshops and a laboratory at the port. Workshops are used for maintenance work including rebuilding and welding of ship parts and machinery such as generator and crane parts. The laboratory is used for the analysis of cargo coming in and out of the port. Samples of cargo such as fertilizers, pesticides, aluminum powder, and chemicals are taken at random intervals for routine analysis.

8.13.2.1.6 Storage facilities

The quayside adjacent to the cranes is used as an open warehousing facility. On the day of survey, the quayside adjacent to berths 3, 4 and 5 comprised a large amount of scrap metal being loaded onto ships for export. Berths 1, 2, 6 and 7 had a small amount of cargo and a number of containers awaiting loading. The quayside adjacent to berths 8, 9, 10 and 11 were vacant. Here, housekeeping was in good order. The area had recently been swept and cleaned.

Indoor warehouse facilities comprise 7,800 square metres of storage space housed in three buildings, two of which are over 40 years old (one of these is currently being renovated) and one new building which was completed in 2002.

Rail spurs from the port also have access to storage areas (both covered and open) located on the outskirts of Poti. Whilst these areas are used for storing rail wagons, they have not been used for storing cargo for some time. Three of the sites were visited on the day of the survey and are described below.

8.13.2.1.7 Power supply

Cranes in the port are electric powered. Power supply to the port improved between 1999 and 2000 with a power shortfall of 1,970 hours during 1999 and 1,900 hours in 2000. Cuts in power supply is most noticeable during winter and early spring. The port has four static diesel field generators located to the east of Berth 7. One is capable of generating 1,100KW, two are capable of generating 800KW, and one is capable of generating 400KW. The generators are over 20 years old and require constant attention when operational.

8.13.2.1.8 Drainage

Numerous drains were identified across all parts of the Port. All surface water appears to drain directly into the harbour waters.

8.13.2.1.9 Housekeeping

Based on a visual assessment, housekeeping at the port varied depending on the location. As discussed, the quay alongside berths 8, 9 and 10 was completely cleared and had clearly been swept and cleaned. Storage facilities too were well maintained and organised. The quay alongside berths 3, 4 and 5 however was poorly ordered. A number of small oil spills along with parts of scrap metal were strewn across the area. Some scrap metal items had clearly been left for a considerable length of time, eg scrap left in inaccessible places such as underneath cranes. At a number of locations, scrap metal was wedged in between crane rails.

Boundary walls, gates and fencing were of very poor quality in a number of places.

8.13.2.1.10 Potential contamination sources

Potential contamination sources at the port include the oil sump and pumping facilities associated with Berth 1 and its connecting rail lines; the substation with associated transformers and diesel generators; the workshops and laboratory; and the small fuelling facilities.

It is understood that the Port Authority has proposed Berths 3 and 4 for the pipe unloading and therefore Berth 1 was not inspected during the site visit. However, located along side the rail lines connecting to Berth 1 were a number of small oil stained areas.

The substation located in the north-eastern part of the site was inspected as well as the diesel generators adjacent and were found to be in a clean state. Located near this was the small fuelling facility with up to ten small fuel tanks. A number of small spills were visible in the immediate vicinity of the tanks.

Located in the south-eastern part of the site were a number of buildings that contained workshops and a laboratory. The workshops were old and in poor conditions, it is possible that contamination is present, but was not apparent at the time of the visit.

A potential cause of contamination of the environment, and in particular the port waters, is associated with the lack of bunds or capture system near the berth edge. During the site visit to Berths 3 and 4, rainwater runoff was observed flowing directly into the port waters.

8.13.2.1.11 Environmental policies & procedures

It is understood that the port has a ship, which is capable of treating oil spills, taking contaminated sea-water on board, gathering solid waste, and taking waste-water from incoming ships on board. According to Port representatives, contaminated sea-water and waste-water from ships is taken to a treatment facility in Poti; solid waste is transported by ship to a treatment facility in Batumi.

As part of routine checks in the port area, water and air samples are collected every three months or whenever a boat that is considered as having the potential to contaminate water or air is in port. These samples are sent to the laboratory on site for checks on quality. According to the port representatives, samples have ‘never shown anything unusual’.

The port also carries out radiation checks on all cargo entering and leaving the site. These are also carried out on the trains and ships.

The port did not appear to have any documented environmental policies or procedures such as impact assessments or oil spill response plans.

8.13.2.1.12 Surrounding area

Approximately 1.5km to the east of the port is the western edge of a Ramsar designated site, the boundary of which runs parallel with the Black Sea coastline. One location on the edge of the Ramsar site and approximately 2km from the port was surveyed. The site was found to support an extensive habitat dominated by various species of sedge (*Carex spp.)* and rush (*Juncus effusus*). It is remarkably rich in biodiversity supporting more than 200 species of vascular plants. The site is an important habitat for the migratory and nesting species of avifauna such as corncrace (*Crex crex*) and black stork (*Ciconia nigra*).

Associated Pipe Yards

Three pipe yards (Figure: Map 8-15a) with 2km of the port have been proposed as potential contingency storage areas should rail wagons not be immediately available to receive cargo from ships. This section provides a description of each of these sites.

Site 1: Princess Diana

Site Survey

The site known as 'Princess Diana' is located approximately 2km north of the Port on the eastern side of Nadaba town. The site is situated within an existing industrial area located to the south and west, with wetlands and marshlands located to the north and east. It is currently used as a storage area and customs terminal.

The site contains two main structures: one dilapidated concrete building and one in-use concrete refrigerating building, located in the north east corner and the south west of the site respectively. A rail spur enters the site on the eastern boundary and diverges. One spur leads to the storage area and the other to the refrigerating building. A generator and out-building is located next to a timber house in the western corner of the site.

Potentially contaminated areas located at Princess Diana proposed storage yard include:

- The generator and transducer building located adjacent the house in the western corner
- Scattered debris located at the rear of the dilapidated building in the NE of the site. This contains fragments of corrugated PACM sheeting
- Scattered waste and paint tins located near the dam located on the NW boundary
- The Potentially Asbestos Contaminated Material (PACM) sheeting located on the western side of the refrigerating building
- Two metal tanks: one located immediately behind the refrigerating building and the other near the generator building

Flora Survey

The habitat on site is colonized by numerous pioneer, introduced and nitrophilous annual and perennial herbaceous plant species including bristle-grass (*Setaria glauca*), finger-grass (*Digitaria sanguinalis*), white clover (*Trifolium repens*), pokeweed (*Phytolacca americana*),etc. The banks of a small pond are occupied by pure stands of common reed (*Phragmites australis*) and the saplings of alder (*Alnus barbata*) and false acacia (*Robinia psedoacacia*). Both deciduous and coniferous tree lines are found along the fences composed of spiny false acacia and Japanese cedar (*Cryptomeria japonica*). A small number of areas are colonized by the monodominant groupings of blackberry (*Rubus spp*.). It is unlikely that habitat supports Red Data Book, rare, endemic or endangered species of flora or fauna.

Site 2: Kaisa 2

Site Survey

The Kaisa 2 pipe yard is located approximately 1.5km north east of the Poti Port. The site is situated within an industrial area with wetlands to the east. It is currently used as a storage and parking area for trucks and trailers. A number of containers are also located on site. The site is covered with loose gravel.

Two main structures are located side by side over in the north east of the site. These two structures are made up of corrugated iron and steel construction and contain a rail off-loading ramp. The rail spur enters the site north of the main entrance on the western side of the site. An electrical substation building of concrete construction is located centrally on the site. Main power lines leading to the electrical substation enter the site underground from the southern boundary. All other structures including the administration building are temporary units.

Potentially contaminated areas located at Kaisa 2 proposed storage yard include:

- The electrical substation building located centrally on site
- Scattered scrap metal and debris located on the southern boundary of the site and on the northern boundary west of the storage buildings
- Three empty metal tanks approximately 2.5m diameter and 7m long located on the southern boundary and a metal tank located in the north west corner approximately 2.5m diameter and 5m long

Flora Survey

The habitat on site is colonized by numerous pioneering, introduced and nitrophilous annual and perennial herbaceous plant species including bristle-grass (Setaria glauca), finger-grass (Digitaria sanguinalis), white clover (Trifolium repens) and pokeweed (Phytolacca americana). A small number of areas are colonized by alder (Alnus barbata) saplings. It is unlikely that the habitat supports Red Data Book, rare, endemic or endangered species of flora or fauna.

Site 3: Railway Greenfields

Site Survey

The Railway Greenfields pipe yard is located approximately 1km east of Poti Port. The site is currently vacant and used for grazing; the only notable features being a 5m wide canal in the western part of the site, a dam centrally located on the southern boundary and three areas or 'mounds' of concrete blocks. The site is covered in grass.

A 2m high concrete wall partly surrounds the site. The main north south trending canal has associated smaller canals and water bodies mainly in the western part of the site. Two power lines traverse the site on the northern and southern borders. A concrete driveway leading to a domed corrugated iron storage building and small fuelling tanks is located in the eastern part of the site.

Potentially contaminated areas located at railway greenfields proposed storage yard include:

- The three areas comprising concrete blocks. These structures may have been former buildings
- Scattered piles of fill comprising metal, brick, concrete and soil (gravel and sand) located across a large area in the north-eastern part of site
- The eastern storage building with associated fuelling tanks
- The neighbouring property situated to the south contains a washdown and cleaning facility for trains

Flora Survey

Numerous, pioneering, introduced and nitrophilous annual and perennial herbaceous plant species, colonise this habitat; for example: bristle-grass (*Setaria glauca*), finger-grass (*Digitaria sanguinalis*), white clover (*Trifolium repens*), and pokeweed (*Phytolacca americana*). The vegetation is heavily impacted by intensive grazing. No trees or shrubs were recorded on site. It is unlikely that the habitat supports Red Data Book, rare, endemic or endangered species of flora or fauna.

8.13.2.2 Batumi Port environmental survey

Batumi Port (Figure: Map 8-15b) is located on the eastern coast of the Black Sea and occupies a total area of approximately 54 hectares. A visit was made to the port in order to undertake a site survey to establish the environmental baseline. All information contained within this report was obtained during a site visit on the 13th February 2002 and through meetings with personnel from the Ecological Department from Batumi Sea Port.

8.13.2.2.1 Port facilities

Currently the port (Figure 8-71) has 11 berths, four of which are equipped with portal cranes each with a capacity of between six and twenty tonnes, and nine of which are served by rail spurs and associated sidings. The port has its own fleet of tugboats, pilot boats, and oil and garbage collecting boats. A wide variety of cargoes can be handled including bulk cargo (ore, grain, scrap metal, timber and construction materials) and liquid cargoes.

Figure 8-71 Batumi Port

8.13.2.2.2 Berthing facilities

Berths 1, 2 and 3

Berths 1 to 3 have a combined length of 505m and a maximum depth of 12m and are currently used as a petroleum products export facility. Petroleum products are transported to the Port by rail. On arrival, rail wagons are taken to a holding facility approximately 2km east of the port. The product is then piped to Berths 1 and 2 where it is pumped onto ships for export.

Berths 4 and 5

Berths 4 and 5 are currently under construction.

Berths 6, 7, 8 and 9

Berths 6 to 9 have a combined length of 799m and a maximum depth of 11m. They currently handle bulk cargo including scrap metal, concrete powder, timber and construction materials.

Berths 10 and 11

Berths 10 and 11 have a combined length of 414m and a maximum depth of 11.6m. They are currently used as passenger ferry terminals serving a small ferry (maximum 70 people with no vehicle capacity) that runs weekly during winter and twice weekly during summer.

Deep water tankers can be berthed at an offshore mooring facility located approximately 100m north of the breakwater/pier.

8.13.2.2.3 Fuelling facilities

It is understood that the only fuelling activities that occur on site are for the ships owned by the port itself. Fuelling is carried out only by a specialised fuelling vessel. This vessel is fuelled at Berths 1, 2 or 3 by a pipeline that is fed by fuel arriving by rail to the port. The fuelling vessel can carry a maximum of 600 tonnes of fuel. Once full it re-fuels port vessels either whilst berthed or within the harbour area.

8.13.2.2.4 Rail spurs

Nine of the eleven shipping berths are served by rail spurs and associated sidings. Rail spurs enter the port at a single location on the eastern boundary. They are connected to the national rail network at Batumi Station. Cargo can be loaded directly from ships onto parked wagons. There are ample sidings and shunting facilities both within the port and directly adjacent to the port to allow full cargoes to be unloaded immediately. The port has two diesel-powered locomotives for shunting within the port. As part of the new renovations, Berth 5 has a hydraulic lift that allows the loading and unloading of rail carriages.

8.13.2.2.5 Storage facilities

Quaysides adjacent to cranes are used as open warehousing facilities. At the time of the site survey, the quayside adjacent to Berth 7 was occupied by bags of powder cement awaiting loading. Otherwise, all of the quay areas were clear and in good order. At the time of the survey no loose cargo, scrap or debris was observed lying around.

Indoor warehouse facilities comprise 13,000 square meters of storage space housed in four buildings. All of the warehouses are old and in a poor state of repair. The port has just begun the implementation of a scheme that will replace all of the warehouses. On the day of survey, demolition had just begun on the first building to be replaced.

8.13.2.2.6 Port workshops

Two buildings on the southern side of the port are used for machinery maintenance, welding and repair.

8.13.2.2.7 Power supply

Cranes in the port are electric powered. The port has a dedicated power supply from a sub-station located off-site approximately 500m to the east. Power cuts are reported to be very rare. The port has one diesel generator with a capacity of 1,150kW.

8.13.2.2.8 Drainage

Gravel-filled open drains are located at Berths 6 and 9 (possibly connected underground) and run parallel to the quayside. This collection drain releases its build up of surface runoff via a number of smaller underground drains leading directly into the port. Surface grills are evident on the drain openings thus preventing any gravel sized material from entering the drains.

8.13.2.2.9 Housekeeping

Based on a visual assessment, housekeeping at the port was generally of a high standard. Quayside areas, rail spurs and the construction site were all tidy and well managed. There was no debris or scrap lying around open areas. It was clear that quayside areas were regularly swept and cleaned.

There were however, a number of redundant facilities that were left to decay. Three empty fuel tanks were located on the north-east corner of the site. The tanks were heavily rusted but no evidence of fuel contamination surrounding the area was observed. In the same location, redundant pipes that looked as if they had been used to pipe oil to berthed ships, had been exposed by earth moving associated with construction works at Berth 4. This area was contaminated by an oil spill.

8.13.2.2.10 Potential contamination sources

Potential contamination sources at the port include the oil storage tanks, the above ground piping facilities, and the below ground piping facilities (disused). The oil storage tanks are located to the north of the site and comprise three 300 tonne capacity tanks. Associated pipes are connected with the above ground pipes leading around the northern breakwater of the port area. These above ground pipes enter the site from the north east. The disused underground pipes running parallel with these pipes on the northern breakwater, turn to run alongside Berths 4 and 5. For renovation purposes, these pipes have been cut and removed. Located near the northern part of Berth 4, where the pipes are exposed and cut, are collected areas of oil and oil waste.

After renovations to the port area, storage facilities will be located around the southern part of the port. Currently, storage of products is in the trains, at an off-site railway storage area, to the south. There is consistent covering of oil and oil waste products over the surface of the rail storage facility.

Buildings currently located on the southern part of the site contain workshops and small fuelling facilities. Also located near the oil storage tanks are a number of small disused metal tanks possibly used for fuel products. No associated spills were observed near these tanks.

8.13.2.2.11 Environmental policies and procedures

Batumi Port and the surrounding area has been subject to a comprehensive Environmental and Technical Review, funded by the EU TACIS Programme. The review was completed in 2000 and includes a number of volumes covering the environmental baseline of the port and the surrounding area, a description of the port, and environmental procedures implemented at the port. The port has a Department of Ecology that deals with environmental matters.

The Department of Ecology has put together an environmental assessment of port activities and has just finalised its oil spill response plan. The port owns a dedicated ship that is used to clean up oil spills or can take on board contaminated seawater. It is understood that three large tanks adjacent to Berth 3 are used for storing and treating contaminated water.

As part of the ports environmental control measures, routine water samples are collected in the port area twice a month. These samples are dispatched to a laboratory in Batumi for analysis. Also, radiation checks of all cargo before loading and unloading are undertaken.

8.13.2.2.12 Surrounding area

Situated east of the port area, is an open area approximately 5-6 hectares in size. This area is surfaced with hard-standing and gravel. At the time of the investigation, part of the site (located immediately behind Berth 4 buildings) contained a number of piles of metal pipes, scrap metal, metal tanks and other metal products. The rest of the site was vacant, but was undergoing leveling and minor re-surfacing.

The area to the south-west of the port comprises a mix of residential, commercial and recreational land uses. Immediately flanking the port boundary is a strip of land approximately 15-20 metres wide containing a concrete path, grassed area, benches and palm trees. This strip runs along the north side of Gogebashvili Street. On the other side of the street are a mixture of residential, commercial, and State buildings including the Ministry of Internal Affairs and the residence of the Chairman of the Supreme Consulate of Agara Autonomous Republic, on the junction with Chavchavadze Street.

Situated to the south-east of the port is the rail storage area. This area comprises up to 15 lines dedicated to the short-term storage of products on-route to the port.

To the north-west and immediately behind the passenger ferry terminal, is an open recreational grassed area of approximately 2-3 hectares. Beyond this area is a residential district comprising two, three and four storey terraced and semi-detached houses.

Flora Survey

A visual survey was done of sites surrounding Batumi Port. A number of habitats were identified including secondary wet meadows, roadside vegetation, Eucalyptus plantations, and field boundaries.

The wet meadows are populated by plants, which typically grow under the high moisture conditions of the southern Colchis. This community is mostly dominated by rush *Juncus effusus*, and is relatively impoverished owing to intensive grazing by cattle. A number of arborescent plants are found in the community including young individuals of Alder *Alnus barbata*.

Roads in the vicinity of the port are characterised by diverse vegetation along with abundant growth of common and introduced species. Alder (*Alnus barbata*) frequently occurs alongside roads together with introduced eucalyptus (*Eucalyptus globulus*). As in many other areas in the Colchis, the roadside vegetation very often consists of *monodominant Rubus sp*. characterized by dense growth.

A number of Eucalyptus plantations are established in the hillside areas surrounding the port. Eucalyptus is characterized by light brown bark, which peels in long ribbons to reveal smooth underbark. The dominating *Eucalyptus globulus* is accompanied by *Rubus sp*. as a prevailing understorey component.

The vegetation along field boundaries is similar to those along roads. In addition to grass and shrub species, mosses and native climbers are found growing on wooden fences. The prevailing species is ivy (*Hedera colchica*).

Other species present include the introduced North American species *Phytolacca Americana* within disturbed ground areas, and hazelnut, red pepper, and grapes cultivated in agricultural areas.

8.13.3 Pipe yards

The pipe that will be required to construct the proposed pipeline will be shipped from the supply base at the port(s) to the pipeline route where it will be temporarily stored at a number of locations prior to being transported to the ROW itself. Although the choice of pipe yards is at the discretion of the construction contractors, a number of potential sites have been pre-identified by the BTC project team.

This section provides a description of the sites, including environmental considerations such as previous land use and disturbances. The sites are further discussed in Section 5 *Project Description.* Their locations are detailed in Figure: Map 5-3.

8.13.3.1 Site 1. Gardabani 1 - Proposed pipe-yard and camp

The site is located approximately 10km south of Rustavi and is situated in close vicinity of a power station in a large, relatively flat expanse. The site appears to have been used previously as a storage area for the power station is mostly covered in grass. It contains three non-electric rail lines, of which two are in disrepair and one is useable, a bitumen road, and two buildings; one located in the northeast corner of the site, and the other on the southwest boundary.

8.13.3.2 Site 2. Gardabani 2 - Proposed pipe-yard

The site is located approximately 1.5km northeast of the town of Gardabani. The proposed pipe-yard is located in an area that comprises two former factories (one of which is known to have been a sauce factory) with bitumen yards.

The adjacent factory sites are the main contamination concern. This site is bound to the southwest by three electric rail lines, to the southeast by the main bitumen road and to the northwest by oil/fuel storage site. Separating the former factory sites with the oil/fuel storage site is a single, non-electric rail line that merges with the main rail lines to the southwest. The proposed pipe-yard may also use the nearest factory site as a possible off-loading area.

8.13.3.3 Site 3. Gatchiani - Proposed pipe-yard

The site is located within the industrial area associated with the main rail line. The proposed pipe-yard was a former WREP pipe yard and was vacant at the time of the investigation. It comprises a number of bitumen and gravel road and parking areas, three pipe bund rows, and two non-electric rail lines along the northeast boundary. There are four stockpiles of metal piping located at the western corner of the site. Southwest of the site there is a residential area and on all other boundaries there are industrial/storage sites.

8.13.3.4 Site 4. Marneuli - Proposed pipe-yard and camp

The site is located to the east of the town of Marneuli and its boundary is defined by a concrete wall. At the time of investigation the proposed pipe-yard was a vacant storage yard comprising three non-electric rail lines. Two are located side by side near the northern boundary and the other is located centrally on a raised embankment approximately 1.5m high. The area is bound by a concrete wall/fence.

8.13.3.5 Site 5. Kotishi - Proposed pipe-yard and camp

This site is located approximately 7km west of the town of Marneuli. It is proposed that the pipe-yard be located on the western side of the main rail line, which comprises three overhead, electrified tracks. The area consists of a 7m high cut located to the east of the main track, with filling (possibly sourced from the cut) extending for approximately 50m to the west. A partly disused rail line that merges with main line is situated at the centre of filled area. This non-electric line enters an electrical substation containing a number of transformers and associated building. The electrical substation is fenced and secured. On the southern boundary of the site, is a railway station/building immediately adjacent the western-most line. Located to the west of the site is farming area consisting of a number of small buildings. The area was covered with grass at the time of investigation.

8.13.3.6 Site 6. Tetritskaro - Proposed pipe-yard

The site is located approximately 2km south southeast of Tetritskaro and comprises an area currently under cultivation to the south of a road and railway sidings.

There is a hard standing area located within a concrete-walled rail siding yard, and an adjacent small area of rough grazing. This is located on the southern side of the main rail lines, which comprise three electric lines. The site contains a number of steel and brick/concrete buildings associated with a small crusher, which was operational at the time of investigation. At the time of investigation there were numerous stockpiles of crushed and un-crushed rock. An aboveground fuel tank is also located on-site near an electrical transformer. An elevated section (1.5m to 2.0m above the level of the remainder of the site), is located centrally on the site and has been used as a heavy goods storage yard with a large trolley crane on tracks (in disrepair). To the north of this heavy goods storage area is a soil and gravel covered pavement area extending to the southern most rail line, and a large single level platform building. To the south is a settlement dam surrounded by lower lying grassed areas.

The likely potential pipe-yard located south of the bitumen access road was being used for agricultural purposes at the time of investigation.

8.13.3.7 Site 7. Tsalka 2 - Proposed pipe-yard and camp

This site is located 4km east of the town of Tsalka. The site is in a field situated near the merging of the main bitumen road and main electric rail line to Tsalka. The site slopes gently down to small stream and is covered in grass interspersed with rock outcrops.

8.13.3.8 Site 8. Tsalka 1 - Proposed pipe-yard

This site is located approximately 1.5km southeast of the town of Tsalka. The site is the main rail station for Tsalka and comprises three main electrical lines and two non-electric lines diverging from the main to the south of the site. The area also contains a number of disused buildings constructed from brick and concrete. The site is covered in grass interspersed with rock outcrops.

8.13.3.9 Site 9. Borjomi - Proposed pipe-yard dump

This site is located within the town of Borjomi approximately 300m south of the Mtkvari River and adjacent to a small stream which is one of the Mtkvari tributaries. The site is a former rail siding. The eastern half of the site appears to have been founded on a cut, with the western half founded on up to 1m of fill. Aboveground structures on site include several small gate and signal houses alongside rail lines, a canopy covering an hydraulic weigh station, a loading ramp and grain silos with associated conveyer belts. Below ground structures observed included two hydraulic weighing stations approximately 2 to 3m deep. No underground storm water system was noted.

Surrounding the site are several residential dwellings and large industrial buildings to the east and south (including a former water bottling factory), a large loading crane and scrap metal yard yard to the north, and the tributary river to the west. The operational rail line running from Borjomi runs across the northwest corner of the site. A small mechanical workshop is situated along the western boundary adjacent to the river, which contained what appeared to be a large oil tank.

8.13.3.10 Site 10. Andezit - Proposed pipe-yard

This site is located approximately 2.5km north west of the Andezit township. The proposed pipe-yard is located on a relatively flay and open grassy site. The area is situated in between a steep hill to the east and a northerly flowing stream to the west. The site slopes gently to the west and is grass covered. It appears that clearing of this area has been undertaken previously to allow access to power lines.

8.13.3.11 Site 11. Tsikhisjvari - Proposed pipe-yard

The site is located 500m to the west of Tsikhisjvari (and is situated at the convergence of two streams (easterly flowing) in a low-lying, possibly flood-prone area. The site comprises one dirt track leading into the hills further to the west and sloped down to the stream and is grass covered.

An adjacent site located to the south of the proposed site is possibly more suitable as a pipe-yard. The area is situated upon an old flood levee approximately 2m to 3m higher than the stream. The site contains a number of small fenced yards used mainly for farming. The site is grass covered and contains no areas of obvious contamination.

8.13.3.12 Site 12. Atskuri - Proposed pipe yard

The site is located to the southwest of Atskuri, alongside the main rail line. The proposed pipe-yard is situated on the south eastern side of three main electric rail lines and contains a non-electric line, which merges to the main lines further to the southwest. The area also contains two small brick and concrete buildings used for a toilet and control/electrics room. The area is situated partially on fill and natural ground. Extensive cut to fill operations were employed for the main rail lines with a cut face up to 5m on the northwestern side of the tracks. Located outside of the rail yards to the southwest is a lumber yard with a large gravel area used for storage of timber.

8.13.3.13 Site 13. Akhaltsikhe - Proposed pipe-yard and camp

This site is located in the northeastern industrial area of Akhaltsikhe. The proposed pipe yard is located within a former walled rail storage yard located south of the main electric rail line. The site contains three non-electric rail lines that merge with the main line to the east, and a large centrally located platform building. The site is partly covered in a bitumen/cobblestone pavement and partly with concrete sleepers. On site there are a number of small stockpiles of coal and coal ash along with numerous pieces of broken PACM sheeting.

8.13.3.14 Site 14. Vale 1 - Proposed pipe-yard

This site is located approximately 2km west of Skhvilisi. The proposed pipe-yard is situated between a dirt/gravel road (to the south) and the main east west trending rail line (to the north). The area comprises a retained and elevated fill platform approximately 1m above the non-electric line that merges with the mains to the east. This non-electric line was formerly in use for the batch plant, which is located to the west of the site. This batching plant contains a three story office type building, a five story loading facility above the rail line and some underground structures. All the buildings are brick/concrete constructions.

8.13.3.15 Site 15. Vale 2 - Proposed pipe-yard

This site is located 3km west of Skhvilisi further along the main rail line from Site 14 (Vale 1). The proposed pipe yard is located on the southern side of the main rail line, separated from the main line by a wire fence. The site comprises two dilapidated non-electric rail lines and a retained, elevated platform used for loading and unloading of trains. The surface is generally dirt/gravel covered and grass. Two small brick/concrete buildings, now abandoned, are located on the southern boundary. The southern boundary is marked by a wire fence, beyond which are residential properties.

8.13.3.16 Environmental Issues at pipe yards and work camps

With the exception of Andezit and Tsikhisjvari no significant ecological issues were identified at any of the proposed pipe storage yard and worker camp sites.

The Andezit site comprises sub-alpine meadow communities surrounded by beech wood and conifers. At Tsikhisjvari, the vegetation comprises secondary meadow communities which have developed following forest clearance. The meadow communities are characterised by abundant growth of typical high-mountain meadow species including brome (*Bromopsis variegata*), fescue (*Festuca spp.)*, bent (*Agrostis spp*.), and clover (*Trifolium ambiguum, T. repens*). The occurrence of weedy thistle (*Cirsium obvallatum*) in the community indicates a trend towards secondary composition. Approximately 50 meters south of the proposed site are thinned forest fragments composed of beech (*Fagus orientalis*), pine (*Pinus sylvestris*), and pear (*Pyrus caucasica*). To the east of the site, the south-east banks of river Oshora are populated by impoverished vegetation predominantly consisting of weedy species. To the west of the site are hay meadows and agro-pastoral landscapes. It is likely that no species or communities of floral interest are associated with the above habitats.

8.13.4 Borrow pits and spoil disposal

8.13.4.1 Introduction and methodology

Depending on construction methods used on the proposed ROW, and on opportunities for re-use, it is possible that up to 6 million m^3 of rock and soil spoil may need to be removed from the ROW and transported to disposal sites.

From an examination of stereo pairs of aerial photographs, together with geological and topographic maps, and in-house information on environmentally sensitive areas, over 50 potential spoil disposal sites were identified (Figure: Map 8-16a-c). The sites were either immediately adjacent to the ROW or within a short haul distance. They included disused and working quarries, distinct topographic depressions and areas of relatively level land. Care was taken to avoid obvious watercourses, ponds, and areas of boggy or unstable ground. Mountain meadows and good quality agricultural land were avoided unless there were no other feasible sites in the immediate vicinity.

A site walkover survey was carried out between 25 October and 9 November 2001. The field party comprised a construction expert and engineering geologist, assisted throughout by a landman/driver, and accompanied in environmentally sensitive areas by a local ecologist. Prior to starting fieldwork, environmental consultants EAS Dzelkva of Tbilisi, provided 1:25,000 scale maps of the pipeline route and surroundings showing features of archaeological interest and wildlife conservation value. Additional sites were identified and assessed during the course of the field survey, giving a total of approximately, 70 sites for consideration.

Potential borrow pit and spoil disposal sites had previously been identified on the basis of site observations and borehole/trial pit information (Report on Trenchability and Re-Use of Trench Spoil – Georgia Section, No.410088/30/L/PL/RP/044).

8.13.4.2 Results of assessments

The desk based assessment and field works show that there are both large and small potential spoil disposal sites along the ROW, and preferred sites have been identified which have a total capacity of about 15 million m^3. Table 8-51 provides a summary of the preferred borrow pit and spoil disposal sites.

Table 8-51: Summary of preferred borrow pit and spoil disposal sites

Ref. (1)	Site Description	Coordinates (KP)	Approximate Distance from RoW (km)	Estimated Disposal Capacity (million cu.m)	Estimated Reserves (million tonnes)	Potential Use		Environmental Significance Evaluation (2)	Remarks
						Borrow Pit	Spoil Disposal		
DS 2 BP 17	Disused sand/gravel/cobble pit. Located on south side of Djandari village.	8513500, 4591300 (KP 5)	2.00	0.066	0.010	√	√	Low	No recorded potential archaeological constraints or environmental sensitivities. Approximate area is 8,250sq.m with potential infill depth of 8.0m. Workings could potentially extend north and, west.
DS 3	Disused clay pit	8507600, 4597000 (KP 12)	0.60	1.260	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities. Some chemical waste and slag contamination present
DS 5	Disused sand pit	8503800, 4605500 (KP 25)	<0.50	0.015	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities.
DS 7 (A)	Currently rough pasture	8496400, 4606000 (KP 33)	<0.50	0.900	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities. Disused concrete irrigation channels, with culvert under main road
DS 7 (B)	Currently rough pasture	8495800, 4606400 (KP 34)	<0.50	0.310	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities. Disused concrete irrigation channels, with culvert under main road
DS 8	Disused gravel/cobble pit	8494350, 4607300 (KP 36)	0.6	0.019	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities. Access across an area of rough pasture
DS 9	Currently rough pasture & dry lake basin	8492500, 4606700 (KP 38)	0.6	1.440	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities.

Ref. (1)	Site Description	Coordinates (KP)	Approximate Distance from RoW (km)	Estimated Disposal Capacity (million cu.m)	Estimated Reserves (million tonnes)	Potential Use		Environmental Significance Evaluation (2)	Remarks
						Borrow Pit	Spoil Disposal		
DS 12 BP 14	Intermittently worked sand/gravel/cobble pit	8480900, 4598400 (KP 53)	0.8 to 1.2	0.252	0.500	√	√	Low	No recorded potential archaeological constraints or environmental sensitivities. Two access points from ROW.
DS 14	Disused basalt quarry	8480000, 4596200 (KP 55)	1.0	0.067	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities.
DS 15	Disused basalt quarries	8479500, 4597600 (KP 55)	<0.5	0.154	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities.
DS 19 (B)	Farmland	8465500, 4598700 (KP 69)	0.6	0.325	n/a	---	√	Low	Site is small meadow, with hares (*Lepus europaeus*) identified. No recorded potential archaeological constraints or environmental sensitivities.
DS 19 (C)	Disused basalt/andesite quarry	8464400, 4599700 (KP 71)	1.3	0.444	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities. Access from ROW through a culvert beneath a railway line.
DS 19 (D)	Disused kaolinite/mineralised basalt pit	8464100, 4600000 (KP 71)	1.6	0.040	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities. Access from ROW through a culvert beneath a railway line.
DS 21	Disused mineral workings pit	8458950, 4598350 (KP 76)	<0.50	0.007	n/a	---	√	Low	No identified species. Very little existing spoil.
DS 24	Meadow	8447700, 4608000 (KP 94)	<0.50		n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities. Kestrel (*Falco tinnunculus*) identified.

Ref. (1)	Site Description	Coordinates (KP)	Approximate Distance from RoW (km)	Estimated Disposal Capacity (million cu.m)	Estimated Reserves (million tonnes)	Potential Use		Environmental Significance Evaluation (2)	Remarks
						Borrow Pit	Spoil Disposal		
DS 26 BP 7	Intermittently worked microgranite quarry	8436200, 4609700 (KP 105)	2.00	0.400	0.750	√	√	Low	No recorded potential archaeological constraints or environmental sensitivities. No species identified. Located adjacent to a rail line.
DS 28 (B) BP 15	Disused sand/gravel pit	8429900, 4612300 (KP 114)	1.30	0.024	0.040	√	√	Low	No recorded potential archaeological constraints or environmental sensitivities. No species recorded. Remote from houses. Reserves need to be proven.
DS 30 (B) BP 18	Intermittently worked sand/gravel pit	8412900, 4609200 (KP 132	3.00	0.068	0.010 to 0.200	√	√	Low	No recorded potential archaeological constraints or environmental sensitivities. No species recorded. Reserves need to be proven. Range from 10,000 to 200,000 tonnes.
DS 31	Meadow	8403400, 4615800 (KP 143)	<0.50	1.120	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities. No species recorded. Possible seasonal stream identified drainage blanket would be required.
DS 32 (A)	Meadow	8398400, 4616200 (KP 148)	<0.50	0.120	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities. No species recorded. Watercourse to the south, measures required to prevent fines discharging into stream.

Ref. (1)	Site Description	Coordinates (KP)	Approxi-mate Distance from RoW (km)	Estimated Disposal Capacity (million cu.m)	Estimated Reserves (million tonnes)	Potential Use		Environ-mental Significance Evaluation (2)	Remarks
						Borrow Pit	Spoil Disposal		
DS 35 BP 8	Meadow	8388000, 4616000 (KP 161)	0.40	0.300	0.150	√	√	Low	No archaeological constraints recorded. Fox (*Vulpes vulpes*) identified on site. This is an intermittently worked site. Little vegetation cover and reserves may extend into meadow beyond. Reserves need to be proven. Volcanic cinder cone, potentially environmentally sensitive.
DS 37 BP 9	Working andesite quarry	8372200, 4622800 (KP 182)	1.60	0.870	0.300	√	√	Low	No species identified. Working quarry with rail spur, access could by-pass local village of Andezit. No archaeological constraints recorded. Environmentally sensitive area, restoration would be required to enhance the conservation value.
DS 40	Former orchard, now partly arable	8347200, 4621200 (KP 210)	<0.50	0.200	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities. No species identified. Ravine present on the north side, potential conservation value.
DS 44	Currently rough pasture	8340000, 4616200 (KP 221)	<0.50	0.180	n/a	---	√	Low	No recorded potential archaeological constraints or environmental sensitivities. No species identified. Site is former military ground.

Ref. (1)	Site Description	Coordinates (KP)	Approximate Distance from RoW (km)	Estimated Disposal Capacity (million cu.m)	Estimated Reserves (million tonnes)	Potential Use		Environmental Significance Evaluation (2)	Remarks
						Borrow Pit	Spoil Disposal		
BP 20	Sachkere Sand Pit – the site is located 7km east of a rail branch at Sackhere which connects to main rail network at Zestaponi. Site can be accessed along 60km of tarmac road from main Tbilisi-Alkhaltsikhe road.	No coordinates available.	150km from KP 223	n/a	0.750	√	---	Low	No recorded potential archaeological constraints or environmental sensitivities. Reserves are possibly in the order of 0.750 million tonnes with a potential 2 million tonnes behind the old working face.

Notes:(1) "DS" = disposal site, "BP" = Borrow Pit
(2) Environmental Evaluation Criteria defined below:
Low - areas under high anthropogenic stress, intensively used by population and do not have significance in terms of biodiversity.
Medium – areas under relatively less anthropogenic stress, with potential for degradation owing to anthropogenic impacts and/ or local diversity
High - areas have significance for local biodiversity.

Several of the sites detailed above would first be worked as borrow pits for various construction materials. The report 'Assessment of Potential Spoil Disposal Sites and Borrow Pits – Georgia Section' (Document No. 410088/00/L/PL/RP/053) provides details of the sites examined and assesses their suitability for use as spoil disposal sites and/or sources of borrow materials and the potential for re-use of soils and rocks along the route. The relative value of sites was considered in terms of construction and environmental factors.

There is a concentration of potential sites towards the eastern end of the route, from KP 0-80, and again towards the western end, from KP 204-247.8. There are relatively few sites from KP 80-204. This latter section contains areas of social and environmental sensitivity and there are also significant amounts of rock locally.

Environmental damage will be minimised in the most sensitive areas by processing rock spoil for re-use on site. Additional materials required, eg for road-making, could be obtained from existing pit/quarry sites. After extraction, the sites would be backfilled with surplus spoil and then reinstated to blend in with the surrounding landscape.

A number of the preferred sites identified may have to be discounted on social or environmental grounds. This could result in additional handling and haulage of spoil. Relatively long haul journeys might be justified, however, provided that returning trucks carried a full load. It might be possible to achieve this by developing, and progressively backfilling, borrow pits.

Following initial field investigation, all preferred sites need to be investigated further to determine whether they are available for use, and also to confirm their overall fitness for purpose. Similarly, potential sources for a range of construction materials are provided, and these will require further investigation.

8.13.5 Waste disposal sites

The quantities of non-hazardous and hazardous waste which are anticipated to be generated by the project have been estimated by the engineering procurement contractor (see *Section 5 Project Description*). Since no suitable facilities are currently present in Georgia, the BTC project team has initiated a site selection process to identify areas that may be suitable for development of a waste disposal facility.

The selection process consisted of three stages:

- Initial (desk-top) screening
- Field verification of short-listed sites
- Correlation of available and field data and selection of recommended sites

At all stages of the works a site matrix was developed to enable a comparison of the facilities. The site matrix is enclosed below.

1.	General	
1.1	Site Id.:	
1.2	Site Name:	
1.3	Administrative District:	
1.4	Distance and location relative to the closest residential area:	
1.5	Geographic Co-ordinates:	

1.	**General**	
1.6	Field Visit Date:	
1.7	Team Composition:	
2.	**Available Infrastructure and Land Use**	
2.1	Location relative to WREPG facilities:	
2.2	Site Access and Type:	
2.3	Land Use on the Site:	
2.4	Available Area for Potential Use:	
2.5	Land Use of Adjacent Areas:	
2.6	Any Evidence of Contamination:	
2.7	Description of Site and Any Waste Tipping:	
2.8	Availability of water, power and gas supply. If yes, distance to the above:	
2.9	Availability of support facilities – vehicle parking, quarantine area, recycling, etc. If yes, distance to the above:	
2.10	Presence of void. If yes, indicate Depth of Void, area, presence of water in the void, extracted materials	
3.	**Natural Characteristics**	
3.1	Geological Information:	
3.2	Presence and Use of Surface Water:	
3.3	Hydrogeological Information:	
3.4	Ecological Description:	
3.5	Climate and meteorology:	

8.13.5.1 Desk top screening

The first stage consisted of a review of available information, along with the selection of sites that had the potential to comply with the specified requirements, through the use of aerial photography.

The criteria used for the initial site selection were as follows:

- Formerly / currently used for industrial activities
- Areas with low soil fertility or inadequate for agriculture

The site exclusion criteria were as follows:

- Sites located in floodplains and /or lower alluvial terraces
- Sensitive ecosystems
- Areas with high value surface and ground water resources
- Areas with high seismic activity
- Areas subject to Karst or other types of instability
- Close to residential areas

The initial screening demonstrated that the majority of potentially suitable sites are located at the eastern and western extremity of the proposed route. Only a few sites were identified in the central area covering the section between KP 120 and 220 (from Tsalka to Sakire) owing to the combined presence of two or more exclusion characteristics (seismic activity, erosion potential, sensitive ecosystems, areas with significant surface and groundwater resources).

A total of twenty-seven (27) sites were short-listed for field verification. These sites were selected bearing in mind proximity to the proposed pipeline route, to pump stations and camp locations and existing access.

8.13.5.2 Field verification

The second stage consisted of field verification visits at the short-listed sites. All 27 sites were visited. The field verification included only visual surveys and did not include specialised detailed surveys for accurate determination of specific natural characteristics. Special attention was paid to the site access, power, gas and water supply issues.

8.13.5.3 Selection of preferred sites

The third stage consisted of the review of the field data and of integrating the collected information, where possible, with information available in the literature. As a result of the data analysis, a number of general and specific criteria were developed for the sites:

- Low category land (functioning / abandoned quarries, decommissioned pits, etc)
- Proximity to the proposed route and pump stations
- Proximity to roads and road conditions
- Easy access to power (sometimes gas) and water supply
- Available space for a landfill and auxiliary infrastructure (areas for parking, temporary storage)
- Favourable natural conditions (depth of groundwater, soils with low or medium permeability, area stability)

These were used for final screening and grouping of the sites.

8.13.5.4 Preferred sites

Twelve sites (NN 2, 9, 14, 15, 17, 18, 19, 20, 21, 22a, 22b, 24) were dismissed as a result of failure to comply with the criteria outlined above. The remaining sites largely comply with the general criteria, however, some have undesirable characteristics, which reduce them to the category of the secondary options, eg soils on sites 3, 5 and 6 are permeable while land of site 23 is used for agricultural purposes.

From the remaining eleven, three sites are preferred options (NN 1, 16, 26), four are secondary options (NN 6, 5, Koda, 25). These sites are detailed in Table 8-52 and Figure: Map 8-16a-c.

Table 8-52: Summary of preferred landfill sites

Ref.	Current Use/ Description	Coordinates	Approximate Distance from RoW (km)	Administrative District	Important Natural Characteristics			
					Geology	Surface Water	Hydrogeology	Ecology
1	Operational clay quarry	8508137, 4596741	0.40	Gardabani	Quaternary deposits (>20m thickness), overlying Upper Pliocene Sediments	No surface water in the vicinity.	Depth to groundwater is 30 to 35m.	Topsoil removed herbaceous cover is over grazed.
16	Abandoned dolerite quarry	8479550, 4596229	1.50	Gardabani	Upper Pliocene lava flows, total thickness approximately 250m.	No natural or artificial surface water in or adjacent to quarry.	Depth to groundwater is 30 to 35m.	No topsoil in quarry.
26	Vale closed coal mine No. 4	8321326, 4610499 8321456, 4610412	1.00	Akhaltsikhe	Deluvial-proluvial deposits (>20m) overlying Oligocene strata. Strata comprises gypsum, carbonate clays with sandstone lenses, lower part is coal and carbonate shale.	No natural or artificial surface water in or adjacent to quarry.	Depth to groundwater is 15 to 16m.	Topsoil is mixed with construction debris. Well developed but thin herbaceous cover.

Secondary Options - Waste Disposal Sites

Ref.	Current Use/ Description	Coordinates	Approximate Distance from RoW (km)	Administrative District	Important Natural Characteristics			
					Geology	Surface Water	Hydrogeology	Ecology
6	Operational sheetrock quarry	8503497, 4606255	4.00	Gardabani	Quaternary (5 to 10m thickness) overlying Middle Pleistocene alluvial sediments and Miocene thin layered sandstone with layers of clay and microconglomerates.	Seasonal stream to east of site.	East corner has a dried spring. Groundwater present at 5 to 10m in Quaternary deposits.	No topsoil on site, no herbaceous cover.
5	Abandoned sheetrock quarry	8504123, 4605220	1.00	Gardabani	Quaternary (5 to 10m thickness) overlying Middle Pleistocene alluvial sediments and Lr. Miocene sandstone with clay layers.	No natural or artificial surface water in or adjacent to quarry.	Water bearing layer at between 3.5 and 9m.	No topsoil on site, no herbaceous cover.
Koda	Abandoned military site	848202, 4603925	3.30	Tetritskaro	Lower Pleistocene deposit (<20m) overlying Oligocene - Lower Miocene clay-sandstone.	No natural or artificial surface water in or adjacent to quarry.	Depth to groundwater is 10 to 20m.	Topsoil is mixed with construction waste on site. Well developed herbaceous cover.
25	Unused	8324276, 4612449	1.00	Akhaltsikhe	Surface comprises 5 m of elluvial deposits overlying Oligocene clays with lignitic and carbonate clays.	No natural or artificial surface water in or adjacent to quarry.	Depth to groundwater is unknown.	Topsoil is thin and there is no herbaceous cover.

The four outstanding sites are back-up options (NN 8, 23, 13, 3) should some circumstances prevent use of the first seven areas as landfills.

The three preferred sites comply with the general criteria listed in Section 8.13.5.3 above:

- Site 1 is a pit of approximately 8m depth extending over approximately 35ha. Sixteen hectares have historically been used for disposal of industrial waste

- Site 16 extends over approximately 50ha. About 0.5 – 1 ha is used for waste disposal. This site is closest to Tsalka-Javakheti sensitive regions. One drawback is medium soil permeability

- Site 26 is a former colliery and extends over approximately 4.4ha. The colliery is decommissioned and includes concrete vaults and bunkers located at various depths

8.13.6 Transportation of equipment, materials and people

The road infrastructure along the pipeline route has been visited and reviewed in considerable detail. Of approximately 600km of road length initially identified as having potential for being adopted as supply/access routes, some 94% was eventually covered, the remaining 6% being abandoned during surveying owing to weather conditions; note, however, that this 6% was confined to two minor routes, and in both cases it was possible to assess their general conditions.

In evaluating the existing infrastructure, the following general aspects were considered:

- Existing traffic volumes
- Existing traffic composition
- Suitability of routes for access
- Structures on, or crossing, each route
- Settlements traversed by each route

The road network that may be used for transportation of has been logically broken down into eighteen routes. These are shown on Figure: Map 8-17 and may be identified as follows:

Table 8-53: Surveyed route network

Route	Description	Length (km)
1	A308/M8/M1/M9: Turkish border – Akhaltsikhe – Khashuri – Gori – M4/M9 interchange	246.2
2	A306: M8 – pipeline (towards Batumi)	7.1
3	Akhaltsikhe – pipeline (towards village Tskruti)	3.2
4	Akhaltsikhe – pipeline (towards village Tatanisi)	2.2
5	Atskuri – pipeline (towards village Tiseli)	5.8
6	Village Dviri – pipeline (towards village Sakire)	9.5[†]
7	Borjomi – pipeline (at village Tsikhisjvari)	35.0

Route	Description	Length (km)
8	Bakuriani – pipeline (at Tskhratskaro)	12.4
9	Bakuriani ring road	3.0
10	A303: Tskhneti – Manglisi – Tsalka – pipeline (at village Avranlo)	102.6
11	Near Tsalka – pipeline (towards Tetri Tskaro)	21.2
12	M4/M6: M4/M9 interchange – Soganlugi – Koda – Marneuli – Tetritskaro– pipeline (west)	71.2
13	M4: M4/M9 interchange – Rustavi – Algeti – Marneuli	34.0
14	Pipeline crossing (Route 12) – pipeline crossing (Route 15)	5.4
15	Soganlugi – Lake Kumisi	7.4
16	Tetritskaro– pipeline (south-east)	2.7
17	Village Tsnisi – pipeline	0.8
18	M9 – Rustavi – Gardabani	27.6
	All Routes	597.3

Of these 18 routes, the major routes with apparent potential for general use (Routes 1, 7, 12, 13, 16, and 18) were subject to traffic surveys in the form of Manual Classified Counts (MCCs). Where appropriate, long routes were further broken down into logical sequences of links, and each link surveyed separately.

Some 49 count sites were identified, and daily counts were conducted during the week 07/11/2001 – 15/11/2001, each site being counted for a single day over a seven-hour period 10:00 – 17:00 (with minor variations). All flow values are expressed as two-way totals; where two site references are combined, this merely refers to a single location where traffic was expected to be too high for one person to count both directions simultaneously, and thus each direction was assigned its own ID and counting staff.

The traffic counted was categorised into five separate vehicle types as follows :

a) Cars (saloons, 4x4s, estates, taxis, cars towing trailers)
b) Light Vans (two axles, single rear wheels)
c) Medium Trucks (two or three axles, non-articulated, double rear wheels)
d) Heavy Trucks (four or more axles non-articulated, three or more axles articulated)
e) Buses & Coaches (including mini-buses, single-decker buses, coaches, etc)

These definitions are based on standard European practice, with subtle modification for the local conditions; note that bicycles, motorcycles, horse-drawn carts, and so forth were not counted.

Such categorisation allows for the determination of Heavy Goods Vehicle (HGV) content within an overall link flow; HGVs are considered to comprise Medium Trucks, Heavy Trucks, and Buses & Coaches (types (c), (d), and (e) above). Such information can be significant in assessing the likely impact of a link flow on both the road surface and the surrounding environment.

There is at least anecdotal evidence to suggest that there is little traffic flow at all during the hours of darkness, not least because of the general lack of street-lighting, and thus the flows actually counted during the surveyed hours can perhaps be considered more or less to be the total flows for those days. However, it is acknowledged that the surveys were completed during a time of year when daylight hours are limited, and therefore follows that the flows actually counted may not be truly representative of average daily flows on those links, since there is simply more daylight in the summer months, with a likely commensurate increase in total daily traffic.

The detailed assessment of traffic and road conditions for each of the above routes is included in Appendix C, Annex 1. In general it was found that, by and large, the road network around the BTC pipeline route is in poor condition. However, some viable routes can at least be identified (in particular the main highways of Tbilisi-Batumi and Khashuri-Akhaltsike), with varying levels of remediation required, suitable for access to the BTC pipeline route by heavy goods vehicles. It also seems clear that there are many road routes with parallel rail provision, and it seems at least worth pursuing options for direct supply by rail over and above initial supply to the two main distribution centres.

SOCIO ECONOMIC BASELINE

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9. SOCIO ECONOMIC BASELINE

9.1 INTRODUCTION

This Section provides an introduction to the demographic, social and economic characteristics of the study area that are relevant to the project and its impacts, within the national context. Its purpose is to provide a basis against which social and socio-economic impacts can be assessed, and against which comparisons can be made in the future to assess the impact of the project.

Information for this Section was gathered through a series of interviews and consultations with respondents within, or encroaching upon, 2km either side of a proposed centreline of the ROW, because the populations of these settlements are most likely to be affected by pipeline construction activities. Communities within 5km of (temporary) worker camps and (permanent) pump stations were also consulted, as were those within 2km of pipe yards [1]. Communities outside this area were not consulted in order to avoid raising expectations in a large number of dispersed communities.

These community consultations and interviews were conducted over a number of months by a team of international and local consultants, using standard quantitative and qualitative methodologies and tools, including numerous interviews and consultations [2]. The interviews conducted during 2000 and 2001 were as follows:

- Quantitative surveys
  - Over 700 random household surveys were conducted in 72 villages within 2km of the ROW, pipe yards and associated temporary infrastructure. These were aimed at establishing baseline conditions in the affected communities

- Qualitative interviews
  - Over 150 interviews were conducted with residents of communities within 2km of the ROW in order to assess people's overall knowledge of and attitude towards the proposed pipeline

  - Over 70 interviews were further conducted with residents of communities within 2km of the ROW in order to assess people's overall knowledge of and attitude towards the BTC oil pipeline in particular

  - Forty interviews were conducted with village leaders[3], including both officially appointed government leaders, elected village leaders and other recognized leaders in the communities, in order to understand the view of local leaders

(1) This zone of influence of construction and operation was determined by the consultants on the basis of previous pipeline experience and confirmed as appropriate by the local consultants in relation to Georgia
(2) Please refer to the Methodology Section for an explanation of these methodologies and tools
(3) Village Leaders included Gamgebelis (Official Village Leaders), the Head of the Sakrebulo, and others seen as leaders in the community, such as teachers and doctors

- Over eighty interviews were conducted with residents of communities within 5km of the pump stations and pigging stations in order to understand issues related to being close to the AGIs during both construction and operation

- Over 120 interviews were conducted with residents of communities within 5km of potential worker camp and 2km of pipe yards in order to understand the issues related to being close to those facilities during construction.

In addition to the village level consultation, a focus group for the district leaders and five in-depth interviews with government and regional government representatives was held in Poti Port. The aim of this was to help understand some of the possible benefits that might accrue from the construction of the pipeline in addition to some of the potential challenges that might be faced in that area.

Data that could not be gathered through interviews or consultations were collected from public sources, including data provided by Regional Deputy Governors and census data, provided by the Department of Statistics.

During visits to the communities, information leaflets were distributed containing information about the project and its possible impacts. These were given to interviewees and the community members at large.

9.2 NATIONAL CONTEXT

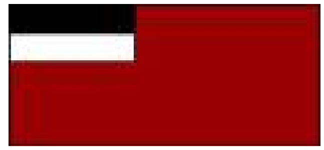
9.2.1 Introduction

Georgia, once a prosperous and highly productive country with one of the highest standards of living among the Soviet Republics, has had a turbulent history since the Soviet Union dissolved in 1991. Since independence, lack of confidence in the economy and the disappearance of Soviet support has contributed to an industrial decline of 90% leaving thousands of workers in the formal sector without jobs. This social and economic decline with associated decreased productivity, increased poverty and inequality in the distribution of wealth has arguably contributed to a marked decline in overall stability. However, the past five years has seen relative improvement in the move towards a market economy.

Figure 9-1 Georgian national statistics

GEORGIA

Main Language:	Georgian
Capital:	T'bilisi
Currency Unit:	Georgian Lari
Currency/ US$:	2.08



ECONOMY		
GDP (US$bn):	22.8	(CIA 2000)
GDP per capita (US$)	4600	(CIA 2000)
GDP real growth rate (%):	1.9	(CIA 2000)

POPULATION AND SOCIETY		
Population size (million):	5.0	(CIA 2001)
Estimated Population in 2015:	4.8	(HDR 1999)
Average annual growth 2001 (%):	-0.59	(CIA 2001)
Life expectancy at birth:	64.6	(CIA)

EMPLOYMENT		
Total labour force (million):	3.08	(CIA 1997)
Agriculture:	40%	(CIA 1999 est.)
Services:	40%	(CIA 1999 est.)
Industry:	20%	(CIA 1999 est.)
Unemployment rate (1999):	14.9%	(CIA 1999 est.)

PRINCIPAL RELIGIONS		
Georgian Orthodox:	65%	(CIA 2001)
Muslim:	11%	(CIA 2001)
Russian Orthodox:	10%	(CIA 2001)
Armenian Apostolic:	8%	(CIA 2001)
Unknown:	6%	(CIA 2001)

STRUCTURE OF OUTPUT		**% of GDP**
Agriculture & mining:	23.7%	(WB 2000 est.)
Industry:	13.9%	(WB 2000 est.)
...of which manufacturing:	7.5%	(WB 2000 est.)
Services:	62.4%	(WB 2000 est.)
Imports as % of GDP:	46.6%	(WB 2000 est.)
Exports as % of GDP:	37.7%	(WB 2000 est.)

EDUCATION		
Adult literacy (%):	99	(WB/ NG)
Primary enrolment ratio:	98%	(Sakartvelo 2000)
Secondary enrolment ratio:	57%	(Sakartvelo 2000)
Tertiary enrolment ratio:	15%	(Sakartvelo 2000)
Expenditure on education as % of GNP:	1.41%	(EFA 2000)
Primary pupil teacher ratio:	17	(EFA 2000)

HUMAN AND GENDER DEVELOPMENT		
UN HDI score:	74%	(UNDP 1999)
UN HDI rank:	32	(UNDP 1999)

HDR 1999 – Human Development Report
CIA 2001 - World Factbook
WB 2000 – World Bank
UNDP 1999 – United Nations Development Programme
EFA 2000 – From World Education Forum
Sakartvelo http://www.library.uu.nl/wesp/populstat/Europe/georgiag.htm

Note 1: In general, official unemployment figures are lower than the real figures owing to hidden unemployment [1] Therefore it can be assumed that the actual unemployment rate in Georgia is higher than that stated here. See Section 9.5.1.1 for more details

9.2.1.1 Politics and administrative structure

Since 1991, Georgia has been a democracy with a division of powers between a strong executive led by the president, a parliament (the highest representative body at national level) and an independent judiciary. Although the process of democratization has rarely been smooth, elections have typically been considered relatively free and fair by international observers. [2]

President Eduard Shevardnadze is both chief of state and head of government. Parliament is the highest representative body at national level.

Georgia is divided into 10 regions (including Tskhinvali region, whose status has not yet been defined) and the Autonomous Republics of Ajara and Abkhazia. The regions of Georgia are broken down into:

(1) Underemployed labour and that part of the population which is arguably part of the labour force but is excluded from a measure of unemployment because of the definition of unemployment used
(2) For example, the U.S Department of State. Source: www.state.gov/www/background_notes/Georgia_9811_bgn.html

- 67 Districts
- 61 District towns
- 52 Small towns
- 4,488 Villages
- 1,032 Sakrebulos

The villages are united to form administrative units called Sakrebulos, or Village Councils, of which there are 943. These are former village soviets that were formed to incorporate between one thousand and two thousand people in each. This has resulted in some Sakrebulos in densely populated areas incorporating three to four villages, whereas in sparsely populated areas such as mountainous regions, a Sakrebulo can include ten to twelve villages. Each village has a village leader who is subsequently a member of their respective Sakrebulo.

The heads of the regions, districts, capital cities and principal towns are appointed directly by the President, while the governors of villages, towns, and towns of regional importance are appointed by the Representative of the President in the Regions on the basis that they have been referred by the District Governor (Gamgebeli).

9.2.1.2 Economy and infrastructure

During the Soviet time, Georgia's economy revolved around Black Sea tourism, cultivation of citrus fruits, teas and grapes, mining of manganese and copper, and output of its industrial sector producing wine, metals, machinery, chemicals, and textiles. Since gaining independence, the industrial sector has declined sharply and agricultural production has fallen, though not as dramatically. As with almost all other sectors, there has been very little investment in farm equipment and irrigation systems, and inputs such as fertilizer are expensive and difficult to obtain.

The country suffers from an energy crisis and severe energy shortages, although privatization of the distribution network in 1998 has steadily improved delivery[1] in the urban areas (particularly around Tbilisi). Its only sizeable internal energy resource is hydropower and the bulk of its energy needs, including natural gas and oil products, are imported. It also suffers from a highly degraded transportation system.

Georgia has made substantial economic gains since 1995, increasing GDP growth and cutting inflation and is on track towards a market economy and greater integration with Western institutions. However, the economy continues to experience large budget deficits owing to a failure to collect tax revenues. The growing trade deficit, continuing problems with tax evasion and political uncertainties, cloud the short-term economic picture.[2]

9.2.1.3 Society

Internal conflict caused by a complex mix of economic, regional political, and ethnic factors, has caused divisions within the country, the loss of several thousand lives, acts of terrorism, and the

(1) CIA (2001) The World Fact book
(2) CIA (2001) The World Fact book

internal displacement of hundreds of thousands of people. This has arisen in particular from violence within the enclaves in Abkhazia and former South Ossetia (Samachablo).[1] There is a high level of inequality in the distribution of wealth. This can be attributed to the consequences of mismanagement in the early days of privatization, the apparent collapse of formal wages and income opportunities, and the consequent reliance on self-employment to provide household income. The informal sector, where labour efficiency and social guarantees are extremely low, employs a vast portion of the work force.

The social security system in Georgia is currently weak. As a result, families are increasingly playing an important role in providing support for the unemployed.

9.2.2 The survey area

The area of study is within two regions (Kvemo Kartli in the south-east and Samtskhe- Javakheti in the south west) and six [2] districts, going from east (Azerbaijan border) to west (Turkish border), which the pipeline crosses:

- Gardabani
- Marneuli
- Tetritskaro
- Tsalka
- Borjomi
- Akhaltsikhe

The survey included a total of 72 communities within a 4km corridor of the proposed pipeline (2km either side) and 5km of the AGIs, across the six districts (see Table 9-2 and Figure 9-2). The vast majority of communities are small (<500) or medium (500+) sized villages, but some larger (5,000+) villages and towns (up to 15,000) are included. The term ‘communities’ is used throughout the text when referring to all the settlements (hamlets, villages and towns) surveyed (Appendix D Annex I contains information on the 72 communities visited, their primary socio-economic characteristics and attitudes to the pipeline. Annex II contains maps (Figure 9-2a-j) of the pipeline route with 5km KP points, divided into portions and showing the quality of infrastructure in each settlement). Statements about conditions or districts are based on the results of the survey and interviews, which have been extrapolated to apply to the communities or area as a whole.

Geographically, the area surveyed divides into four broad sections:

- Azeri Border to Marneuli
- Marneuli to Tsalka
- Tsalka to Borjomi
- Borjomi to the Turkish Border

(1) Note: The proposed BTC pipeline route does not pass anywhere near to these areas

(2) The pipeline crosses a seventh district) Adigeni, for less than 10km. However there are no settlements in this district which lie near or within 2km either side of the pipeline. It is therefore not considered to be impacted by the pipeline, and hence not included in the social baseline report

Table 9-1 Description of geographic characteristics of surveyed areas

Azeri Border – Marneuli	Marneuli - Tsalka	Tsalka - Borjomi	Borjomi – Turkish Border
Mostly grazing and agricultural land	Meadows and Pastures	Mountainous, high altitude meadows	Most arid part of survey area
Almost no forested areas	Some forested areas	Areas of dense forest	Small patches of forested woodland
People are generally farmers or work in large towns	People are generally farmers and raise a variety of livestock, from sheep to cows to pigs	People are mostly pastoralists and farmers and hope to develop mountain tourism. People from other areas of Georgia graze sheep in the high meadows	People are generally farmers in this district, growing cereals and cultivating orchards. Some people keep cows but very little real grazing is done

Other areas impacted by the project but not by the pipeline routing include Poti and Batumi ports on the Black Sea, with populations of 47,442 and 139,650 respectively. Pipe will be transported by rail directly from these ports to the pipe yards along the route. Consultations were not conducted with the communities in these areas, as the percentage increase in business through the ports at that time was considered to be so low that the impact on the communities would be negligible.

Figure 9-2 Surveyed communities along the BTC pipeline (See Appendix D Annex II for an A3 version of Figure 9-2)

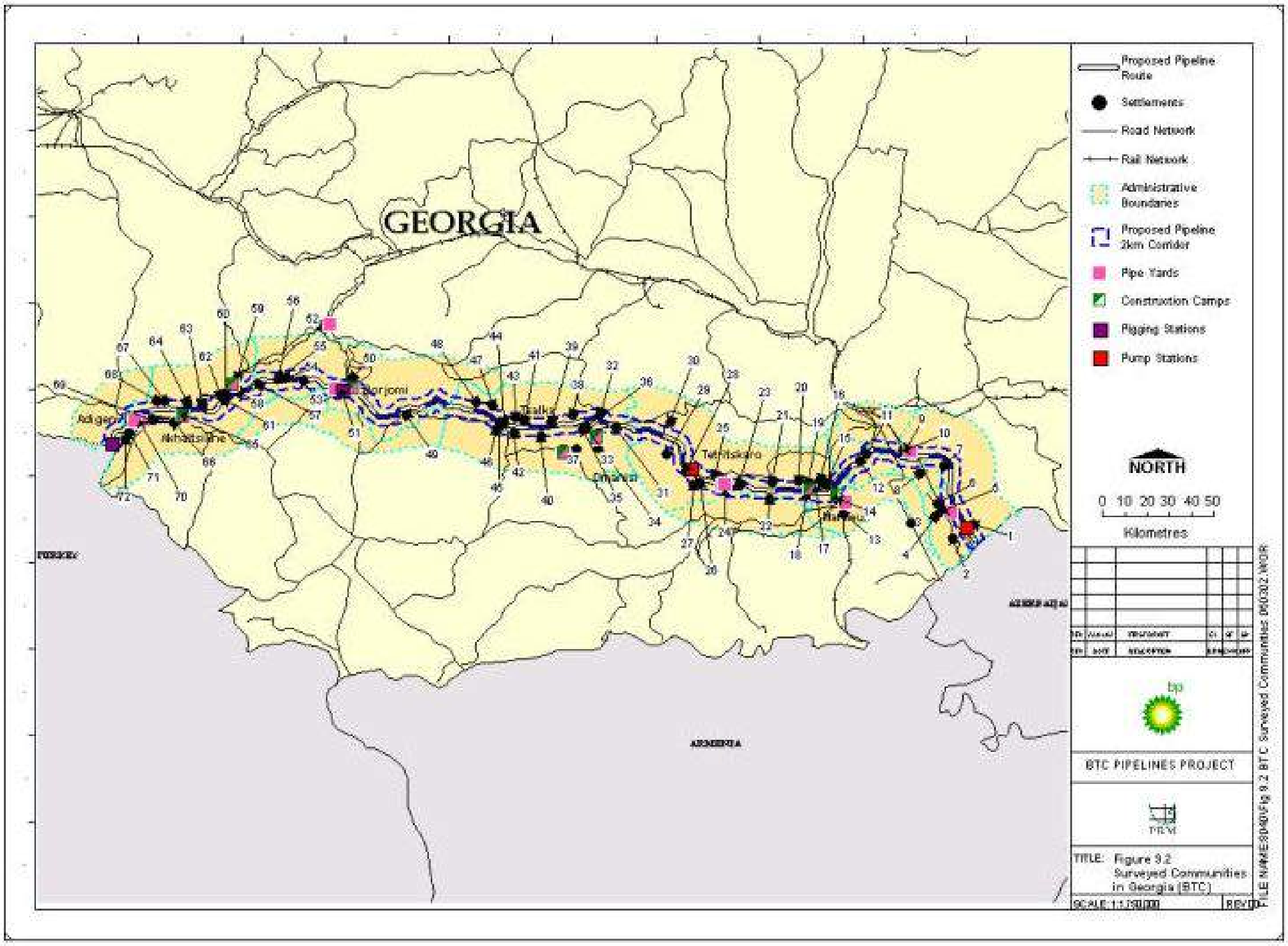


Table 9-2 Table of settlements - with map references for Figure 9-2

See Appendix D for information and maps on the 72 communities visited, their primary socio-economic characteristics and attitudes to the pipeline

	Gardabani		Marneuli		Tetritskaro		Tsalka		Borjomi		Akhaltsikhe
1	Jandari (G)	13	Marneuli Town	15	Akhali-Marabda	31	Imera	49	Tabatskuri	57	Tiseli
2	Nazarlo	14	Jandari (M)	16	Dzveli-Marabda	32	Bashkoi	50	Bakurianis Andeziti [1]	58	Tkemlana
3	Kesalo			17	Kotishi	33	Akhaliki	51	Tsikhisjvari	59	Atskuri
4	Kapanachi-Lelashka			18	Khaishi	34	Shapar-Haraba	52	Borjomi	60	Agara
5	Gardabani Town			19	Patara-Durnuki	35	Shipiaki	53	Kodiani	61	Sakuneti
6	Birliki			20	Didi-Durnuki	36	Beshtasheni	54	Dviri	62	Zikilia
7	Akhali Samgori			21	Tsintskaro	37	Tsalka	55	Sakire	63	Tsnisi
8	Rustavi Town			22	Kosalari	38	Kariaki	56	Tadzrisi	64	Klde
9	Akhtagla			23	Daget-Hachin	39	Santa			65	Suburb of Akhaltsikhe
10	Karatagla			24	Samshvilde	40	Tsintskaro			66	Akhaltsikhe Town
11	Krtsanisi			25	Tetritskaro Town	41	Ashkala			67	Tsira
12	Kumisi			26	Chivschavi	42	Jinisi			68	Tskruti
				27	Ipnara	43	Gumbati			69	Skhvilisi
				28	Jigrasheni	44	Avranlo			70	Vale Train Station
				29	Ivanovka	45	Kizil-Kilisa			71	Vale
				30	Akhalsopeli	46	Ozni			72	Naokhrebi
						47	Rekha				

(1) Also referred to as Andezit.

						48	Khando				

9.3 DEMOGRAPHICS AND POPULATION

Table 9-3 Summary of demographics and population in surveyed communities

District	Population	Gender	Age [1]	Ethnicity	Religion [2]
Gardabani	122,500	M=F	Ageing population [3]	Georgian & Azeri	Orthodox Christian & Muslim
Marneuli	128,500	M<F	Ageing population	Azeri	Muslim
Tetritskaro	36,300	M=F	30% > retirement age	Ethnically diverse	Orthodox Christian & Muslim & Gregorian
Tsalka	44,100	M=F	30% > retirement age	Greek & Armenian & Georgian	Orthodox Christian & Gregorian
Borjomi	40,800	M=F	25% of population < 16	Georgian (& Armenian & Azeri)	Orthodox Christian
Akhaltsikhe	55,000	M=F	Ageing population	Georgian & Armenian	Orthodox Christian & Gregorian & Atheist
TOTAL	427,200	M=F	Ageing population	Ethnically Diverse	Diverse: Majority Orthodox Christian

9.3.1 Population and migration

The population of Georgia was approximately five million in 2001. The total population of the districts in the surveyed area which the proposed pipeline would cross is approximately 427,000. The size of communities varies across districts. Communities in Tetritskaro District tend to be quite small, with populations generally less than 500. Communities in Marneuli and Gardabani, by comparison, tend to be larger, with populations generally over 1,500. The population of communities in the other four districts are more variable. The average household surveyed is 3.3 people/household, with Marneuli having the largest households (3.64) and Tetritskaro having the smallest (2.9) (see Table 9-4).

(1) Retirement age is officially 60 years for women and 65 years for men
(2) Orthodox Christian includes Georgian Orthodox and Russian Orthodox. Gregorian is a Christian denomination
(3) An ageing population is one in which the percentage of elderly people (+60 years) in the population is growing

Table 9-4 Population data for districts and communities

District	Total Population	Number of Communities Surveyed	Population of Communities Surveyed	Total Number of Households in Surveyed Communities
Gardabani[1]	266,431	12	154,465	44,477
Marneuli	128,500	2	22,498	6,172
Tetritskaro	36,300	16	8,492	2,964
Tsalka	44,100	18	13,155	4,465
Borjomi	40,800	8	22,159	7,136
Akhaltsikhe	55,000	16	34,210	9,458
TOTAL[2]	571,131	72	254,979	74,672

The surveyed communities have generally decreased in size over the last ten years. This is mainly owing to outward-migration of young people looking for work and opportunities elsewhere. Approximately 30% of households surveyed indicated that at least one member of their household had left the village in order to settle elsewhere permanently. The main reasons given were:

- To find employment in another country (48%)
- To get married (40%)
- To work in Tbilisi or another part of Georgia (15%)
- For educational opportunities for themselves and their children (9%)

Thirteen percent of household members said they planned to leave the village, mainly to obtain better services. There is also some voluntary repatriation of ethnic minorities, particularly Greeks, to their countries of origin. Communities whose population has remained stable tend to be those that have basic infrastructure (including gas, water and roads) and better work opportunities. Examples include Vale (Akhaltsikhe) and Jandari (M) (Marneuli).

There are six main towns in each of the districts that the proposed pipeline would cross, as shown in Table 9-5.

Table 9-5 Population of major towns in relevant districts

Map Ref	District	Town	Population
8	Gardabani	Rustavi	111,966
13	Marneuli	Marneuli	25,350
25	Tetritskaro	Tetritskaro	5,300
37	Tsalka	Tsalka	4,037

(1) For the purposes of this ESIA, the population and household number for Rustavi Town has been included in Gardabani District. According to legislation, however, Rustavi Town has been given special status and is not included as part of a district. Rustavi Town has a population of 111,966
(2) This figure includes the numbers for Rustavi Town

52	Borjomi	Borjomi	27,700
66	Akhaltsikhe	Akhaltsikhe	19,118

9.3.2 Gender distribution

The gender split within the surveyed communities is most pronounced in Marneuli where the population is 46.3% male and 53.7% female, linked to the out-migration of more males than females in search of employment elsewhere. In other districts it is closer to a 50-50 split between men and women.

9.3.3 Age distribution

An important demographic trend is the ageing of the population. In half of the communities surveyed in Tetritskaro and a third of the communities surveyed in Tsalka, the majority of the population is over retirement age (age 60 or over), reflecting the out-migration of young people, mostly in search of economic opportunities that do not exist in Georgian villages. This is significantly higher than for other districts, probably because there are fewer larger towns here, and therefore fewer local opportunities. From the data it appears that Marneuli has the highest percentage (25%) of people under the age of 16, but for no obvious reason.

9.3.4 Ethnicity

Georgia is characterized by significant ethnic diversity, with Southern Georgia being the most ethnically diverse. Of the surveyed communities:

- 43% are Georgian
- 25% are Armenian
- 16% are Azeri
- 15% are Greek
- 7% are Russian and Byelorussian

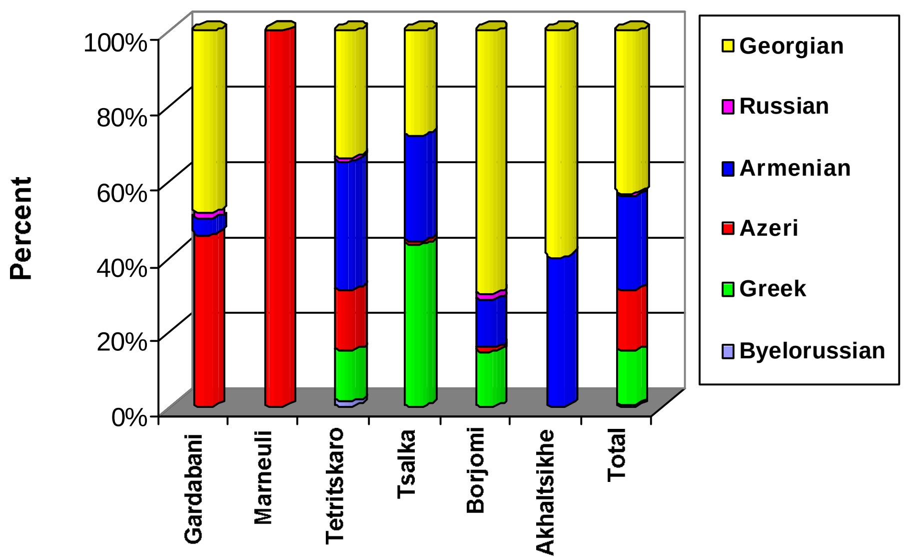
This ethnic breakdown is not necessarily represented in each district, as shown in Figure 9-3.

- In Gardabani most people are ethnically Georgian (48%) or Azeri (46%)
- In Marneuli, 100% of the surveyed population is of Azeri ethnicity
- In Tetritskaro, the majority of people are ethnically Georgian (34%) or Armenian (34%), although it is generally ethnically diverse, with representatives of a number of ethnicities
- In Tsalka, 43% of the population is ethnically Greek, and 56% of the population is ethnically Armenian or Georgian
- In Borjomi 70% of the population is ethnically Georgian, and the rest is split between people of Armenian and Greek ethnicity
- In Akhaltsikhe people are ethnically Georgian (60%) or Armenian (40%)

In the majority of cases, settlements tend to be dominated by one ethnic group. This is not as a result of overt ethnic tension, but is rather a pattern that has arisen over time. In Tsalka, however, there is tension between the Greek and Armenian communities. In the proximity of the Turkish border, and particularly within Armenian communities, there is also anecdotal evidence that tensions exist between the Turks and the Armenians, probably for historical reasons. It was mentioned during interviews in these communities, that if "foreign" [1] workers were imported for pipeline work, it would create tensions in these areas.

(1) Any workers that are not of the same ethnicity as that of the local workers.

Figure 9-3 Ethnicity of surveyed communities (% of surveyed respondents)

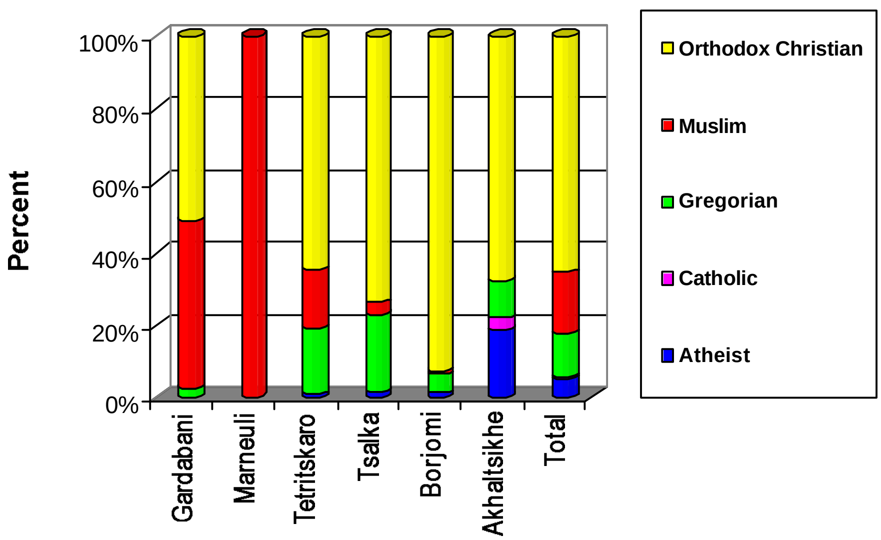


Note: Analysis based on results of quantitative household interviews. (n=708)

9.3.5 Religion

The majority of the population that was surveyed in the area is Orthodox Christian, but religion varies significantly by district. For instance, 93% of the population in Borjomi is Orthodox Christian, while nearly 100% of the population in the surveyed villages in Marneuli is Muslim, a reflection of the large number of ethnic Azeris in the district. Gardabani is nearly equally split between Orthodox Christians and Muslims (see Figure 9-4).

Figure 9-4 Religion of surveyed communities (% of surveyed respondents)



Note: Analysis based on results of quantitative household interviews. (n=708)

9.3.6 Public health[1]

During the 1990s, the significant socio-economic crisis, civil war, internally displaced people, increasing unemployment and deterioration of living conditions for most people had a strong negative impact on health behaviour and health status. The deterioration of healthcare facilities in communities has also had an impact on health.

9.3.6.1 Life expectancy

Life expectancy at birth in 1990 was 68.1 years for men and 75.7 years for women, compared with 71 and 78 years respectively in Western Europe. The death rate peaked sharply in 1993, perhaps the most difficult year of Georgia's transition. The death rate levelled out in 1997 and increased again in 1998.

The most striking development in population dynamics is the dramatic decline of the birth rate, from 19.0 per 1,000 in 1992 to 9.1 in 1998. The total fertility rate has decreased from 2.20 per 1,000 (1990) to 1.35 (1996), which is far below replacement level. The reasons for the fall in fertility seem to be the outward-migration of young people from Georgia, declining numbers of marriages and the tendency to postpone marriage and start a family later.

(1) All data reported here are from National data statistics for the country as a whole. Source: National Data Statistics (1999) Strategic Health Plan for Georgia 2000 – 2009. This information has been included as it provides a good indication of the (deterioration) of the standard of living in Georgia

9.3.6.2 Maternal mortality

Maternal mortality has more than doubled since 1993. The actual number of maternal deaths has not changed significantly since the beginning of the 1990s, but because the number of births has rapidly declined, the real number of maternal mortalities (68.6 per 100,000 live births) is more than four times the WHO target for 2000 for the European Area, which is 15 per 100,000 live births.

9.3.6.3 Frequency of diseases

Cardiovascular diseases and malignant neoplasms (i.e., cancers) are the leading causes of mortality in Georgia. This is linked to an increase in adverse health factors such as unemployment, poverty and continuous stress, which increase the harmful impact of smoking, alcohol and drug abuse, unhealthy eating and lack of physical activity.

Infectious diseases have been increasing, mainly as a result of:

- Deterioration of sanitary conditions
- Widespread poverty
- Inefficient implementation of preventive measures

Diseases once considered eradicated, including malaria (16 reported cases for 1998), visceral leishmaniasis (96 cases in 1996, 80 cases in 1997 and 82 cases in 1998) and rabies have increased. There has also been a recent outbreak of Hepatitis A in Akhaltsikhe and Poti.

9.3.6.4 Sexually transmitted diseases

Reporting of sexually transmitted diseases does not reflect the real situation, as most patients prefer to use anonymous health services. In general, the cases of syphilis and gonorrhoea are greatly under-detected and under-reported.

HIV/AIDs has become an increasing problem in Georgia. By June 1st 2000, Georgia had 131 registered cases of HIV/AIDS. However this is widely recognized to be an under-estimate of the true level of infection. According to UNICEF Georgia [1], the estimated number of cases is around 1,000, and they expect this number to rise rapidly in the near future. The majority of reported cases come from Tbilisi and the coastal urban areas. Intravenous drug users account for 67% of registered cases, and 25% come from heterosexual contacts. The predicated rise in HIV/AIDS is owing to the following factors:

- Rapid increase in rates of drug addiction
- Rapid increase in HIV/AIDS in neighbouring countries
- Increased population migration and wide international contacts
- Traditionally low use of condoms
- Low awareness of HIV/AIDS in the population

(1) UNICEF (June 2001) Georgia Draft Plan of Action on National Response to HIV/AIDS in Georgia 2001 - 02.

- Lack of sanitary conditions in hospitals (eg proper sterilization of syringes, needles used, etc)
- Increased prostitution as a result of poverty and lack of economic opportunities, particularly in Akhaltsikhe and Tbilisi

9.3.6.5 Psychosocial and behavioural problems

The radical political and socio-economic changes have caused high levels of stress, and a considerable increase in psychosocial and behavioural problems. The morbidity rates of reactive and senile psychosis in particular, psychosomatic disorders and depression have rapidly increased.

9.4 LAND TENURE AND USE

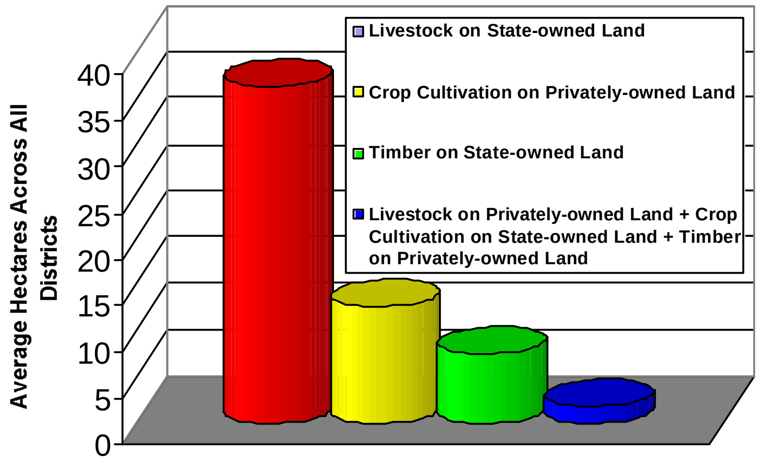
Ownership and the use of land is an important part of the social economy in the survey area, as well as Georgia as a whole. The majority of the population in the surveyed communities relies on the land for subsistence, and it provides an integral part of their income if not the majority in many cases. The land is used for three main productive activities:

- Crop cultivation
- Livestock raising/grazing
- Timber harvesting and wood cutting

9.4.1 Land tenure

In general, people use state land for pasture and for timber harvesting and woodcutting, and own the land they use for crop cultivation. State land is used under a lease agreement or sometimes without formal permission. The land tenure of the communities surveyed is broken down as shown in Figure 9-5 and Table 9-6.

Figure 9-5 Average land tenure and use in surveyed communities (hectares per type of use)



Note: Analysis based on results of quantitative household interviews. (n=708)

Table 9-6 Land tenure and use in surveyed communities (% tenure per type of use)

% of Land	Livestock Raising/ Grazing	Crop Cultivation	Timber Harvesting
State-owned (% of total land use)	99	1.4	86
Privately-owned (% of total land use)	1	98.6	14
TOTAL	100	100	100

9.4.2 Land ownership

The average amount of land owned or used per household in the surveyed area is almost one hectare.

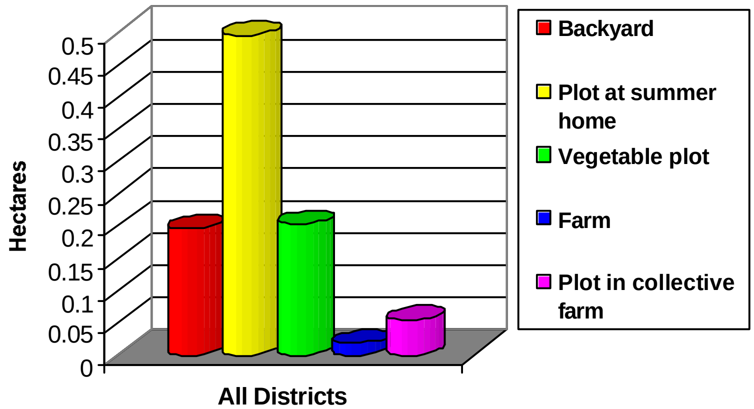
This includes:

- **Backyard gardens** – small gardens attached to the house. These are typically used for vegetables, (lettuce, carrots), herbs and fruit trees
- **Summer plots** – land that is normally cultivated in the summer and that is not attached to the house. These are the largest piece of land owned by any one household, and are used for vegetables, including tomatoes, cucumbers, etc[1]
- **Vegetable plots** – typically close to the house and used only for growing vegetables – typically potatoes
- **Collective farm land** – typically far from the house, used to cultivate cereal crops and fodder
- **Privately-owned farm land** – a very small percentage of communities have private farms

The remaining categories of land make up only a small fraction of the total. Private and collective farm plots are used for cereal crops and fodder. In most cases, all except the private farm and collective farm plots would be irrigated. Officially there are no longer any state farms.

(1) Such plots may be as far as several kilometres from the house. Some people erect small shacks on the land, thus the term “plot at summerhouse”.

Figure 9-6 Types and uses of privately–owned land in the surveyed area (hectares/type of use)



Note: Analysis based on results of quantitative household interviews. (n=708)

9.4.3 Land use

9.4.3.1 Crop cultivation

In general, vegetables are the most widespread type of crops cultivated (79% of communities surveyed), followed by herbs (64%) and fruit (60%). However, the districts differ significantly in terms of what crops are cultivated, based mainly on climatic and geographic conditions (see Table 9-7). Borjomi is the district where the largest number of respondents cultivate crops.

Table 9-7 Dominant crops in the survey area by district

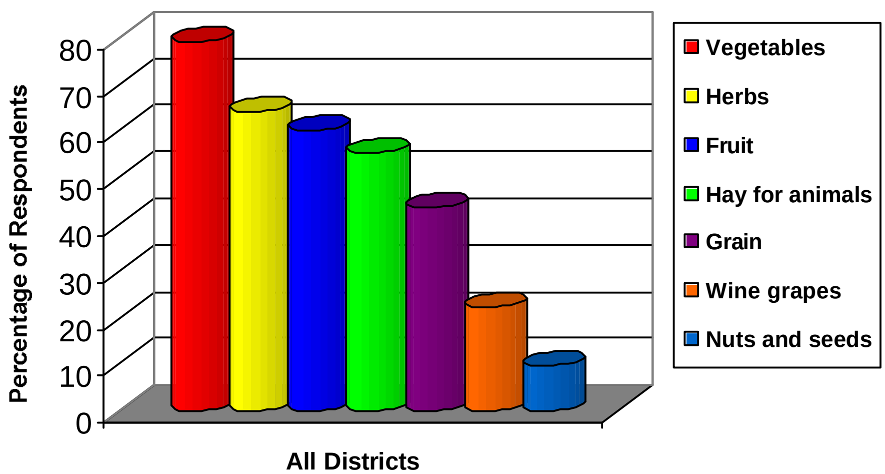
Gardabani	Marneuli	Tetritskaro	Tsalka	Borjomi	Akhaltsikhe
1. Vegetables 2. Herbs 3. Fruit	1. Vegetables 2. Herbs 3. Fruit	1. Vegetables 2. Fruit 3. Herbs	1. Vegetables 2. Hay 3. Herbs & Fruit	1. Vegetables 2. Herbs 3. Hay	1.Vegetables 2. Grain 3. Herbs

- Akhaltsikhe is the district where the most grain is cultivated, with four out of every five households growing grain
- Wine grapes are grown in 40% and 38% of households in Akhaltsikhe and Gardabani, respectively, given the arid and hot summer climate suitable for the crop
- Herbs are grown by households throughout the area, but are particularly widespread in Akhaltsikhe and Borjomi
- Hay for animals is grown by over 80% of households in Tsalka, reflecting the dependence of households in Tsalka on animal products for both livelihood and income (see Figure 9-7 for a summary)

The main purpose of crop cultivation in all districts was found to be for "own use." Nearly 80% of those interviewed in all districts responded that they consume most of the agricultural products they produce. Tsalka was the district with the highest proportion of those who sell crops (21%) and Tetritskaro was the district selling the least crops (less than 5%).

The overwhelming majority of people (87%) said that agricultural production had decreased in the last five years. The main reasons cited for decreased productivity were drought, lack of technology, and decreased use of both chemical fertilizers and chemical pesticides as a result of lack of money.

Figure 9-7 Crop cultivation in all surveyed communities



Note: Analysis based on results of quantitative household interviews. (n=708)

9.4.4 Livestock

The most frequently owned livestock in the area is poultry – approximately eight fowl per average household. On average, 50% of families own a pig and 10% a horse and a goat.

In terms of monetary value (to keep or sell), sheep and cows are the most valuable livestock. An average household owns two to three cows and one sheep. With a few exceptions, none of the households owned more than ten cows or sheep. The price of livestock varies according to quality, age, and weight, and may vary according to district.

The most active months of shepherding are May to September, when 90%-95% of shepherds are moving sheep to grazing pastures. The majority of sheep produced for the Georgian market come from other areas of Georgia, and the number kept by villagers in this area is comparatively small. It is not cost-effective to move sheep long distances for grazing; most people graze their sheep in nearby pastures.

Sheep herding is most common in Gardabani, which has a large population of Azeris, who are traditionally shepherds, and in Tsalka, where high altitude land, unsuitable for cultivation, provides suitable grazing for sheep. There is a seasonally occupied village in Borjomi district called Kodiani, which is used by residents of Sakire. Approximately 85 families own wooden structures in which they stay over this period, but not all families are there at one time. They take cattle up to the summer village to graze during the summer months (May-September).

The high altitude land around Tabatskuri lake and village is leased, mainly to ethnic Azeri shepherds from Eastern Georgia who take care of sheep for several families. The land is generally leased for a period of 20 to 50 years, and families live in tent camps of four to five families (20 – 25 people) during the summer months (mid-May – mid-September).

9.4.5 Forest use

More than half of the households in Borjomi reported collecting plants in the forests, including berries and mushrooms, and more than three quarters reported being engaged in woodcutting in the forest. These high percentages are explained by the existence of forested areas in Borjomi district. In Gardabani, Tetritskaro, Tsalka and Akhaltsikhe only 10%- 25% of households reported collecting forest plants. In Marneuli, which is largely open land, only 2.5% of respondents report such activity.

Only a very small percentage of households in Borjomi and Tetritskaro report selling wood commercially, despite the abundance of forested areas in these districts. This indicates that the vast majority cut wood is for personal use as firewood. Officially people have to pay for logging permits, which allow them to harvest agreed amounts from specific areas. The actual number of people engaged in wood cutting and especially engaged in selling wood commercially may be higher than reported as some of the activity is certainly being done illegally and people do not want to admit to being engaged in illegal woodcutting and selling. Anecdotal evidence suggests that this is the case.

The majority of people considered that the results/yields of forest activities in the year 2000 were worse than previous years. Reasons for worsening conditions in the forest included:

- High levels of cutting wood (37%)
- Government policies which restrict access (18.7%)
- Deterioration of forest roads (15.5%) 1
- Weather conditions (drought)

9.4.6 Hunting and fishing

Neither hunting nor fishing are common activities in the area surveyed. Only 10% of respondents said they hunt or fish. Of those who do hunt, the game sought is primarily birds (eg pheasant) and rabbits. Much of the hunting reported is for recreation rather than subsistence.

(1) Forest roads are significant for those who obtain a licence to cut wood and take it from the forest

9.4.7 Beekeeping

Statistically, there is evidence of a small amount of beekeeping as a significant source of livelihood in the surveyed communities, with 2.5% of respondents saying that they keep bees. However, anecdotal evidence suggests that beekeeping provides both a commercial and domestic livelihood to a higher percentage of people than the survey reveals. According to the Georgian Professional Beekeepers' Association, beekeeping is developed mainly in the Gardabani and Marneuli districts in summer, but in winter these hives are moved to the vicinity of Kumisi Lake.

In the summer (June to September), beehives from the lowlands are taken to the Tsalka area (in the vicinity of Bashkoi and Santa villages), so at this time of year there could be 300 to 1,500 hives in the area. As bees are highly sensitive to dust and noise, this is an important factor to take into consideration.

9.5 LIVELIHOODS

9.5.1 Livelihood and employment

9.5.1.1 Employment

Much of the relevant area of rural Georgia is characterized by agriculturally based livelihoods and high levels of unemployment. Approximately 80% of the adults surveyed are unemployed or under-employed [1]. Among those who are steadily employed, half are employed in the state sector, which is characterized by long delays in payment of salaries. Only 3% of people interviewed reported being employed in the private sector. This survey clearly indicated that lack of paid work opportunities is one of the greatest problems at both the household and village level.

"If we had jobs, there wouldn't be any problem living here. But now, even those who are employed in state institutions do not receive their salaries for long periods." (Nurse, Tsikhisjvari, Borjomi district)

9.5.1.2 Sources of income

Wage income earned by individuals in the surveyed communities provides the highest of all income sources in the area. However, only 34% of respondents in the surveyed communities earn income in this form. The majority of respondents earn income from selling produce. On average, nearly 50% of household income is generated by the sale of agricultural products, livestock products or livestock itself combined.

There are clear differences in sources of income across the districts:

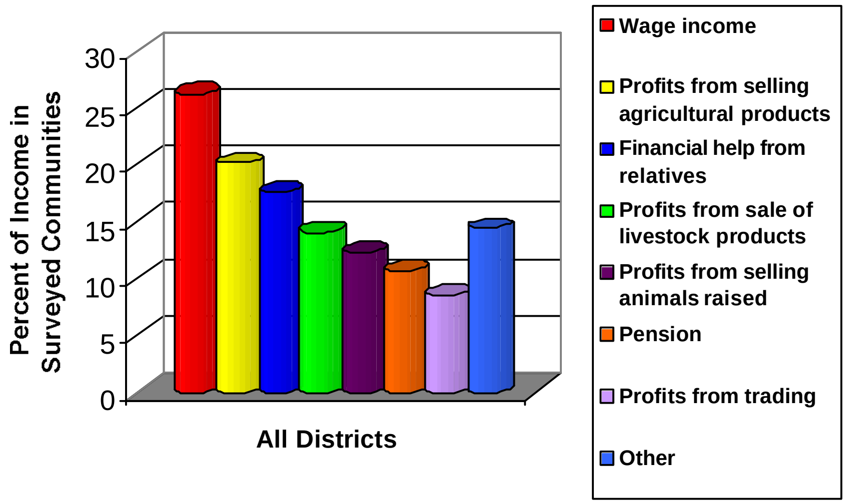
- Households in Gardabani attribute the highest portion of their income to wages

(1) Underemployed is a term used to describe working people who do not have a permanent or full-time job

- Households in Marneuli generate the majority of their household income from trading[1]
- Households in Tetritskaro are particularly dependent on the sale of livestock products such as milk, cheese, hides and wool
- Households in Borjomi and Tsalka mainly depend on financial help from relatives
- Households in Akhaltsikhe are clearly more dependent on the sale of agricultural products for income than any other source

[1] Trading is defined as being in the business of buying and selling products, which may be agricultural products.

Figure 9-8 Sources of household monthly income in the surveyed communities



Note: "Other" includes profits from leasing land, property, or from selling private belongings, selling products of picking mushrooms, herbs, etc, selling wood cut and collected, sale of processed wood products, unemployment benefit, selling products of fishing, other benefits (maternity, alimony, child support), stipend, profits from tourist/visitor accommodation, and selling products of hunting.

Note: Analysis based on results of quantitative household interviews. (n=708)

Table 9-8 Summary of livelihoods in surveyed communities by district

District	% Fully Unemployed[1]	Main Sources of Income	Secondary Sources of Income	Main Produce	Comments
Gardabani	31%	Wage income	Crops Livestock rearing	Vegetables Herbs / Fruit Wine grapes Grain Poultry Sheep	Significant wine growing district Crop cultivation for sale is quite high at 17%
Marneuli	36%	Trade	Crops Wage income Livestock raising	Vegetables Fruit Herbs Hay Wine grapes Grain Poultry	Marneuli residents make greater profit from trade than residents of any other district

(1) The figure of 80% unemployed cited earlier includes all those who are not fully employed. That is, pensioners are included in the 80% figure, as are people who take care of their children at home, casual manual labourers, etc. "Fully unemployed" does not include underemployed

District	% Fully Unemployed[1]	Main Sources of Income	Secondary Sources of Income	Main Produce	Comments
Tetritskaro	35%	Wage income Livestock raising	Pensions	Vegetables Fruit Herbs Grain Hay Wine grapes Nuts and seeds Honey from beehives Poultry Pigs	Animal products are particularly important in Tetritskaro Tetritskaro has more poultry, pigs and beehives than any other district Crops are grown primarily for subsistence use
Tsalka	34%	Financial help from relatives	Crops Wage income Livestock raising	Vegetables Hay Fruit Herbs Honey from beehives Poultry	More crops are grown for sale in Tsalka than in any other district Tsalka is also the district with the highest average household income
Borjomi	39%	Financial help from relatives	Crops Livestock Wage income	Vegetables Herbs Hay Fruit Grain Cattle Poultry	Sale of livestock animals is particularly important in Borjomi
Akhaltsikhe	30%	Crops	Wage income Livestock raising	Vegetables Grain Herbs / Fruit Hay Wine grapes Poultry	Crops are grown for sale as well as subsistence Four out of every five households in this district grows grain crops

9.5.2 Income and expenditure

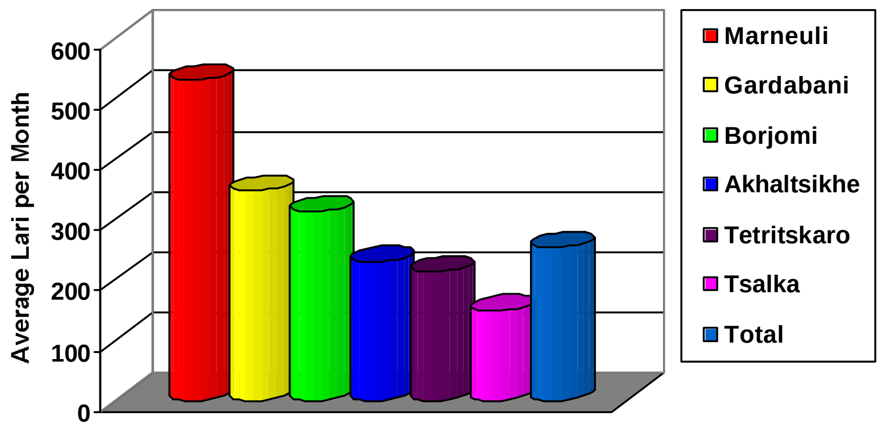
The average household income in the communities surveyed is approximately 253 Lari, or US$113[1] per month. According to the survey results, communities in Marneuli have the highest average levels of income, at GEL530 per month (US$250), whereas the surveyed communities in Tsalka have the lowest average incomes, at GEL150 per month (US$70).[2] See Figure 9-9 below. It is typically difficult to receive direct income information, especially from rural

(1) As of March 2001, the exchange rate was approximately US$1:2.1 Georgian Lari

(2) These figures are based on a wide range of incomes and are skewed because of a few very high incomes at the top end of the scale. Average incomes therefore appear to be higher than in reality, as can be seen from the standard of living in most communities

populations whose income is not cash-based. Hence these income levels must be treated as estimations rather than exact figures.

Figure 9-9 Average income in the surveyed communities (average Lari per month)

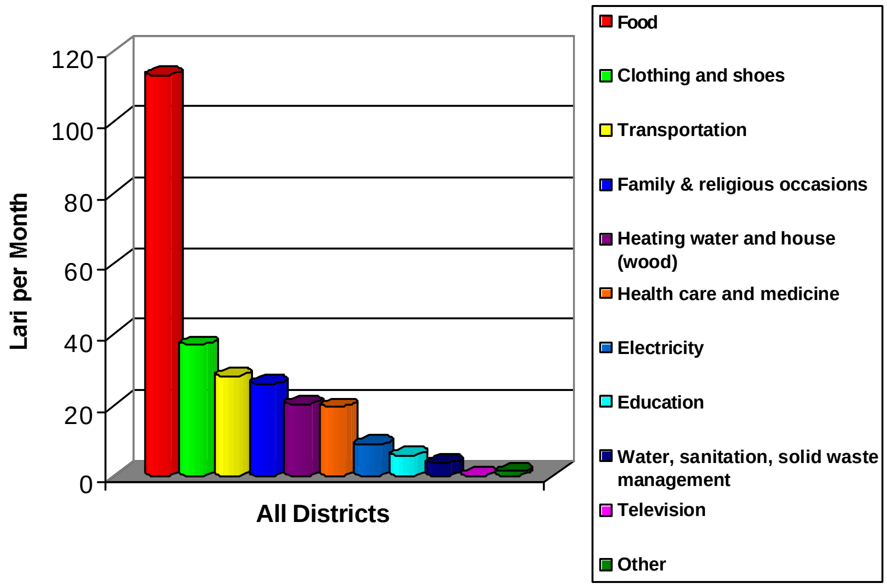


Note: Analysis based on results of quantitative household interviews. (n=708)

In the surveyed area, the average monthly expenditure per household is 261 Lari/month or approximately US$124 (see Figure 9-10). Because income is difficult to calculate, it is not unusual in a survey such as this for expenditures to be higher than income. This reflects, however, the fact that people are becoming increasingly cash-poor.

Residents of Marneuli and Gardabani tend to spend the most each month (490 and 319 Lari respectively), while residents of Borjomi report the smallest expenditures per household (190 Lari per month). Approximately 70% of household expenditure for surveyed households across all six districts was on food, transportation and clothing. Education, electricity and water, sanitation, and solid waste management represent the three smallest household expenditures. This can be explained by the fact that education is free, there is little electricity to be had, especially in winter, and there are almost no water, sanitation or solid waste management services in existence in rural Georgia.

Figure 9-10 Average household monthly expenditure in surveyed communities



Note: Analysis based on results of quantitative household interviews. (n=708)

9.5.3 Skills levels and previous construction experience

Almost none of the respondents have worked on a pipeline before, although in Akhaltsikhe some people did report that they had previously worked on pipeline construction.

When asked what kind of skills could be found within the communities, the most often cited were for:

- Physical work (53%)
- Cooking/food preparation (15%)
- Housekeeping/cleaning (10%)

3% – 4% of people thought that people in the communities could offer electrical, mechanical or driving skills.

9.6 INFRASTRUCTURE, RESOURCES AND SERVICES

9.6.1 Overall

Since independence, services and infrastructure in the surveyed communities have suffered from poor maintenance and lack of investment from the public and private sector.

9.6.2 Services

Many services, such as fire departments and banks are virtually non-existent along the route [1], while other services such as police services and health clinics are severely degraded and in need of major investment. With the exception of Marneuli, where the majority of respondents cited that the presence of local government is not very apparent, local government is considered to be of average standard, or above average in comparison with other services. Of all the services, schools seem to have been maintained the best, although they are sorely lacking in funds and as a result lack the necessary amenities and facilities for a conducive learning environment (see Table 9-9).

Table 9-9 Summary of perceptions of services within the surveyed communities2

	Local Government	Police Services	Fire Department	Health Clinics/ Hospitals	Banks	Schools
Gardabani	Average	Good	Non-Existent	Good	Virtually Non-Existent	Quite Good
Marneuli	Virtually Non-Existent	Average	Non-Existent	Non-Existent	Non-Existent	Average
Tetritskaro	Quite Good	Average	Non-Existent	Non-Existent	Non-Existent	Average
Tsalka	Average	Poor	Non-Existent	Non-Existent	Non-Existent	Average
Borjomi	Good	Quite Good	Non-Existent	Good	Non-Existent	Good
Akhaltsikhe	Average	Quite Good	Non-Existent	Average	Non-Existent	Poor

Note: Analysis based on results of quantitative household interviews. (n=708)

(1) There is, for example, a fire station in Akhaltsikhe, but residents of nearby communities report that the station lacks water supply and petrol for the fire truck

(2) It is important to note that this is a generalisation across each district. There are some villages within these districts which are exceptions

9.6.2.1 Healthcare

The provision of healthcare in rural Georgia is poor and has deteriorated extensively during the past decade. Only 30% of communities have any kind of healthcare services or facility located in the village. A visiting nurse or doctor usually provides medical care on an occasional basis in rural communities. In the most remote communities, doctors or nurses rarely visit, leaving villagers to come to the larger communities or town centres to seek medical care.

Almost all respondents said that family health has deteriorated over the last five years. Across all the surveyed areas, one of the main reasons cited as the cause of deteriorating health conditions was "worsening economic conditions". The larger communities and district centres (like Vale, Gardabani, etc) sometimes have their own healthcare institutions, hospitals or polyclinics [1]. Village inhabitants reported that they typically use local health services for emergencies and go to district healthcare centres in case of serious diseases or conditions. Ambulatory centres that have traditionally provided local walk-in service at village level are rapidly deteriorating. Many are closed owing to lack of supplies and a shortage of staff (salaries have not been paid).

Most respondents were satisfied with the healthcare services they had received at central district institutions, but they all complained about the expense of medical services. Inhabitants of almost all communities reported that medications were expensive and that they simply could not afford to purchase them.

It is notable that healthcare services in ethnically Greek villages are better than in other communities. All Greek villages have fairly well equipped healthcare centres or polyclinics that provide free services and basic medications. These services are provided by a private Greek firm in the US and are granted to Greek villages throughout Georgia. Additionally, the Catholic Church provides some communities with large Catholic populations (eg Vale in Akhaltsikhe) with free medical services several times a week.

9.6.2.2 Education

The adult literacy rate in Georgia is very high, with 99% of the adult population being literate. Just over 50% of the adult population had completed secondary school in surveyed communities, although only 5.7% had completed higher education. School attendance is generally high, over 90% in most areas. For those who do not go, the main reason cited was that the school is too far away. Another 16% said they lacked clothes or shoes for school. Another reason cited by respondents in Kosalari in Tetritskari was that poor road conditions prevent children from getting to school.

Most of the larger communities offered some form of school that serves both primary and secondary school-aged children. Most children, therefore, go to school in their own village. All of the facilities shared the same problems, most significantly late payment of teachers' salaries and the deterioration of school buildings. The problem of late payment of salaries, and occasional resultant teachers' strikes, was reported most frequently in Armenian communities (such as Naokhrebi in Akhaltsikhe).

(1) For outpatient services

Almost all school buildings are in poor condition and need repairs. Additionaly, there is no heat in the winter and few funds to buy wood for heating. In some communities the schools have deteriorated to the point of being unusable, and education is carried out in the municipal building. In Ipnara in Tetritskaro, there are too few children to go to school.

Village schools typically teach in the native language of their inhabitants. Lessons are taught in Armenian, Azeri, Georgian or Russian (in the case of Greek communities). If a school does not teach in Georgian, the Georgian language, as the State language, is taught as part of the school curriculum

9.6.3 Infrastructure

Infrastructure along the route is generally in a delapidated state and often non-existent, ineffective or inoperable (see Table 9-10.). In summary:

- Transport infrastructure is in a poor condition, with roads that are severely degraded and pot-holed.[1] This is a hindrance to any other attempt to develop infrastructure in the surveyed communities
- Energy is a major problem with communities receiving an infrequent supply of electricity, or no electricity at all. This results in a high reliance on gas, which is often not available, and wood, which is cut and gathered by the communities themselves
- Telecommunication and telephone lines are in very poor condition or non-existent. The infrastructure for mobile phones is available and reliable. However very few people in the affected communities own mobile phones
- Water supply is a problem in almost all communities, with some communities receiving running water for a few hours a day, or no piped water at all
- Sanitation services are almost non-existent, and when they do exist, they are often ineffective

Table 9-10 Summary of condition of selected infrastructure within the surveyed communities

	Roads	Landline Tele-communication	Energy Source	Water Supply	Sanitation
Gardabani	Poor	Poor	Wood, Gas, Very Little Electricity	Household wells/ water bought	Poor
Marneuli	Poor	Very Poor	Wood, Gas, Very Little Electricity	Water bought	Non-Existent
Tetritskaro	Poor	Very Poor	Wood, Some Gas, Very Little Electricity	Stored Water Supplies	Non-Existent
Tsalka	Poor	Very Poor	Wood, Gas, Very Little Electricity	Stored Water Supplies	Non-Existent
Borjomi	Poor	Very Poor	Wood, Some Gas, Some Electricity	Regular Running Water	Poor
Akhaltsikhe	Poor	Very Poor	Wood, Gas, Very	Stored Water	Very Poor

(1) A detailed report on the state of the roads along the pipeline route has been done in the environmental impact assessment. Please refer to Section 10 for further details

			Little Electricity	Supplies	

Note: Analysis based on results of quantitative household interviews. (n=708)

9.6.3.1 Energy

In the surveyed communities, wood, manure, electricity and gas are used as sources of energy. In general, energy supply is considered to be a major problem in the pipeline-affected communities. However, anecdotal evidence suggests that although communities cite lack of gas an issue of priority, if communities could receive energy in a form that is inexpensive, reliable and easily accessible, it would not matter whether it was gas, electricity or an alternative source of energy.

Wood

In the total survey area, wood is the main source of energy for both cooking and heating, and is the least expensive energy option. In Marneuli, gas is also often used for cooking, and in Tsalka manure is often used as an alternative [1].

Given the forest resources, Borjomi and Tetritskaro were the districts with the highest volume of wood consumption, especially for cooking. Most people cut wood for household use themselves. The common procedure for cutting is to buy a woodcutting licence at the local forestry department and go to the forest with vehicles to bring it home. However, the fuel for the trucks is expensive and many households cannot afford such services and therefore carry wood on horses or by hand.

Villagers cite high cost and insufficient supply as main reasons for not using non-wood options for heating and cooking.

"Yes, we receive gas, but it is too expensive to use for heating, we use it only for cooking and can hardly pay for this." (Jandari (M) resident, Marneuli)

Electricity

All surveyed communities experience severe electricity power shortages (see Table 9-11) and most receive electricity for only a few hours each day. With the exception of Borjomi, households in all districts do not receive continuous electric power, and most reported that they rarely receive electricity.

It appears that the problem with electricity relates more to supply than infrastructure, which is often largely intact. The supply is particularly poor in winter, when demand is high (short daylight hours) and some power generation sources (eg hydro-power) are not contributing [2].

(1) In Tabatskuri, people are also almost fully dependent on manure for heating and cooking purposes

(2) Anecdotal evidence suggests that lack of supply may be linked to the fact that suppliers are aware of some communities' ' inability to pay. They therefore often cease to supply to these communities

Communities in Borjomi have somewhat better access to electricity, as the famous winter resort Bakuriani is situated nearby. There, approximately 25% of respondents report having electricity 24 hours a day all year. At a minimum, all have access to electricity at some time during the day.

Table 9-11 Electricity supply in the surveyed communities (% of villages /level of service)

Receive electricity…					
%	Always	Often	Sometimes	Rarely	Never
Gardabani	-	21	18	57	4
Marneuli	8	3	8	73	8
Tetritskaro	-	1	1	71	27
Tsalka	-	-	-	80	20
Borjomi	25	27	17	31	-
Akhaltsikhe	-	-	19	81	-
Total Survey Area	4	6	9	69	12

Note: Analysis based on results of quantitative household interviews. (n=708)

Some of the surveyed communities receive electricity according to a schedule, while others receive it on an irregular basis. One village reported that during winter they have electricity between the hours of 1 am – 3 am only.

Electricity is used only as a light source and very seldom for cooking. To light their homes when there is no electricity, village inhabitants usually use oil lamps. A small percentage of villagers (about 5%) cannot afford to buy lamp oil regularly. They have become accustomed to going to bed as soon as it gets dark, or to sitting in the dark.

Respondents reported that they used to pay for electricity via withdrawals from their salaries, but now they either pay a flat fee no matter how much they get or use, or pay the meter reader who comes every month. However, owing to the severe electricity shortage and the fact that people tamper with the meters [1] so that real consumption (and hence real rates) isn't shown, electric bills are minimal and do not pose much of a problem to most villagers.

Very few households can afford to use generators for electricity. Generators are more common in communities that are close to the main road.

Gas

Only 17 of the 72 communities surveyed have gas supply infrastructure in their communities, and ten of those are currently receiving gas (see Table 9-12). About half of the respondents in the area reported that they purchase gas canisters. High cost and lack of availability prevents most others from buying gas canisters.

Villagers who use gas use it almost exclusively for cooking and rarely ever for heating, owing to the high cost. If gas (or electricity) were approximately the same price as wood, however, people would prefer to use gas (or electricity), as collection of fuel wood requires a significant investment of time and labour, in addition to the cost of the wood itself.

(1) In most cases, people tamper with electricity meters owing to lack of affordability.

Village leaders and local authorities cited that gas is the most desirable form of energy if given a choice. However, any form of inexpensive and easily-accessible energy supply is in great demand in most of the communities.

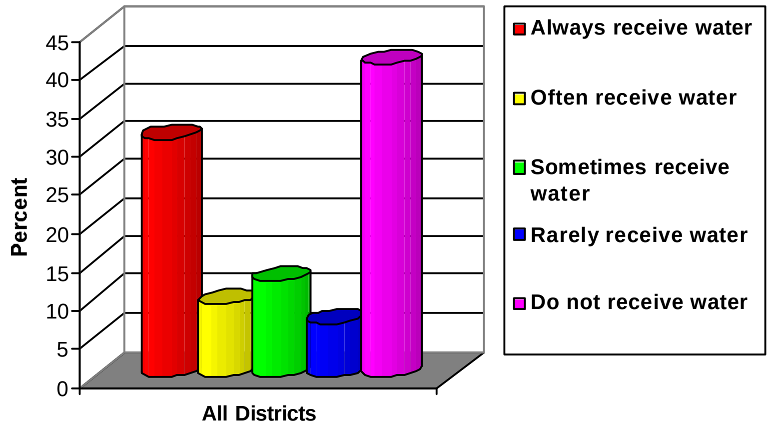
Table 9-12 Surveyed communities with gas infrastructure

Communities with gas infrastructure and supply		
Map Ref	**District**	**Community**
4 8 9	Gardabani	Kapanachi-Lelashka Rustavi Town Akhtagla
14	Marneuli	Jandari (M) Marneuli Town
15 16	Tetritskaro	Akhali Marabda Dzveli Marabda
44	Tsalka	Avranlo
52	Borjomi	Borjomi
Communities with gas infrastructure but no supply		
Map Ref.	**District**	**Community**
3 5 10	Gardabani	Kesalo Gardabani Town Karatagla
24 25 27	Tetritskaro	Samshvilde Tetritskaro Town Ipnara
35 34	Tsalka	Shapar-Haraba Shipiaki

9.6.3.2 Water

Water supplies are problematic for all surveyed districts. Very few people receive enough piped running water for household use and irrigation remains a problem in all communities. With the exception of households in Borjomi, where 72% of interviewees report getting running water regularly in their houses, between 30% and 66% of households in other districts do not receive running water in their homes at all (see Figure 9-11).

Figure 9-11 Piped water supply in the pipeline-affected communities



Note: Analysis based on results of quantitative household interviews. (n=708)

The lack of running water supply has resulted in communities having to find alternative water sources. The majority of households in the districts report getting water for domestic use from rain-fed storage reservoirs, with the exception of Marneuli where the majority of water is bought, and Gardabani, where the majority of water comes from household wells. In almost all cases a village has at least one spring, although in mid-summer these springs occasionally dry up.

Box 11-1 Examples of very poor water supply

In Chivschavi (Map Ref 26), a Svaneti refugee village in Tetritskaro, the inhabitants drink unfiltered river water that is potentially contaminated.

"Water is the most important problem in our village. Most of the other problems are also related to water supply." (Chivtschavi resident, Tetritskaro)

In Khaishi [1], another Svaneti refugee village in Tetritskaro, people report having to get both their drinking water and take their livestock for watering to the Algeti Reservoir which is approximately 4km from the village.

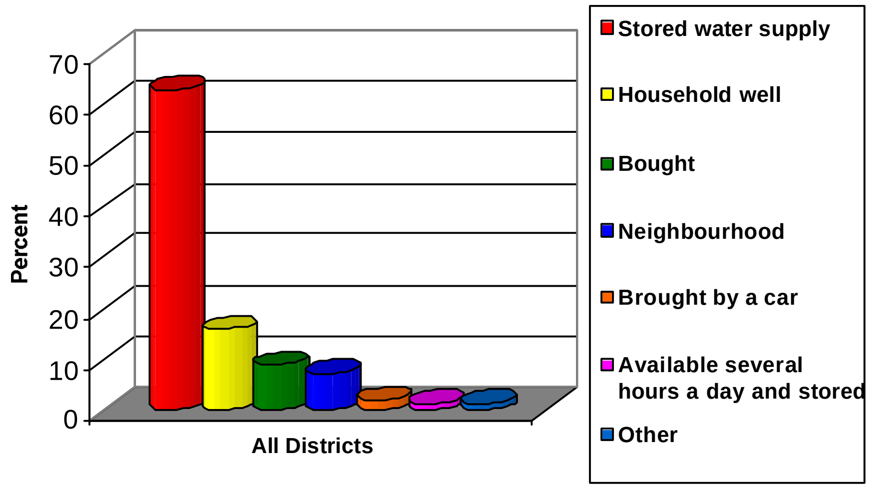
Problems with water supplies are mainly owing to deteriorated pipes or pumps, not lack of water. Tetritskaro, for instance, translates to "white spring" referring to the rich supply of local spring water. There the water crisis is due entirely to technical problems, including power shortages.

Irrigation systems and infrastructure have been consistently deteriorating over the past ten years. Most systems are un-usable with either the infrastructure (canals themselves) or the infrastructure (pumps) in disrepair. Some farmers also note, however, that even if the pumps were functioning, they would not be able to pay the pumping fees. But farmers rely on water for their livelihood, therefore some have come up with other ways to irrigate, such as in Naokhrebi, where some farmers pump water from the Potskhovi River. Given the conditions of the irrigation systems, people in the surveyed communities did not object to the pipeline crossing irrigation channels but noted that the channels that the pipeline crosses should be repaired. See Figure 9-12 for a summary of alternative water sources.

"The land itself is strong in our district and if it is irrigated properly, it would yield good crops every year."(Klde inhabitant, Akhaltsikhe district)

Figure 9-12 Alternative water sources for households in the survey area

(1) Map Reference 18 in Figure 9-2



Note: Analysis based on results of quantitative household interviews. (n=708)

9.6.3.3 Sewage and waste disposal

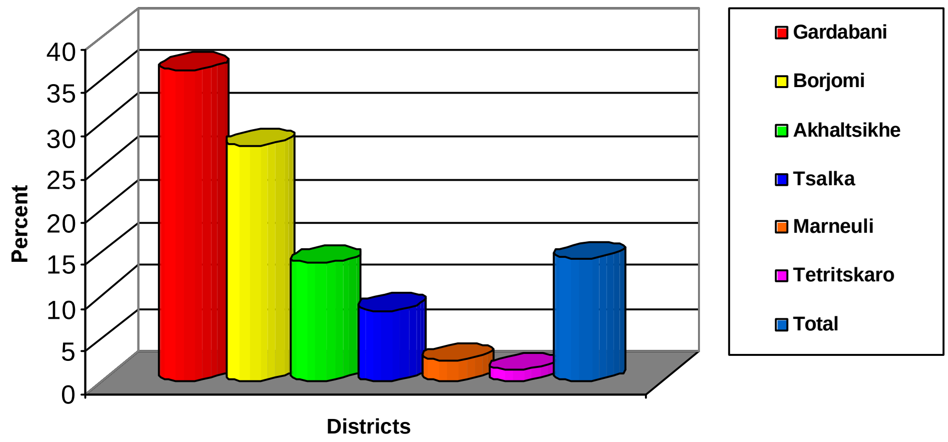
There are almost no refuse or sewer systems in the surveyed communities (see Figure 9-13). There are sewer lines in some communities in Gardabani and Borjomi, but they are sometimes out of operation. Some of the households in larger communities have their own "local" sewage systems.

There is no organized waste collection service in the rural areas, and villagers tend to bury organic waste in the land around the homes, or burn it. In some areas, solid waste is dumped into nearby rivers and streams.

Villagers tend to underestimate the severity of problems of water supply and sanitation as these are regarded as less acute than their immediate financial and energy supply problems.

Figure 9-13 Percentage of households connected to sewer lines 1

(1) The fact that sewer lines exist does not necessarily mean that the sewage infrastructure is functioning.



Note: Analysis based on results of quantitative household interviews. (n=708)

9.6.3.4 Telecommunications

Only 10% of people surveyed have a reliable telephone service in their homes. The remainder have no telephone service at all, have unreliable service in their house, or have service only at communal points. The Marneuli district is unusual in this regard, with half the households having reliable telephone service in their homes.

It is estimated that less than half a percent of the population surveyed use mobile telephones. It is usually only local government officials who have mobile phones. Village inhabitants often ask mobile phone owners to place calls for them.

9.7 DEVELOPMENT NEEDS AND PRIORITIES

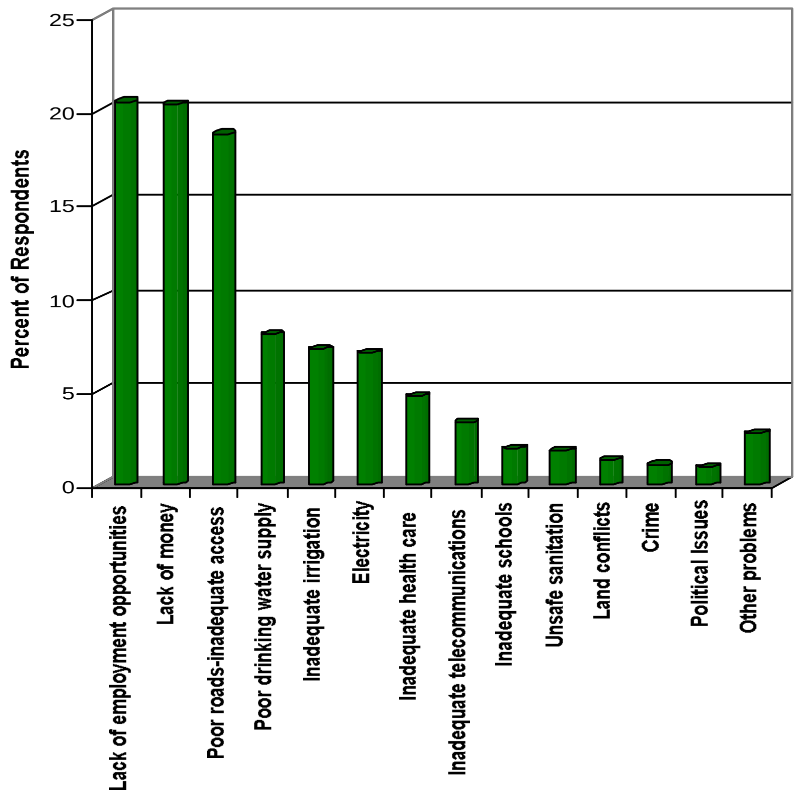
9.7.1 Priority village problems

Lack of employment opportunities, lack of money and the poor condition of roads were reported to be the three most serious problems at the village level. There are differences in village priorities among the districts. These variances in priority reflect differences in geographic conditions and development opportunities:

- Gardabani - more industrialized than the other districts, hence particularly concerned with electricity supply
- Marneuli –a particular problem with poor drinking water supply
- Tetritskaro – lack of employment opportunities, lack of money and poor condition of roads were the three most important problems, reflected in the results of the survey area as a whole
- Tsalka – electricity is a priority concern

- Borjomi - hoping to develop tourism, thus access roads are particularly important. Inadequate telecommunications also poses a big problem
- Akhaltsikhe – communities are heavily dependent on agriculture, thus inadequate irrigation is among the priority problems in that district. Inadequate schools are also a particular concern for respondents.

Figure 9-14 Priority village problems for the surveyed communities

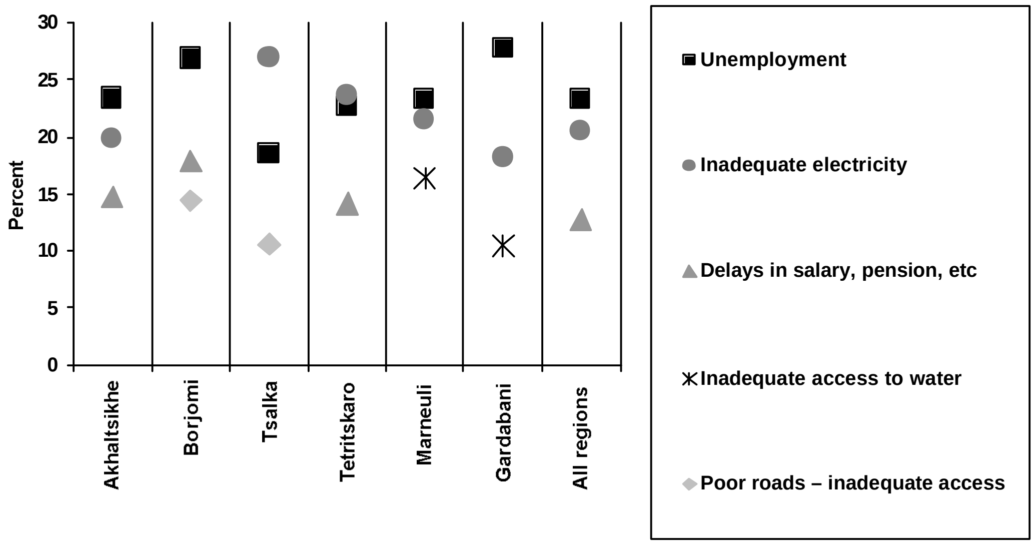


Note: Analysis based on results of quantitative household interviews. (n=708)

9.7.2 Priority household problems

At the household level, unemployment, inadequate electricity and salary delays were noted as the most serious problems, as summarized below. Again, difference across districts can partly be explained by socio-economic conditions. For instance, Tetritskaro has the highest percentage of pensioners, making delays in payment of pensions a particularly difficult problem.

Figure 9-15 Priority household problems in the surveyed communities



The priority problems included in the figure account for up to 60% of total problems cited. The remaining 40% of problems are shared between political instability, inadequate healthcare, poor quality drinking water, ethnic or religious conflict, inadequate heating, inadequate housing, inadequate access to land, insufficient food, etc.

Note: Analysis based on results of quantitative household interviews. (n=708)

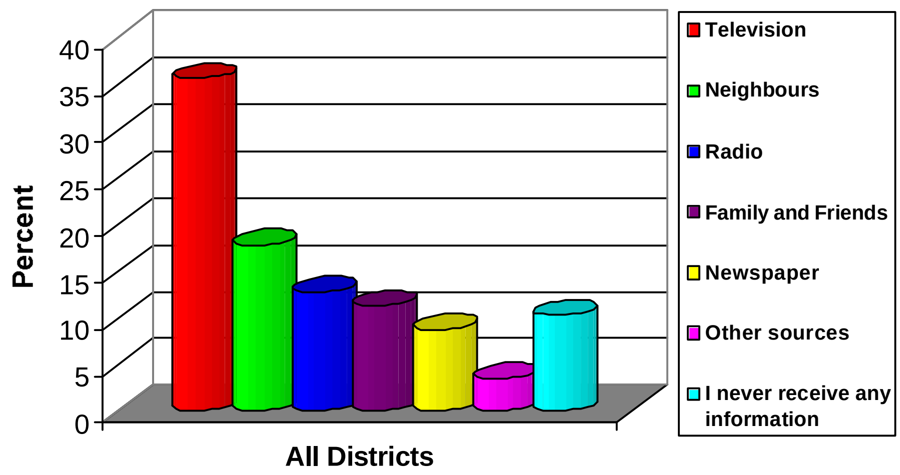
With respect to infrastructure, the surveyed villagers and village government representatives reflected that the main priority is access to energy – particularly gas supplies.

9.8 INFORMATION SOURCES

9.8.1 Media for receiving information

People receive information most frequently from the television (about one third of all respondents). This is also the most trusted source of information, although unreliability of electricity and mountainous terrain, which affects reception, limits its availability. Ethnicity plays a large role in what channels are relied on or watched at all. Many respondents who are not ethnically Georgian do not watch any “Georgian” channels at all. Radio, and family and friends were also frequently cited as a means of receiving information. In fact, the number of respondents using “word of mouth” (which includes family, friends and neighbours) is comparable to that of television – 30% and 33% respectively. Trust in radio and newspaper is significantly lower than trust in television, friends, family or neighbours.

Figure 9-16 Sources of information in surveyed communities



Note: Analysis based on results of quantitative household interviews. (n=708)

The majority of respondents in Tetritskaro, Tsalka, Borjomi, and Akhaltsikhe were dissatisfied with the way they receive information about local and national issues and events. The main reasons were lack of access to their preferred media source (i.e., television) and that information is not understandable.

The preferred method of receiving information on the pipeline in almost all communities was brochures, direct meetings with the population and television [1]. People prefer to have written brochures in both Georgian and Russian, as some of the ethnic minorities do not speak or read Georgian. Newspapers were also cited as a possible source of information, but it was often added that few could afford to buy newspapers. Many people volunteered to help distribute information in their communities.

9.8.2 Information needs regarding the pipeline

Given the limited knowledge about the pipeline, people expressed an interest in knowing:

- Details of the construction including schedule and what to expect in terms of numbers of people involved, machinery, etc
- Details of the possible benefits of the pipeline, including compensation
- The exact pipeline route
- The potential for employment (what kinds of jobs and how many)
- Possible impacts on forests (especially important to mountainous villages who hope for tourism potential) and other ecological features
- Potential damage to grazing land and what mitigation would be offered

(1) This is a hold over from Soviet time, when people were very reliant on television for information and entertainment. Although the lack of electricity supply hinders many people from watching television, anecdotal evidence that people often use alternative sources of energy, such as car batteries, for their televisions

- Long-term land use issues
- Details about worker camps and foreign workers
- Health and safety rules and mechanisms
- Potential for improving local infrastructure

In all cases, people wanted to be informed in advance of activities taking place.

9.8.3 Knowledge of and attitudes toward NGOs

The vast majority of people interviewed were not aware of any NGOs operating in their area. Among those who could name any, CARE and the Red Cross were mentioned most often. CARE is active in the Akhaltsikhe district, and the Red Cross has done drought relief work throughout Georgia during the last few years.

9.9 PROJECT-SPECIFIC ISSUES: ATTITUDES AND EXPECTATIONS

In order to gain knowledge about people's attitudes to the pipelines, a series of interviews were conducted in the communities. The following sections provide an amalgamation of the information from the qualitative in-depth questionnaire, the focused BTC AGI interviews and the interviews concerning attitudes to potential worker camps and pipe yard locations [1]. The villages where the interviews concerning the BTC oil pipeline in particular were conducted, were selected according to variations of settlements in terms of size, ethnicity, and location by district [2].These villages are shown in Table 9-13.

Table 9-13 Settlements surveyed for specific attitudes to the BTC oil pipeline

Map Ref	Settlement	District	Ethnicity of Respondents	Size
7	Akhali-Samgori	Gardabani	Georgian/ Azeri	Medium Village
14	Jandari (M)	Marneuli	Armenian/ Mixed	Medium Village
25	Tetri-Tskaro Town	Tetritskaro	Georgian/ Mixed	Town
38	Kariaki	Tsalka	Greek	Small Village
47	Rekha	Tsalka	Greek/ Georgian	Medium Village
51	Tsikhisjvari	Borjomi	Greek/ Mixed	Medium Village
66	Akhaltsikhe Town	Akhaltsikhe	Georgian/ Mixed	Town

(1) Please note: The Village Leader interviews were considered in this section but not used as a main source of information. This is owing to the prevalence of conflicting attitudes of the villagers as perceived by the Village Leaders, and the actual attitudes of the people

(2) For more detail on selection of communities, refer to Section 7: Methodology

9.9.1 Attitudes to the BTC oil pipeline

In general, the attitude towards the pipeline is overwhelmingly positive, although concerns do exist in the communities. People are generally optimistic that the construction and operation would bring both direct and indirect benefits.

Employment was overwhelmingly the most important benefit perceived from the construction and operation of the BTC pipeline. Compensation for the land used during construction and operation is very important to the respondents, and the improvement and repair of roads was also considered to be significant, particularly during the construction phase. Other perceived benefits were improved access to energy and improved living conditions. Respondents had the impression that the operation of the pipeline would result in the same benefits associated with the construction phase. Concerns were raised in many of the communities, but in the majority of the cases, the perceived benefits outweighed the concerns.

Despite the overall positive attitude, there are some communities that are particularly concerned about the pipeline. (see Table 9-14). Negative attitudes in these communities were experienced during consultation with the communities, and are anecdotal rather than in response to interview questions. They are not necessarily pervasive throughout the entire settlement.

Table 9-14 Communities where negative attitudes to the pipeline exist

Map Ref	Settlement	District	Previous Pipeline Experience	Summary of Attitudes
2	Nazarlo	Gardabani	Negative experience associated with WREP	Some overtly negative attitudes to the pipeline. Anticipate pollution and health problems. Sceptical about receiving employment or community investment
3	Kesalo	Gardabani	Negative experience associated with WREP	Some overtly negative attitudes to the pipeline. Concerns regarding safety and terrorism, and doubt that they will receive compensation
4	Kapanachi-Lelashka	Gardabani	Negative experience associated with WREP	Some overtly negative attitudes to the pipeline. Concerns regarding safety, lack of belief that they will see any benefits from it
5	Gardabani Town	Gardabani	Negative experience associated with WREP	Some overtly negative attitudes to the pipeline. Concerns regarding safety, damage to infrastructure during construction and damage to the environment
45	Kizil-Kilisa	Tsalka	None	Some overtly negative attitudes concerning loss of land and foreign workers, sceptical that they will benefit in terms of compensation or employment
49	Tabatskuri	Borjomi	None	Negativity towards the pipeline, foreign workers, safety concerns
51	Tsikhisjvari	Borjomi	None	Some overtly negative attitudes towards the project relating to the environment and health
72	Naokhrebi	Akhaltsikhe	None	High expectations regarding employment. Some overtly negative attitudes expressed if employment expectations not met

In general, the main concerns cited across the survey area are:

- Land disturbance and its associated environmental damage
- Safety[1]
- The risk of jobs being given to foreigners before locals
- No benefits from construction being provided at village level (such as employment)
- Dust and noise

It is interesting to note that the risk of an oil spill was not cited as an issue of major concern in the surveyed communities.

9.9.2 Attitudes to AGIs for the BTC oil pipeline

AGIs on the BTC oil pipeline include two pump stations, two pigging stations and numerous block/check valves. No consultation to determine attitudes to block/check valves was carried out since these are small installations and are not expected to result in specific impacts (impacts will be the same as those relating to pipeline construction). However, the pump stations and pigging stations might have an impact on the surrounding communities. Residents of communities lying within 5km of these facilities were selected for focused interviews as it is more likely that the AGIs will have an effect on communities in these locations [2] (see Table 9-15 for list of communities).

Table 9-15 Surveyed communities potentially affected by AGIs on the BTC oil pipeline

Map Ref	Settlement	District	AGI
1	Jandari (G)	Gardabani	Pump Station
2	Nazarlo		
3	Kesalo		
5	Gardabani Town		
25	Tetritskaro Town	Tetritskaro	Pump Station
27	Ipnara		
26	Chivschavi		
70	Vale Train Station	Akhaltsikhe	Pigging Station
71	Vale		
72	Naokhrebi		

In general, the "AGI-affected" communities have a positive attitude towards the potential operation and construction of the AGIs. These attitudes are summarized in Table 9-16 and Table 9-17 and described further in Section 9.10.

All respondents stated that they would be willing to work on the pipeline or in the pump stations.

(1) Respondents did not specify what these were, but rather that the construction and operation of the pipeline may be a threat to their safety and security

(2) Communities in the vicinity of the pigging station in Borjomi (map ref 51) have not been consulted, as the presence of this AGI was not established at the time of consultation. It is expected that the attitudes in these communities will not differ extensively from those expressed in other AGI-affected communities

Table 9-16 Attitudes to AGIs during construction

CONSTRUCTION	Gardabani	Tetri-Tskaro	Akhaltsikhe
Perceived Benefits	1. Direct Employment	1. Direct Employment	1. Direct Employment
	2. Indirect Employment	2. Indirect Employment	2. Improved Communication
	3. Improved Communication	3. Improved Communication	3. Indirect Employment
Concerns	1. Damage to Roads	1. Loss of Land	1. Damage to Roads
	2. Loss of Land	2. Garbage & Waste	2. Loss of Land Use
	3. Garbage and Waste	3. Safety	3. Garbage and Waste
	4. Increased Traffic		4. Increased Traffic

Table 9-17 Attitudes to AGIs during operation

OPERATION	Gardabani	Tetritskaro	Akhaltsikhe
Perceived Benefits	1. Employment	1. Employment	1. Employment
	2. Access to Energy	2. Compensation for Land	2. Compensation for Land
	3. Compensation for Land	3. Access to Energy	3. Access to Energy
Concerns	1. Garbage and Waste	1. Loss of land	1. Increased Traffic
	2. Increased Traffic	2. Garbage and Waste	2. Loss of Land Use
	3. Safety	3. Increased Traffic	3. Garbage and Waste
	4. Loss of Job Opportunities	4. Safety [1]	4 Safety and Increased Crime

9.9.3 Attitudes to worker camps and pipe yards

Along the pipeline route, there will be a number of temporary worker camps for people working on the pipeline, and temporary pipe yards where construction materials will be stored. Consultation was done with residents of communities located within 5km of the camps and 2km of the pipe yards in order to share information and understand people's attitudes toward and perceptions of these installations (See Table 9-18 for a list of these proposed locations).

Table 9-18 Potential pipe yard and worker camp locations along the BTC pipeline

Map Ref	Settlement	District	Site
5	Gardabani Town	Gardabani	Pipe Yard (x2)
9 & 10	Gatchiani (=Akhtagla & Karatagla)	Gardabani	Pipe Yard
13	Marneuli Town	Marneuli	Pipe Yard & Worker camp
17	Kotishi	Tetritskaro	Pipe Yard & Worker camp
25	Tetritskaro Town	Tetritskaro	Pipe Yard (x2)

(1) Respondents did not specify what these were, but rather that the construction and operation of the pipeline may be a threat to their safety and security

Map Ref	Settlement	District	Site
37	Tsalka	Tsalka	Pipe Yard (x2) & Worker camp
50	Bakurianis Andeziti	Borjomi	Pipe Yard & Worker camp
51	Tsikhisjvari	Borjomi	Pipe Yard
52	Borjomi	Borjomi	Pipe Yard
59	Atskuri	Akhaltsikhe	Pipe Yard & Worker camp
66	Akhaltsikhe Town & Suburb of Akhaltsikhe	Akhaltsikhe	Pipe Yard & Worker camp
71	Vale & Vale Train Station	Akhaltsikhe	Pipe Yard

In general, most of the respondents were positive about the potential presence of a pipe yard or worker camp near their settlements. However, there were some important concerns that were mentioned by respondents. In particular, the village leader at Patara-Durnuki expressed concern about the worker camp at Kotishi, located between Khaishi and Patara-Durnuki villages. The leader's concern is based on current and past conflicts between these two villages.

The main benefits and concerns are summarized in Table 9-19 and further described in Section 9-10.

Table 9-19 Attitudes to construction and operation of worker camps and pipe yards

Perceived Benefits	Concerns
1. Indirect Employment	1. Increased Traffic & Damage to Roads
2. Direct Employment	2. Impact on Local Electricity Supply
3. Access to Energy	3. Lack of Compensation for Land
4. Improved Roads	4. Sewage and Waste Management
5. Increased Cash in Circulation	5. Depletion of Water Supplies

9.10 SUMMARY OF KEY ISSUES RAISED THROUGHOUT CONSULTATION PROCESS

Consultation along the route, and with communities affected by the AGIs, pipe yards and worker camps as well as the focus groups with regional government representatives highlighted the most important issues. Several of these are issues directly related to the pipeline and facilities during construction and operation. However, others such as employment and access to energy, are not direct impacts of the project activities, but could impact the project if not managed proactively and carefully. The issues are the following:

- Employment
- Land use and tenure
- Energy
- Management of construction and construction workers
- Infrastructure and services

9.10.1 Employment

Owing to the high levels of unemployment and underemployment, expectations regarding potential job creation and employment during construction are very high, particularly in communities where people are reported to be more skilled. Additionally, there is a misconception about the amount of employment that will be available, with expectations about job creation that are much higher than the real situation. In general, respondents do not realise the short-term nature of these jobs, with expectations of being employed for the full construction period rather than for a few months.

9.10.1.1 Positive attitudes and perceptions

The vast majority of respondents hope that some people from their communities will be employed in some way through the pipeline construction process. The majority said that they could provide unskilled labour, while 18% said they could provide skilled labour. In all communities, people also hoped that the population would have employment and income earning opportunities through the provision of goods and services.

9.10.1.2 Negative attitudes and perceptions

All respondents felt strongly that local people should be offered first refusal for jobs for which they were qualified. They understand that some positions require special skills and qualifications that may not be available locally, but for those that are available locally, there was strong sentiment that those positions are offered to locals before outsiders. If outsiders filled all the positions, locals would be highly dissatisfied. In Akhaltsikhe in particular, respondents felt that conflict might ensue as a result of this.

9.10.2 Land use and tenure

9.10.2.1 Positive attitudes and perceptions

Members of regional government expressed the hope that the region would receive compensation for pipeline transit on their administrative land. Compensation was regarded as a contribution to the economy of the regions, as well as all of Georgia.

The majority of respondents in all districts surveyed expected to receive compensation for impacts on property or private land used during pipeline construction.

Inhabitants of mountainous villages often noted that a possible indirect benefit of the pipeline could be increased tourism opportunities in the area. There are hopes that the pipeline will mean increased regional budgets, which could provide funds to establish guesthouses and winter resort services in mountainous areas, as well as hunting camps and mineral water resorts. Areas where respondents perceive that there is potential for tourism included Sakire, Dviri, Tadzrisi and Tsikhisjvari (Borjomi District); Beshtasheni (Tsalka District) and Marabda, Akhalsopeli and Ivanovka (Tetritskaro District).

9.10.2.2 Negative attitudes and perceptions

There was some concern expressed over the loss of the use land during construction and operation of the pipeline and facilities. Respondents also expressed concern over possible damage to local grazing lands, especially in Tsalka, Tetritskaro and Gardabani, where there are a large number of people engaged in herding livestock. In these districts, livestock products are a main source of income, making the quality of grazing land of primary importance.

People in the mountainous villages of Borjomi, and some of those living near other forests, are concerned about the impact that cutting down the trees for pipeline construction could have on local landscapes and forests. Inhabitants of communities in or near forests depend on forest resources for at least part of their livelihood so they are concerned about damage to one of the resources on which they depend[1]. They are also hopeful about developing more local tourism and want to protect the local landscape as a tourist attraction.

Communities with tourism opportunities (as above) reported that damage to local landscapes would be unacceptable.

9.10.3 Energy

9.10.3.1 Positive attitudes and perceptions

The issue of access to energy is extremely important to all those interviewed, both at the community level and the district and regional government level. Almost 100% of the people interviewed expressed hope that access to energy would increase if the pipeline were a success. Anecdotal evidence suggests that respondents associate gas with a source of energy that is inexpensive and easily accessible. However, it would seem that if communities could receive any form of energy that is inexpensive, reliable and easily accessible, the form in which the energy is supplied (ie gas or electricity) would not be an issue.

The district and regional government representatives noted that power shortage is the most important problem facing Georgia today. While electricity shortages affect the population, according to regional government representatives, the lack of gas in particular is a crucial problem for the development of national industry.

Regional government representatives also noted that the energy crisis, together with the lack of finances, is the main reason for widespread unemployment. They also suggested that, given the general level of poverty in the communities, villagers should not be expected to pay for expensive power supplies.

Government representatives and villagers alike are hoping for improvements in the power supply nation-wide, which they hope will result in:

(1) Not all of the activities people undertake in the forest for livelihood are legal. For instance, many people make a living through illegal logging. It is therefore difficult to quantify how many and by how much people are dependent on this for their livelihoods, owing to reluctance to reveal information about involvement in illegal activities

- Improved awareness, by providing power for information sources like television and radio
- Improved irrigation, as the water pumps are run on electricity. There are many communities where the irrigation systems have not been run owing to lack of electricity and have fallen into disrepair [1]
- Providing drinking water in a few communities, and in regional centres, where pumping also depends on electricity supplies
- Improved healthcare facilities, which require reliable energy supplies

It was often mentioned that local forests could be saved if piped gas and/or increased energy were available to the population because it would reduce cutting of fuel wood by the population, providing the cost of gas was similar to that for wood. Respondents felt that this was of particular importance to forests that might have tourist value.

9.10.3.2 Negative attitudes and perceptions

The main concern was that pipeline construction would require so much energy that it would have an extensive impact on the already severely degraded electricity supply and that the communities would be left with even less energy than they have now.

9.10.4 Construction and construction workers

9.10.4.1 Positive attitudes and perceptions

Approximately 75% of people interviewed thought that construction would be good or very good for the local communities because it would bring employment opportunities (76%) and money (20%) into the local economy.

The majority of respondents interviewed felt that the presence of construction workers and worker camps could offer benefits to the local population. All of the benefits were seen as methods for increasing the inflow of cash to the local economy, as there is very little cash in the area currently. It is hoped that this would increase opportunities to trade in local agricultural products and increase sales in local shops. Specifically:

- The increase in job opportunities. Local populations hope to receive income from providing services such as cooking, washing, driving and other unskilled labour to the pipeline workers. However, respondents tended to over-estimate both the number and duration of potential jobs
- The opportunity to house workers or rent apartments to them. This perceived benefit is highly unlikely, as most of the workers will be housed in the worker camps. However, communities hoped that it would be an added benefit during construction, and was considered greatest in communities with particularly high rates of outward-migration such as communities with large Greek populations. There are many empty houses in such

(1) Many respondents also noted that even if there was electricity it would be difficult for some to pay the fee for the power to get the irrigation systems running.

communities, which could be rented by neighbours or relatives of the families that have left
- Increased market opportunities that would come with an influx of workers. They are hopeful that they could sell milk, dairy products, meat, bread and other food items that they currently produce for household use
- Construction work would require improvement to a variety of infrastructure, most notably roads, water resources and telecommunications

9.10.4.2 Negative attitudes and perceptions

Very few people mentioned any kind of negative impacts of the pipeline construction or presence of construction worker in the area. Where concerns were raised they include:

- The environmental impacts of the pipeline. While frequently mentioned, it is notable that almost none of the respondents could expand on what their precise concerns were, perhaps because they do not have previous experience of pipeline construction
- Many of the communities in the surveyed area are small and have experienced little change in population, other than outward-migration of young people, over the last 50 years. The influx of workers from outside the immediate area causes concerns regarding possible increases in crime. While not necessarily linked to construction workers, communities near refugee populations had more concerns about crime. People suggested that public safety services, namely police, be increased to address this issue
- Damage to pasturelands was seen as a significant negative impact, as livestock and livestock products is the only source of income for many households
- Many of those interviewed were concerned about potential dust and noise, though most seemed to feel that immediate impacts of the construction process would be acceptable to them provided that there were tangible benefits as well
- Increased traffic was a major concern, particularly for those communities close to worker camps and pipe yards. This was for various reasons including damage to roads, dust, noise, air pollution and safety
- 20% of respondents were concerned about the safety of the construction process, but the majority of the respondents felt confident that BTC Co would follow safe practices. It was clear that respondents currently have a great deal of trust in BP as the lead owner of BTC Co and as a professional international company, and this trust translates to an overall positive attitude towards the potential pipeline
- A frequently mentioned concern among Armenian villages in Akhaltsikhe district was the possible presence of Turkish construction workers, a concern linked to a history of tension between Armenians and Turks

9.10.5 Impact on local infrastructure and services

The overall reaction to the proposed pipeline and its impact on local infrastructure is mixed, although given the state of disrepair of infrastructure and services, any kind of improvement in local infrastructure would be considered a great benefit to the population. The potential benefits from pipeline transit contributions to district budgets was frequently noted. People feel that increases in local government budgets could be dedicated to improving healthcare, education, road maintenance, and irrigation systems.

9.10.5.1 Positive attitudes and perceptions

- The overall hope/ expectation seems to be that some of the transit tariff and/or compensation will be made to the district or local government budget, and that will then be used for hospitals, schools and other social services. Many respondents hope this could help to improve schools and improve the payment of teacher's salaries. Schoolteachers and directors that were interviewed stated that gas was an important source of heating for the schools (Tsikhisjvari in Borjomi, Vale and Atskuri in Atskuri in Akhaltsikhe and Gardabani)
- According to reports, roads are severely degraded in all districts. Many respondents are convinced that upgrading roads would be necessary in order to carry out construction activities, and that repaired roads could help to overcome transportation problems in the area. This is particularly true of mountainous villages in Borjomi, where they see increased access as very important to potential tourism development
- Villagers tended to comment on the increased importance of telecommunications and to express hope, rightly or wrongly, that overall communications would be improved along with the establishment of the pipeline, AGIs and worker camps
- All districts, with rare exceptions in Tetritskaro, experience drinking and irrigation water shortages that are primarily owing to damaged and/or neglected water pipelines and pumps and seldom to an absence of water in the area. People have hopes that pipeline construction might improve this situation both directly (through the provision of power to water pumps) and indirectly (by improving or enabling the purchase of equipment or repairs)
- Local people also hope that BTC Co will improve local healthcare services and hospitals as necessary infrastructure for the construction phase
- Villagers also hope that fire and police services would be improved out of necessity during the construction phase, and that such improvements will last beyond the construction phase
- Some communities expect repair of particular infrastructure. For instance, villagers from Tsnisi, in Akhaltsikhe, reported that their local bridge required urgent repair work, which they expected would occur with the construction of the potential pipeline

9.10.5.2 Negative attitudes and perceptions

- As stated above, the general poor state of local infrastructure makes it difficult for people to comment on how the pipeline could do any further damage. With regard to roads, however, those living where a road system is available sometimes expressed concern that the transportation of heavy equipment in to the area and/or increased use of the roads could damage them. Such respondents reported that compensation measures would be necessary if local roads were damaged during the construction process
- Sewage and waste disposal was often mentioned as a concern, as respondents felt that the already severe problem would be exacerbated by the presence of construction workers and worker camps in particular
- People were also concerned about increased competition for water. Given the difficulties in obtaining water, people fear that construction operations and worker camps would use too much of the local water resources

POTENTIAL IMPACTS AND MITIGATION

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10 POTENTIAL IMPACTS AND MITIGATION

10.1 INTRODUCTION

This Section describes the environmental impacts that have the potential to result from the construction, operation, and decommissioning of the pipeline and associated facilities. It also discusses the various mitigation measures that have been built into the design or that need to be adopted to minimize the occurrence and/or effects of these potential impacts. Some effects are expected to remain after mitigation measures have been applied, and are considered residual impacts.

These residual impacts are assessed with regard to their significance and scored as described in Section 7 - ESIA Methodology. A summary of the residual impacts and their significance follows in Section 12. A summary of all of the mitigation measures presented here in Section 10 is provided in Section 14 – Management and Monitoring. Section 14 describes the process of effective implementation of the mitigation measures through various management plans and monitoring programmes.

The sections below describe the approach taken for each phase of the project. For example, to locate discussion on noise impacts associated with construction, the reader should refer to Section 10.2.3 or 10.2.4 and then locate the specific geographic area of interest (either by ROW location or off ROW activities). If the reader is interested in air emissions associated with operational activities, they should refer to Section 10.3.3.

As with any project of this kind, there is also the potential for unplanned events. These are described in section 10.5 in terms of the likelihood of the event occurring, and the consequence.

10.1.1 Construction

The Project Description (Section 5) analyses the activities that will take place to construct the pipeline (for example ROW Clearance, Trenching). These activities, or environmental aspects, have been assessed in terms of their associated potential environmental impacts and are described in Section 10.2.1. Each activity has been assigned an identifier code (eg Activity B. - ROW Clearance).

A series of generic mitigation measures have been developed to address these potential environmental impacts, and have been assigned an identifier code (eg Mitigation Measure No. 1). Each activity from Section 10.2.1, with its associated potential environmental impacts, is presented in Section 10.2.2 (Table 10-3) with the corresponding appropriate mitigation measures. An example of an input to this table is shown below to assist with comprehension of the structure and logic presented here.

Project Activities / Environmental Aspects	Environmental Receptor and Potential Impact	Proposed Mitigation Measures
		Mitigation measure no. 1
B. ROW Clearance	Flora Habitat loss	Undertake pre-clearance surveys to identify, transplant or otherwise manage rare and endangered botanical species that are likely

		to be affected by clearance operations

The proposed pipeline route is approximately 248km within Georgia and traverses a variety of significantly different terrain, climatic conditions, habitats and landscape. In view of these factors along the route the approach adopted for the assessment of impacts during construction is based on the identification of *units* along the pipeline ROW that have common characteristics with regard to:

- Project activities/environmental aspects (activities that could result in impacts, eg clearance of the ROW, pipelaying)
- Environmental characteristics (eg slope, vegetation, soil, etc)

Each *unit* has common characteristics with regard to the above criteria, and therefore its geographic extent varies in relation to the uniformity of the above criteria. River crossings are *units* of limited geographic extent in relation to their area of interaction with the pipeline activities, while forest habitats or faunal sanctuaries may have a broader geographic extent.

The next step in the impact assessment applies the generic mitigation measures presented in Table 10-3, to the linear *units* (Section 10.2.3). These units are described by their relative location along the pipeline, for example KP 11-18. Each *unit* has information presented in a tabulated form including: environmental receptors and key issues; project activity; environmental aspect; potential impacts; mitigation measures; residual impacts; residual impact ranking. An example of the input provided in Section 10.2.3 is shown below to assist in with comprehension of the structure and logic presented here.

The generic mitigation measures that apply are listed in the table as shown below. However, it is important to note that it has also been necessary to identify mitigation measures specific to the area or issue being discussed, that are over and above the generic measures applied as a matter of course, in order to reduce the potential environmental impact. These specific mitigation measures are also described in Section 10.2.3 (see column “Mitigation Measures – Generic + Specific” in example table below).

The residual impacts description includes a consequence severity ranking of 1 to 5, and likelihood ranking of 1 to 5, as described in Section 7, ESIA Methodology (Table 7-12). The significance of the residual impact is given in the final column is described by a ranking of Low, Medium or High (determined by using Table 7-12).

Table 10-1 Example of residual impact by unit - KP 0-11

Environ-mental Recep-tors and Key Issues	Project Activity (from Table 10.2)	Environmental Aspect Description	Potential Impacts	Mitigation Measures - Generic + Specific (generic measures from Table 10.3)	Residual Impacts	Residual Impact Ranking
Soil	B. ROW Clearance, ROW Preparation	Land use in the area is predominantly agricultural and construction will require removal and storage of topsoil for up to 2-3 years	The removal and stockpile of topsoil will result in some loss of top soil, reduced fertility of the soil and changes in soil pH, chemistry and structure	The proposed mitigation measures are No. 3, 11, and 12	Conse-quence score of 1 (very low), and is very likely to happen (score 5 for likeli-hood)	1 x 5 = 5 (Low)

Not all aspects of the project will follow the linear distribution of the pipeline ROW. The pipeline construction project will also comprise works that will be outside the limits of a normal pipeline ROW. Typically, this will include modifications to Poti Port, railway infrastructure, access roads, temporary lay-down and storage areas, worker camps, development and re-instatement of borrow pit and spoil disposal sites. Therefore, these are discussed independently in Section 10.2.4.

10.1.2 Operation

The process of assessment of impacts and application of mitigation measures follows the same logic as just described for construction phase. Section 10.3.1 describes the project activities relevant to the operational phase, and Section 10.3.2 the suite of generic mitigation measures. Section 10.3.3 describes the assessment of potential environmental impacts and application of the mitigation measures (from Section 10.3.2). The assessment of operational impacts has been based on the identification of the key facilities and activities that could lead to environmental impacts. The facilities and activities for which the assessment was carried out were as follows:

- Pump stations 1 and 2
- Intermediate Pigging Stations 1 and 2
- Block valves
- Other activities (fuel supplies, pipeline inspection, etc)

10.1.3 Unplanned events

The assessment of unplanned events is based on a quantitative risk assessment that defines the probability of pipeline failure, and the consequence of the failure (Section 10.4.1). The main focus of the assessment is upon the risk to people, and how the pipeline has been designed to meet best practice international standards and acceptable risk levels.

The second part of the assessment consists of the analysis of the environmental consequences of spills of various magnitude at the locations identified through the risk assessment (Section 10.4.2). This consequence analysis was carried out with the aid of three modelling tools:

- Overland flow model: to simulate the path and volume loss of oil when spilled over land
- Surface water model: to simulate the behaviour of the oil in rivers and streams
- Groundwater model: to estimate the migration times from the spill site of any oil that would come into contact with groundwater

10.2 CONSTRUCTION

10.2.1 Identification of project activities

The Project Description (Section 5) analyses the activities (or environmental aspects) that will take place in order to construct the pipeline and facilities. These relevant activities are discussed below including their associated potential environmental impacts. The potential impacts described would only occur should no mitigation measures be implemented or applied; this will obviously not be the case but the detail is presented below as context for the overall environmental assessment.

Table 10-2 List of activities and associated potential impacts

Description of Project Activity/Environmental Aspect	Environmental Receptor/Potential Environmental Impact
A. Haulage: This includes the transportation of materials and equipment by road and rail from the port and supply base to the pipe storage yards and from these to the ROW itself. Haulage also includes the transportation of crews, equipment and fuel from the worker camps or yards to the workstations along the ROW. Transportation of granular material from a borrow pit to the ROW, and of spoil from the ROW to the borrow pits or soil disposal sites is also included	• GHG emissions associated with the combustion of fuel • dust emissions from trucks and their load, and when haulage takes place on unpaved roads, tracks and on the ROW itself • noise and vibrations when heavy equipment transits in the proximity of human receptors • wear of the road networks • rehabilitation of railway network (positive impact) • generation of solid and liquid waste (lead acid batteries, tyres, waste oil, filters, parts, etc) • potential for spill of fuel or waste

Description of Project Activity/Environmental Aspect	Environmental Receptor/Potential Environmental Impact
B: Roads Construction: These will include existing public highways to be maintained, existing tracks to be upgraded and new tracks to be constructed and retained on completion	• short-term visual impact • facilitated access to environmentally sensitive areas and potential disturbance to forests (illegal logging) or wildlife (poaching) • increased demand of aggregate for road construction and repairs
C: ROW Clearance: This includes the removal of man-made structures, obstructions, trees or other tall plants from the ROW to ensure that the ROW can be accessed by earth moving equipment. Clearance of forest areas will be carried out with traditional logging techniques. Clearance of large boulders or other large and heavy structures (concrete, etc) will be carried out with the aid of large earthmoving equipment or through blasting the large boulders with explosives	• removal of trees (if clearance occurs in forest areas) • permanent landscape modification when clearing through primary forests • loss of habitat and/or habitat fragmentation • disturbance to wildlife through noise and vibration • visual impact • destabilization of topsoil where trees and large shrubs have been removed
D. ROW Preparation: This activity consists of ROW preparation to create a level surface on which to safely run vehicles and construction equipment. ROW preparation involves the removal of topsoil and of surplus subsoil, grading the ROW surface with bulldozers or graders and placement of hardcore (crushed rock or angular gravel). Land and surface water drainage structures will be installed as required	• disturbance of floral communities • disturbance of archaeological sites and monuments • removal and storage of topsoil and associated deterioration • disturbance to wildlife through noise and vibration • short-term visual intrusion • introduction of invasive or non-native species by introduced borrow material with seeds, or attached to vehicles • permanent landscape modification (when grading on ridges and on side slopes) • mobilization of fine sediment off the ROW; • triggering of soil erosion processes
E. Trenching: This activity consists of the excavation of the pipe trench along the ROW. This operation is carried out with the aid of a mechanical excavator wherever possible and with specialist rock trenching techniques where hard rock is encountered: blasting or mechanical rock crushing. In general terms the main impact associated with trenching is the generation of large quantities of spoil. Other impacts depend on the type of trenching technique adopted for each section of the ROW and the location of the trenching operations. Trenching in river beds or alluvial plains has, for instance, the potential for deteriorating surface water quality. For rock trenching the options being considered include: E1 Blasting	_General_ • disturbance of archaeological sites • dust emissions • disturbance of surface water at river crossings • disturbance of shallow groundwater • disturbance to burrowing fauna _E1: Blasting_ • localized disturbance to terrestrial wildlife through ground vibrations • localized disturbance of human or wildlife receptors through noise emissions _E2: Mechanical trenching_ • disturbance of terrestrial and avian fauna and human receptors through noise emissions • disturbance to terrestrial wildlife through ground vibrations • increased air emissions

Description of Project Activity/Environmental Aspect	Environmental Receptor/Potential Environmental Impact
E2 Mechanical trenching	
F. Pipe laying: This activity consists of all operations required to align the pipe, bend it to suit the topography, weld the joints, inspect the welds and lower the pipe in the trench. These activities are carried out by heavy mechanical equipment and by specialist work crews	• short-term visual intrusion • localized noise emissions • solid and liquid waste generation • risk of fuel spill
G. Backfilling: This operation consists of backfilling the trench with suitable granular material and of compacting the backfilled trench in layers. The operation is generally carried out by specialist man-operated equipment which compacts the line	• import of graded granular material from borrow pits/quarries (this impact is reduced if crushed rock or excavated trench material is used for backfilling which is the base case) • air emissions associated with haulage of fill/spoil and/or operation of crushing plant • dust emissions associated with haulage of fill/spoil and earth moving • localized noise emissions • solid and liquid waste generation
H. Temporary reinstatement: This operation will be carried out if the ROW cannot be fully reinstated within 12 months of completion of the construction activities and will be implemented to prevent erosion of the ROW until final reinstatement can be carried out. Temporary reinstatement activities will include the installation of erosion control and drainage tools (including jute matting, sediment traps, and diverter berms)	• medium-term visual intrusion (until final reinstatement is carried out) • loss of biodiversity owing to degradation of the stored topsoil • loss of fertility and productivity of the soil • solid waste generation (the materials used for temporary reinstatement that would have to be removed when final reinstatement takes place)
I. Final reinstatement: Final reinstatement consists of: • stabilization of slopes in all potential erosion areas • removal of the construction road • restoration of the topsoil layer • fertilizing, seeding, planting and watering The function of the reinstatement operation is to stabilize the soil to prevent erosion and to harmonise the appearance of the ROW. Effective reinstatement can take considerable time depending on many factors such as climate, soil type, vegetation, slope, etc	• permanent modification of the landscape on side slopes, steep slopes with drainage features, and other conspicuous earth or artificial structures and the reinstatement of narrow ridges • drainage structures associated with the reinstatement of steep slopes could also have adverse impacts on the hydrological regime of local surface water courses as the natural discharge rate of the receiving streams would be altered
L. Fuelling: Fuelling of construction vehicles will take place throughout the ROW and will be carried out with the aid of road tankers, themselves supplied with fuel at the construction yards or worker camps	• accidental spillage of fuel and the potential consequences of this to environmental receptors such as water courses, wetlands, groundwater and soil

Description of Project Activity/Environmental Aspect	Environmental Receptor/Potential Environmental Impact
M. Hydrotesting: This is a test activity which ensures the structural integrity of the pipeline and as such provides a quality check to ensure environmental impact from leak or spillage is eliminated. This activity will require large quantities of water to be abstracted from a surface watercourse and the discharge of the same water after completion of the test. Depending on the quality of the water, its corrosive potential and the potential for fouling the hydrotest water may be treated with chemicals to prevent damage to the pipeline	• disturbance of water balance of small surface water-courses used for abstraction or discharge • contamination of water-courses where hydrotest water is discharged if chemicals are used to treat the water
N. Horizontal Directional Drilling: This activity is associated with the construction of large river crossings and in Georgia is expected to be used at the easternmost crossing of the Mtkvari River. Drilling operations require a relatively large area to set up the equipment and to store the drilling fluids required to facilitate the drilling process	• land-take and consequent loss of habitat if the equipment set up area is in a sensitive location • contamination of surface water if drilling fluids are lost or discharged to surface water courses • localized noise emissions • short-term visual intrusion
O. Horizontal boring: A similar activity to HDD but on a much smaller scale, that is used to construct crossings of roads, railways and smaller rivers. The technique require larger land-take than conventional ROW construction and involves the use of mobile boring equipment, and drilling fluids	• as above but on a much smaller scale
P. AGI and facilities construction: This includes all activities associated with the construction of pump stations, pigging stations, block valves or any other permanent AGI	• temporary habitat loss or disturbance in lay down areas • permanent habitat loss and visual intrusion at AGI sites • noise emissions for a prolonged time at a single location and associated disturbance to wildlife or human receptors • visual intrusion • waste generation • discharge of sanitary effluent and rainwater run-off to water courses
Q. Waste generation: Most activities listed above will generate solid or liquid waste. These wastes will require storage prior to transportation to their final disposal location	• contamination of soil, surface water or groundwater owing to inadequate storage or inappropriate disposal (burning)

10.2.2 General mitigation measures

A general list of mitigation measures have been prepared to summarize the actions that are required to minimise the potential impact of the activities listed above. These mitigation measures are listed in Table 10-3 below.

Table 10-3 Mitigation measures

Project Activities / Environmental Aspects (from Table 10.1)	Environmental Receptor and Potential Impact (from Table 10.1)	Proposed Mitigation Measures
		Mitigation measure no. 1
C. ROW Clearance	Ecology, fauna, flora Habitat loss	Undertake pre-clearance surveys to identify, transplant or otherwise manage rare and endangered botanical species and fauna that are likely to be affected by the clearance operations. Individual trees and shrubs of high conservation value will be marked and preserved wherever possible or transplanted if the root conditions are suitable for such an operation. Cutting down of beech (*Fagus orientalis*) and high-mountain oak (*Quercus macranthera*) are to be avoided where possible as both trees are of high floral interest. Solitary individuals of rowan (*Sorbus caucasigena*), high-mountain maple (*Acer trautvetteri*) and birch (*Betula litwinowii*) are to be marked to avoid damage to them as they are important components of crook-stem forest communities in the Tskratskaro-Kodiana area. Specimens of Georgian endemic herbaceous pasqueflower (*Pulsatilla georgica*) occupying limited areas in Tetritskaro district and those of gentian (*Gentiana angulosa*) growing in Tskratskaro-Kodiana area should be relocated to Bakuriani Alpine Botanical Garden where environmental conditions are suitable for successful adaptation of translocated plants. Individuals of GRDB species globe-daisy (*Globularia trichosantha*) found in Vale area are to be dug out manually and replanted at Tbilisi Botanical Garden. Once the pipeline construction works are completed all translocated plants will be reintroduced in the wild. The conservation of the other plant species –squill (*Scilla rosenii*) and snowdrop (*Galanthus caucasicus*) whose relocation may not be practical will be managed through collection of bulbs and conservation ex-situ in Bakuriani Alpine Botanical Garden although attempts will also be made to re-introduce these species in the wild.
		Mitigation measure no. 2
C. ROW Clearance	Flora, ecology landscape and visual intrusion Loss of standing timber in forests	The trees along forested areas of the ROW will be felled as part of the clearance operation and sold as valuable timber, where possible. Small branches are to be provided to local communities for firewood. A suitable number of trees will be replanted for every tree felled as part of the ROW (or AGI locations) clearance operations. To ensure the restoration of ecological balance, compensation planting at a ratio of 1.5:1 will be carried out (ie 150 trees will be replanted for each 100 trees felled). For compensation planting use should be made of trees

Project Activities / Environmental Aspects (from Table 10.1)	Environmental Receptor and Potential Impact (from Table 10.1)	Proposed Mitigation Measures
		that are existing components of the local flora and specifically: Tetritskaro area Georgian oak (*Quercus iberica*), high-mountain oak (*Quercus machrantera*), hornbeam (*Carpinus caucasica*), oriental hornbeam (*Carpinus orientalis*), pear (*Pyrus caucasica*), willow (*Salix alba*), beech (*Fagus orientalis*), field maple (*Acer campestre*) ash (*Fraxinus excelsior*). Tsalka area pine (*Pinus sylvestris*) Tskhratskaro-Sakire area pine (*Pinus sylvestris*), spruce (Picea orientalis), spruce (*Abies nordmanniana*), birch (*Betula litwinowii*), rowan (*Sorbus caucasigena*), high-mountain oak (*Quercus iberica*), hornbeam (*Carpinus caucasica*), pear (*Pyrus caucasica*), willow (*Salix alba*), beech (*Fagus orientalis*), high-mountain maple (*Acer trautvetteri*), ash (*Fraxinus excelsior*). Mtkvari and Potskhovi crossings species of willow (*Salix alba, S. triandra*), poplar (*Populus nigra*), alder (*Alnus barbata*).
		Mitigation measure no. 3
B. ROW Clearance	Ecology, flora, soil erosion, landscape and visual intrusion Habitat loss	Reinstate the ROW with suitable floral species to reflect endemic characteristics and overall habitat characteristics. Apply site-specific reinstatement provisions depending on the sensitivity of the area to soil erosion. A summary of the reinstatement strategy is enclosed in Appendix A.
		Mitigation measure no. 4
C. ROW Clearance and D. ROW Preparation	Flora, ecology Loss of species of high conservation value	Undertake conservation projects to preserve specimen and stimulate conservation of rare and endangered species disturbed as part of the ROW clearance process.
		Mitigation measure no. 5
A. Haulage; B. Roads Construction	Flora, ecology Habitat loss	Reinstate any temporary access roads or temporary facilities to pre-existing conditions in ecologically sensitive areas. In non-ecologically sensitive areas, roads may be left for community use as agreed as part of the community investment/community relations strategy.
		Mitigation measure no. 6
A. Haulage, B. Roads Construction C. ROW	Fauna, ecology Disturbance to rare or	Undertake pre-clearance bear survey to evaluate whether construction during the winter and early spring times could have detrimental effects on the bears populations. Take adequate action if survey results indicate abundance of

Project Activities / Environmental Aspects (from Table 10.1)	Environmental Receptor and Potential Impact (from Table 10.1)	Proposed Mitigation Measures
Clearance and D. ROW Preparation, E1. Blasting and E2. Mechanical Trenching, G. Backfilling, H. Temporary Reinstatement and I. Final Reinstatement	endangered species	bears in the ROW proximity. Install soft plugs in trench to allow trench crossing by wildlife. Restrict ROW in some forest areas to reduce clearings between continuous segments.
		Mitigation measure no. 7
C. ROW Clearance and D. ROW Preparation	Fauna, ecology Habitat fragmentation as a result of ROW establishment through forest areas Disturbance to wildlife sanctuaries	Promote and undertake wildlife monitoring programme in forest areas and wetlands to promote the conservation of endangered species. The target species for this programme will include: • Migrating birds at river crossings and in wetland areas • Brown bears and other large mammals if pre-clearance survey shows evidence of the animals presence in the proximity of the ROW.
		Mitigation measure no. 8
D. ROW Preparation, E. Trenching, Drilling	Fauna, ecology, water resources (groundwater) Disturbance to watercourses and wetlands	Avoid wetlands though minor re-routes Undertake river crossings so that minimal disturbance to fish is incurred. The measures to be adopted include: • Construction will take place preferably during low flow periods, most likely during the summer season • Continuity of water flow to be ensured through diversion of main river channel away from construction area • Sediment control measures to be enforced. These will include straw bales, silt fences and settlement lagoons depending on river characteristics and seasonal conditions • Prohibition of fuelling and other potentially contaminating operations within floodplain.
		Mitigation measure no. 9
P. Construction of AGIs, M. Hydrotesting	Water resources ecology, fauna Discharges of sewage, oily water and chemicals to water courses	Ensure that discharge of sewage from the temporary construction facilities (camps, pipe yards, supply base in Poti) and hydrotest water to surface courses does not impact surface water ecology. This will be achieved through the provision of treatment facilities and by enforcing the discharge standards.

Project Activities / Environmental Aspects (from Table 10.1)	Environmental Receptor and Potential Impact (from Table 10.1)	Proposed Mitigation Measures
		Mitigation measure no. 10
M. Hydrotesting	Water resources, fauna, flora Disturbance of water balance on small lakes and surface water courses	Ensure that abstractions and discharges of hydrotest water are licensed and do not impact hydrological balance of local surface water features. This will be achieved through the selection of the abstraction locations on the basis of the hydrological and ecological characteristics of the water body and by complying with all the criteria required to obtain an abstraction permit.
		Mitigation measure no. 11
C. ROW Clearance and D. ROW Preparation	Soil erosion, water resources Erosion of ROW during winter season and after construction	Implement reinstatement plan after each construction season. A temporary reinstatement plan will be developed for sections of the ROW that are likely to undergo severe erosion during the winter season if no temporary measures are adopted. A permanent reinstatement plan will be adopted to the entire ROW based on the site-specific soil conditions and topography. The summary Reinstatement Plan is enclosed as Appendix A.
		Mitigation measure no. 12
C. ROW Clearance and D. ROW Preparation, H. Temporary Reinstatement	Soil Loss of topsoil and deterioration of physical structure, loss of fertility and productivity	Stabilize topsoil stockpiles along the ROW.
		Mitigation measure no. 13
L. Fuelling, Q. Waste Generation	Water resources, contamination of land Spillage of fuel or other liquid contaminants	Adopt strict fuelling and spill control procedures in areas where sensitive groundwater resources occur. The construction contractor is to prepare a spill response plan for the pipeline construction phase.
		Mitigation measure no. 14
E. Trenching	Water resources, Contamination of shallow groundwater, localised disturbance of shallow groundwater wells	Ensure adequate management of groundwater occurring in the pipeline trench. Depending on the permeability of the soils, the depth of groundwater and the site-specific construction requirements, the contractor may have to de-water the trench thus potentially causing localized short term changes of the hydrogeological regime. To minimize adverse impacts from these operations the contractor will be required to discharge any abstracted groundwater to the ground or in sections of the trench where work is not being carried out. This will ensure negligible or reduced losses of groundwater from the local hydrogeological system.

Project Activities / Environmental Aspects (from Table 10.1)	Environmental Receptor and Potential Impact (from Table 10.1)	Proposed Mitigation Measures
		Mitigation measure no. 15
C. ROW Clearance and P. AGIs Construction	Landscape and visual Intrusion Visual intrusion along ROW. Longer term landscape impact at AGIs and in areas of high landscape value	Implement landscaping plan for all AGIs (see site specific mitigations) and for all areas where high landscape value and visual vulnerability to the proposed ROW clearance warrants site-specific landscape restoration measures. The Landscape Plan is attached as Appendix E, Annex 1.
		Mitigation measure no. 16
D. ROW Preparation and E. Trenching	Archaeology and cultural heritage Disturbance of known monuments and management of archaeological chance finds	Implement Cultural Heritage Management Plan (Appendix E, Annex III) for priority sites identified as part of baseline study, as well as construction phase finds. Additional archaeological resources are likely to be identified during the early phases of construction. These would include previously known sites that prove to be more extensive than was previously known and site that have not been identified in any way previously. It is likely that these additional resources would include pre-Bronze Age sites, whose structural remains would be more limited because they predate the introduction of cyclopean stone construction. These pre-Bronze Age sites, although physically less substantial, could well be significant, therefore also meriting protection. Such chance finds would be recorded and verified by archaeologists who will be employed to keep a watching brief on the construction process. Site evaluation and potential mitigation of impacts to such sites would, if possible be addressed between the time of discovery and the start of grading and pipe-trench excavation in the site area. In cases where time limitations prevent this, BP has planned for construction "work arounds" to allow additional archaeological mitigation by data recovery as necessary. These late discovery protocols will be in place prior to the start of construction as part of the projects management plans.
		Mitigation measure no. 17
A. Haulage, D. ROW Preparation, E. Trenching G. Backfilling	Air quality Emissions to atmosphere	All new vehicles will comply with all relevant EU directives for emission standards. A regular maintenance programmes for all mobile and stationary plant will be undertaken to minimise potentially polluting exhaust emissions. Vehicle re-fuelling will be undertaken to prevent fugitive emission of VOCs.

Project Activities / Environmental Aspects (from Table 10.1)	Environmental Receptor and Potential Impact (from Table 10.1)	Proposed Mitigation Measures
		Mitigation measure no. 18
A. Haulage, B. Roads Construction D. ROW Preparation, E. Trenching, G. Backfilling	Air quality Emission of dust	When working in dry soils or where construction activities generate airborne dusts, dust suppression techniques will be undertaken where human, plant or animal receptors lie within 300m of the ROW.
		Mitigation measure no. 19
A. Haulage, D. ROW Preparation, E. Trenching, G. Backfilling, N. and O. Drilling, P. AGIs construction	Noise and vibrations Noise generation resulting in disturbance to human and wildlife receptors	Limit the working hours of noisy activities when near the identified sensitive receptors to normal daytime working hours. Select the most appropriate equipment for the task considering the lowest sound power level and maintaining such equipment so that it does not create unnecessary noise owing to mechanical faults. Operate such equipment in a manner sympathetic to the ambient noise environment. Do not leave equipment idling unnecessary; do not rev engines unnecessarily. Eliminate tonal, impulsive or low frequency noise through noise control engineering techniques where practicable (fitting of mufflers, damping, etc), and substitute for a different method if necessary (eg instead of hammering actions use hydraulics). Provide adequate warnings of impeding works to all potential receptors within a 1km corridor surrounding the ROW via public notices and local news.
		Mitigation measure no. 20
A. Haulage; L. Pipe Laying	Traffic and transportation infrastructure Traffic generation	Development and implementation of transport management plan with the objective of maximising safety and minimize disturbance to existing road network.
		Mitigation measure no. 21
A. Haulage; L. Pipe Laying	Traffic and transportation infrastructure Traffic generation	Repair access roads prior to commencement of construction.

Project Activities / Environmental Aspects (from Table 10.1)	Environmental Receptor and Potential Impact (from Table 10.1)	Proposed Mitigation Measures
		Mitigation measure no. 22
Q. Waste Generation	Waste management Waste generation storage and transport	Implement Waste Management Plan (procedures for the classification storage and disposal of all construction wastes; training of employees who handle hazardous materials). The contractor will select a suitable location for the construction and operation of a hazardous waste disposal site. The list of sites screened by BTC Co are contained in Section 8 – Environmental Baseline.

10.2.3 Geographic evaluation of impacts and mitigations

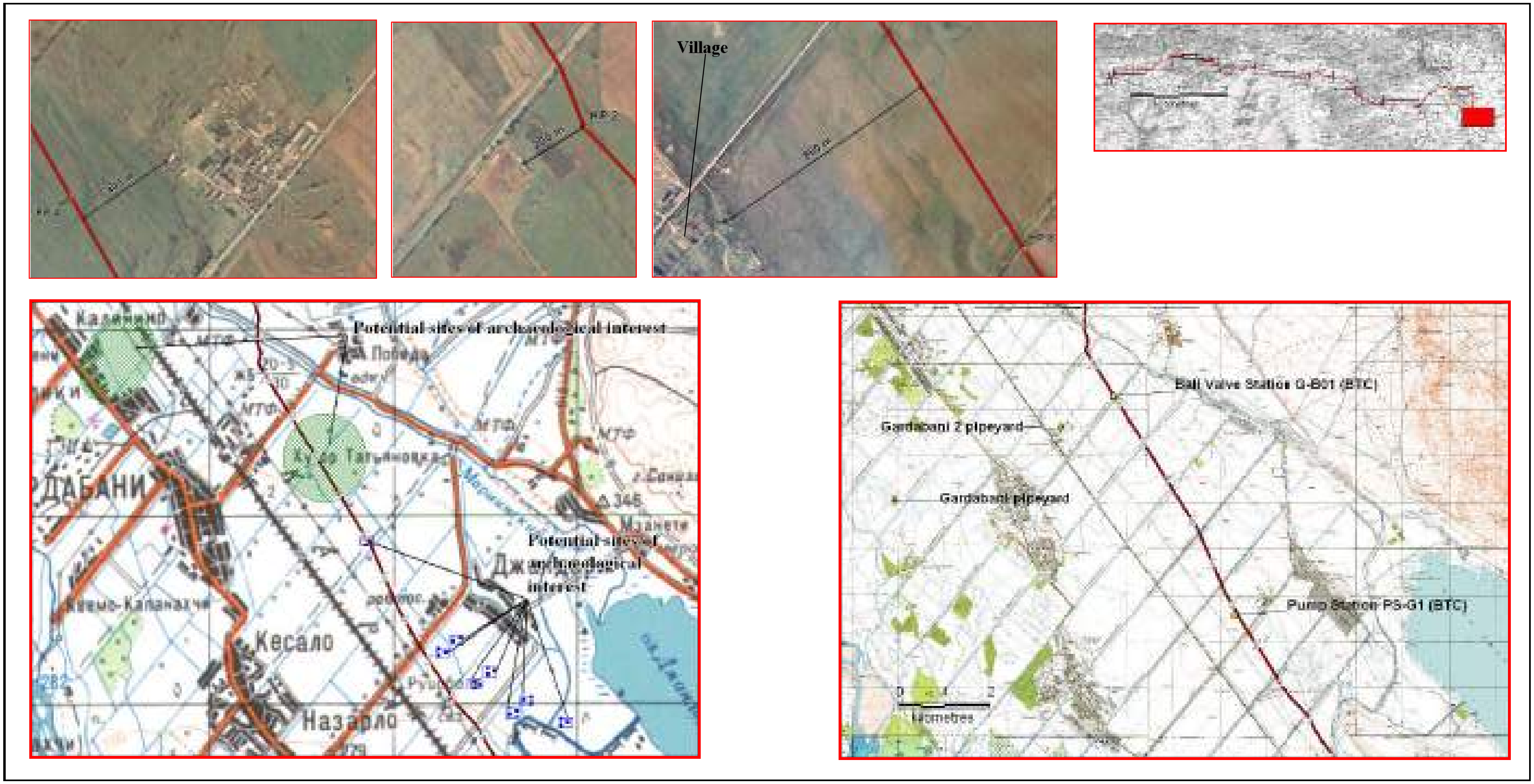
This Section analyses the potential impacts and mitigations identified previously, and applies them to the 34 linear *units* of the pipeline route. The route has been divided in 34 linear *units* based on the criteria cited in Section 10.1.1. The *units* are summarized below:

Location (KPs)	Location name	Location (KPs)	Location name
KP 0-11:	Marinovski irrigation system	KP 157-160:	Narianis Veli
KP11-18:	Samgori	KP 160-165:	Lake Tabatskuri
KP18-28.7:	Samgori upland	KP 165-172:	Ktsia ridge West
KP28.7-29.4:	Mtkvari crossing – East	KP 172-175.5:	Ktsia upper reaches
KP 29.4-53.2:	Kumisi plain	KP 175.5-180.6:	Tkhratskaro pass
KP 53.2-53.8:	Algeti river crossing	KP 180.6-183.3:	Tsikhisjvari forest
KP 53.8-72.8:	Marneuli West	KP 183.3-185.2:	Tsikhisjvari outskirts
KP 72.8:	Geti river crossing	KP 185.2-197:	Kodiana
KP 72.8-84:	Tetritskaro South	KP 197-204:	Sakire outskirts
KP 84-92:	Tetritskaro forest	KP 204-221:	Tiseli-Mtkvari
KP 92-108:	Bedeni plateaux	KP 221-222.5:	Mtkvari crossing West
KP 108-120:	Beshtasheni outskirts	KP 222.5-238:	Akhaltsikhe
KP 120-126:	Tsalka ridge	KP 238-238.5:	Potskhovi crossing North
KP 126-129:	Santa	KP 238.5-243:	Vale uplands
KP 129-139.5:	Tsalka-Kizil Kilisa	KP 243-243.8:	Potskhovi crossing South
KP139.5-151:	Ktsia ridge East	KPs 243.8-247.79:	Turkish Border uplands
KP 151-157:	Mt Tavkvetili		

Within each *unit*, the following issues are identified:

- Project activities that would take place at the specific location
- The environmental receptors affected by such activities
- Potential impacts to the receptors
- Mitigation measures – both generic and specific
- Residual impacts and significance of impacts

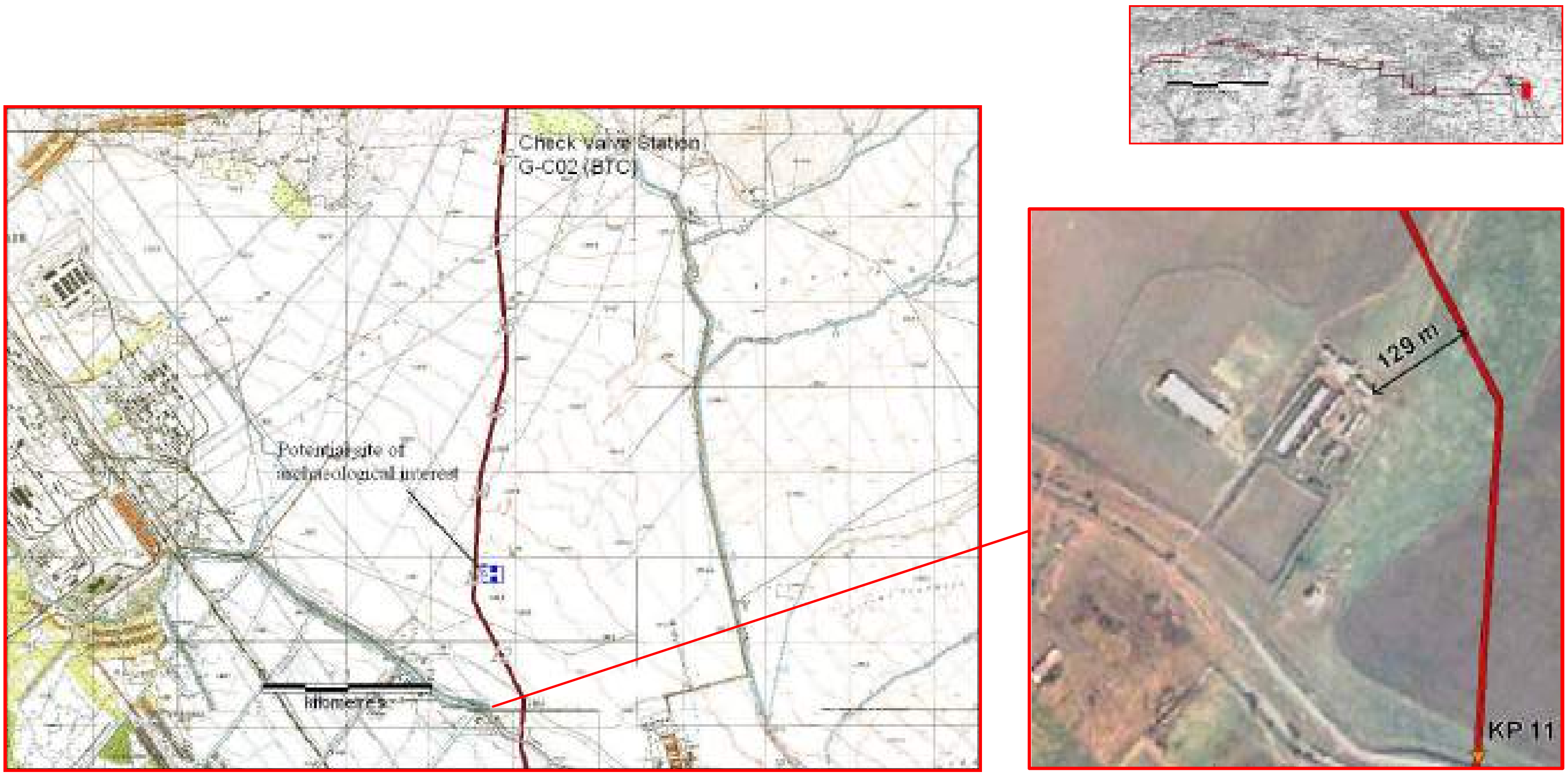
KPs 0-11: Marinovsky irrigation system



Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 10.2.2	Residual Impacts	Ranking of residual impact
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O horizontal boring, P AGI and Facilities Construction, Q Waste Generation	The proposed pipeline crosses a system of irrigation canals known as the Marinovski irrigation system. The irrigation system is fed by the Mtkvari River and exchanges water with Jandara lake. The area is also characterised by a shallow groundwater aquifer overlaying a series of pressurised aquifers at various depths. Construction and operation could result in contamination of surface and ground water. In particular: • Clearance, ROW preparation and trenching activities have the potential of generating runoff of soil • Construction sites will generate sanitary effluent. • Leakage of contaminating fluids such as waste oil, fuel, drilling fluids could cause contamination of groundwater	a) All activities listed have the potential to deteriorate surface water quality of the system of small canals (KP1 to 11), of the ephemeral watercourses and of the Jandara Lake. Deterioration of water quality would be the direct result of the release of suspended solids to the canals (during crossing construction) or to the other water bodies b) Discharges of sanitary wastewater from PS-G1 and BV-GB01 construction site and from the proposed pipe storage yards could also potentially affect local surface water quality c) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measure is 9. For impact "c" the proposed mitigation measures are 13 and 22	No	
Ecology (Flora, Fauna, biodiversity)	C Row Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, M Hydrotesting	The only sensitive receptor in this area is Jandara Lake because of its freshwater ecosystem and its abundance of avian fauna. The listed activities could cause direct or indirect disturbance of the habitats through, noise, dust emissions or deterioration of water quality (see previous point)	a) Clearance of the ROW and the canal crossings may result in adverse impacts on the riparian and aquatic fauna and flora of the Jandara Lake b) Should hydrotest water be discharged to local surface water bodies there could be potential impacts to the freshwater ecosystem of Jandara Lake	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measure is to avoid direct or indirect discharge to Jandara Lake	Any residual impacts on Lake Jandari should have a consequence score 1, very low and a likelihood ranking score of 3 and will largely be not discernable	a) 1 x 3 =3 (Low) b) 1 x 3=3 (Low)
Noise and vibration	E Trenching, O horizontal boring, P AGI and Facilities Construction	Human noise receptors are located at: KP 2, Farm (200 m); KP 4, Factory or military installation (410 m); KP 8.7, Village (880 m). No sensitive ecological receptors	Noise impact will occur during pipeline construction at the nearest receptor (Farm 200 m off the ROW	The proposed mitigation measure is 19	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied	3 x 5 = 15 (Medium)
Air Quality	A Haulage, C ROW Clearance, D ROW Preparation, E Trenching, G Backfilling,P AGI and Facilities Construction	Air quality receptors located at: KP 2, Farm (200 m)	Impacts associated with air quality relate to dust impacts on human receptors arising from construction activities	The proposed mitigation measures are 17 and 18	No	
Soil	C ROW Clearance, D ROW Preparation, P AGI and Facilities Construction	Land use in the area is predominantly agricultural and construction will require	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility	The proposed mitigation measures are 3, 11 and 12	The residual impact will largely not be	1 x 5 = 5 (Low)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 10.2.2	Residual Impacts	Ranking of residual impact
		removal and storage of topsoil for up to 2-3 years	of the soil and changes in soil pH, chemistry and structure		discernable. Score 1, very low. There will be residual impacts as fertility will decrease as a result of topsoil storage, score 5 for likelihood	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste Generation	Construction equipment and land appearance will be modified during the construction of the pipeline	Construction activities at AGIs will result in short-term visual intrusion in a landscape of medium value	The proposed mitigation measure is 15	There are few receptors. Score 2, low, for consequence. The AGI after construction will constitute a residual impact, score 5 for likelihood	2 x 5 = 10 (Medium)
Contamination of land	L Fuelling, Q Waste Generation, P AGI and Facilities Construction	A shallow phreatic aquifer is present in the area. The water quality is however reported to be degraded due to bacteriological contamination and industrial contamination associated with the Rustavi industrial area	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination in an aquifer of medium quality and no practical utilisation	The proposed mitigation measures are 13 and 22	No	
Archaeology and cultural heritage	D ROW Preparation, E Trenching, P AGI and Facilities Construction	Potential archaeological sites are located in this area	Earth moving operations may confirm the presence of archaeological sites	The proposed mitigation measure is 16	No	

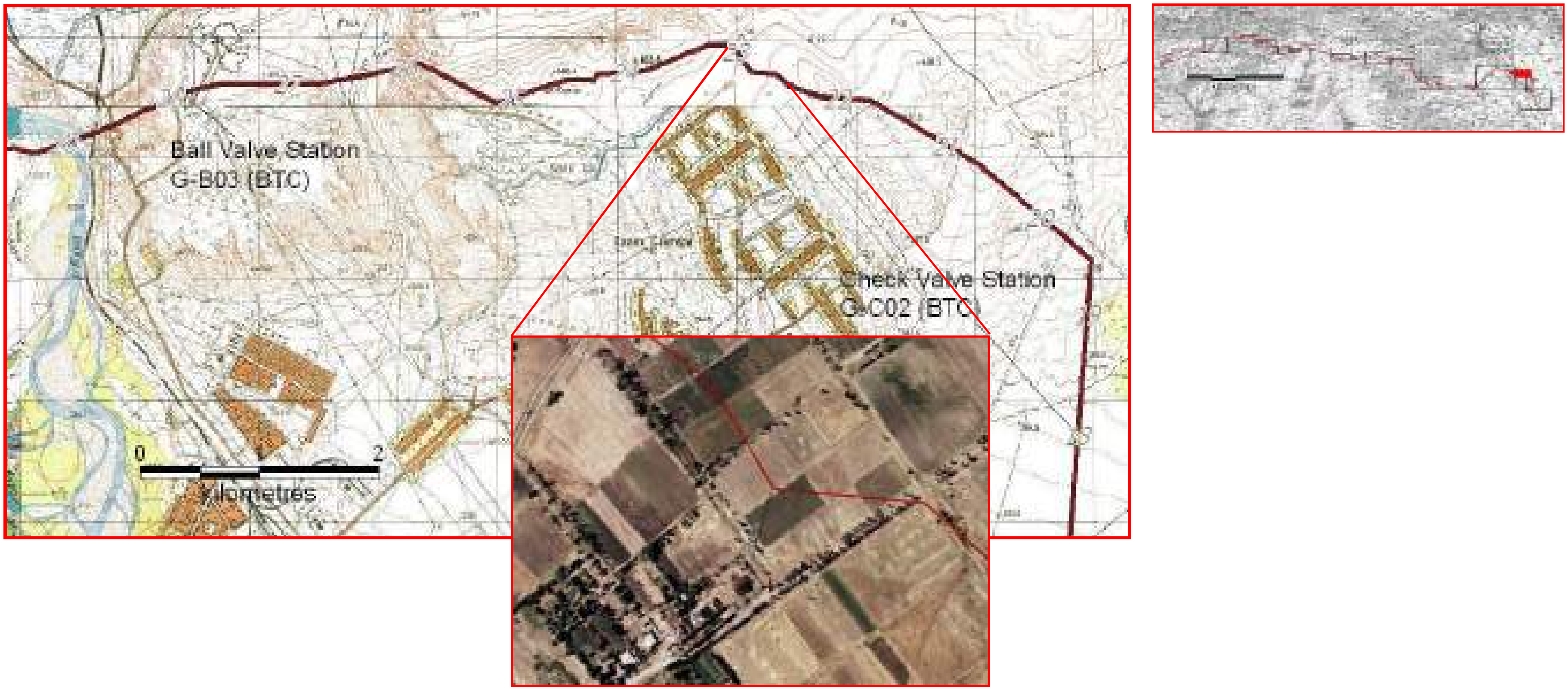
KP 11-18: Samgori



Environmental Receptors affected and key issues	Project Activity	Environmental Aspects	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, L Fuelling, Q Waste Generation	Watercourses are crossed at the following KPs: 15.8, Stream; 16.5, Stream; 17.2, Stream; 17.9, Canal. The area is also characterised by a shallow groundwater aquifer overlaying a series of pressurised aquifers at various depths. • Clearance, ROW preparation and trenching activities have the potential of generating runoff of soil • Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality of streams and ephemeral watercourses. Deterioration of water quality would be the direct result of the release of suspended solids during crossing construction b) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater c) Discharges of sanitary wastewater from BV-GC02 construction site and from the proposed pipe storage yards could also potentially affect local surface water quality	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measures are 13 and 22. For impact "c" the proposed mitigation measure is 9	No	
Ecology (Flora, Fauna, biodiversity)		No significant ecological issues affect this area	n.a.	n.a.	n.a.	
Noise and vibration	E Trenching, P AGI and Facilities Construction, O horizontal boring	Human receptors are located at KP 11.5, Farm (129 m); KP 15, Farm (382m); KP 15.4, Farm (158 m)	Impacts associated with noise emissions in this unit consist of short-term disturbance of human receptors present in the area	The proposed mitigation measure is 19	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied	3 x 5 = 15 (Medium)
Air Quality	A Haulage, C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, G Backfilling	Receptors are located at: KP 11.5, Farm (129 m)	Impacts associated with air quality relate to dust impacts on human receptors arising from construction activities	The proposed mitigation measures are 17 and 18	No	
Soil	C ROW Clearance, D ROW Preparation, P AGI and Facilities Construction	Land use in the area is predominantly agricultural and construction will require removal and storage of topsoil for up to 2-3 years	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure	The proposed mitigation measures are 3, 11 and 12	The residual impact is largely not discernable due to the poor biodiversity in agricultural soils. Score 1, very low. The residual impact will occur, score 5 for likelihood	1 x 5 = 5 (Low)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspects	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, F Pipelaying, G Backfilling, Q Waste Generation	The area has low to medium landscape value. The setting is rural with pockets of industry. Construction equipment and land appearance will be modified during the construction of the pipeline	a) Pipeline construction activities will result in short-term visual intrusion. b) Construction activities at AGIs will result in short-term visual intrusion	For impact "a" mitigation is not applicable. For impact "b" the proposed mitigation measure is 15	There are few receptors, Score 2, low for consequence. The residual impact will occur, score 5 for likelihood	a) 2 x 5 = 10 (Medium) b) 2 x 5 = 10 (Medium)
Contamination of land	L Fuelling, P AGI and Facilities Construction, Q Waste Generation	A shallow phreatic aquifer is present in the area. The water quality is however reported to be degraded due to bacteriological contamination and industrial contamination associated with the Rustavi industrial area	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination in an aquifer of medium quality and no practical utilisation	The proposed mitigation measures are 13 and 22	No	
Archaeology and cultural heritage	D ROW Preparation, E Trenching, P AGI and Facilities Construction	Potential archaeological sites are located in this area	Earth moving operations may confirm the presence of archaeological sites	The proposed mitigation measure is 16	No	

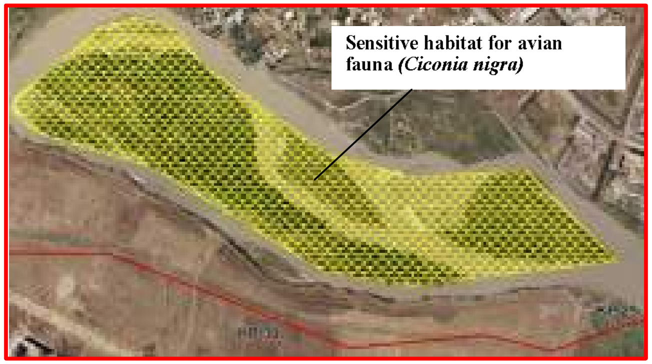
KPs 18-28.7: Samgori upland



Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, P AGI and Facilities Construction, Q Waste Generation	Water courses are crossed at the following locations: KP 19.7, Stream; KP 20.7, Stream; KP 21.2, Stream; KP 21.6, Stream; KP 22.1, Stream; KP 22.6, Stream; KP 23.2, Canal; KP 23.3, Stream; KP 23.7, Stream; KP 24.0, Stream; KP 25.1, Stream; KP 26.4, Stream; KP 26.6, Stream; KP 27.5, Stream; KP 27.9, Stream; KP 28.3, Stream. • Clearance, ROW preparation and trenching activities have the potential of generating runoff of soil • Construction sites will generate sanitary effluent. No groundwater aquifer are present in this area	a) All activities listed have the potential to deteriorate surface water quality at crossings and ephemeral watercourses. Deterioration of water quality would be the direct result of the release of suspended solids to the streams (during crossing construction if the streams are not dry) b) Discharges of sanitary wastewater from BV-GB03 construction site and from the proposed pipe storage yards could also potentially affect local surface water quality c) Spill of fuel or other liquid waste from the construction activities could result in contamination of groundwater	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measure is 9. For impact "c" the proposed mitigation measures are 13 and 22	No.	
Ecology (Flora, Fauna, biodiversity)		No significant ecological issues affect this area	No significant impacts	n.a.	n.a.	
Noise and vibration	E Trenching, O Horizontal boring, P AGI and Facilities Construction	Human receptors are located at: KP 19.8, Farm (383 m); KP 20.8, Farm (584 m); KP 22.8, Village (130 m); KP 26-27, Factory (300 m)	Impacts associated with noise emissions in this unit consist of short-term disturbance of human receptors present in the area	The proposed mitigation measure is 19	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied	3 x 5 = 15 (Medium)
Air Quality	A Haulage, C ROW Clearance, D ROW Preparation, E Trenching, G Backfilling, P AGI and Facilities Construction	Human receptors are located at: KP 22.8, Village (130 m)	Impacts associated with air quality relate to dust impacts on human receptors arising from construction activities	The proposed mitigation measures are 17 and 18	No	
Soil	C ROW Clearance, D ROW Preparation	Potential for soil erosion and soil liquefaction on steep slopes and in dry gorges	The earth moving operations may trigger erosive processes	The proposed mitigation measures are 8 and 11	Impact largely not discernable. Score 1,	1 x 5 = 5 (Low)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
					very low for consequence. The residual impact will occur, likelihood score 5	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste Generation	Steep un-vegetated slopes and dry gorges. Landscape of moderate value in a largely industrial setting	a) Construction and reinstatement activities on the steep slopes will cause landscape impacts due to the impossibility of restoring the existing topography b) Construction of the ball valve will cause short-term visual intrusion	For impact "a" the proposed mitigation measures are 11 and 15. For Impact "b" the proposed mitigation measure is 15	a) Moderate changes to landscape in a localized area due to the need for erosion control measures erosion. Score 3, medium. The residual impacts will occur, score 5 for likelihood b) Many viewers will be affected by minor changes in view, score 3. This residual impact will occur, score 5	a) 3 x 5 = 15 (Medium) b) 3 x 5 = 15 (Medium)
Contamination of land	L Fuelling, P AGI and Facilities Construction, Q Waste Generation.	Any impacts associated with spill of liquid contaminants would be confined to soil contamination as there are no groundwater aquifers in this area	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil contamination	The proposed mitigation measures are 13 and 22	No	
Archaeology and Cultural Heritage	D ROW Preparation, E Trenching, AGI and Facilities Construction	Potential archaeological sites are located in this area	Earth moving operations may confirm the presence of archaeological sites	The proposed mitigation measure is 16	No	

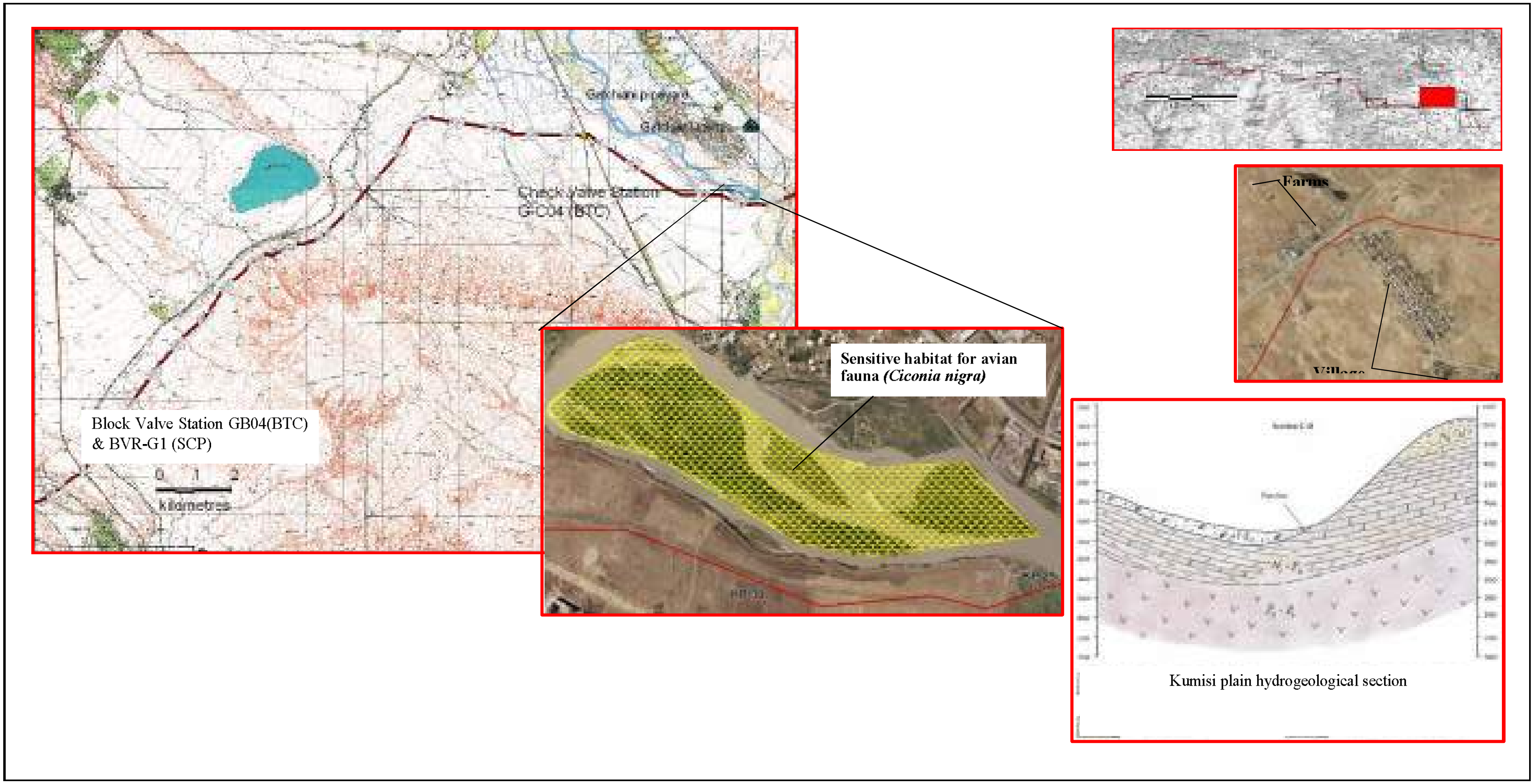
KPs 28.7-29.4: River Mtkvari crossing East



Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, N Horizontal Directional drilling, M Hydrotesting, Q Waste Generation.	The crossing of the river Mtkvari, (width of river bed is 166.7m) is the only sensitive issue in this area. The river crossing will be constructed with horizontal directional drilling at a depth of approximately 20m below the riverbed. A shallow groundwater aquifer is present within the floodplain of the R. Mtkvari.	a) All activities listed have the potential to deteriorate surface water quality of the Mtkvari river. Deterioration of water quality would be the direct result of the release of suspended solids to the river during crossing construction. b) Spill of fuel or other liquid waste from the construction activities could result in contamination of groundwater.	For Impact "a" the proposed mitigation measures are 8, 10, 11, 12 and 14. For Impact "b" the proposed mitigation measures are 13 and 22.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, N Horizontal Directional Drilling, M Hydrotesting.	The riparian islands to the North of the river crossing provide a habitat to nesting and migrating birds including the only population of Little Egrett (*Egretta Garzetta*) to be found in Eastern Georgia. Additional sensitive issues include the presence of fish in the Mtkvari river.	a) The preparation of the directional drilling site and the associated mud circulation pits etc may result in adverse impacts on the riparian and aquatic fauna and flora. b) Drilling of the Mtkvari River crossing may result in adverse impacts on aquatic fauna and flora including the presence of spawning grounds in case of mud losses to the riverbed. c) Hydrotest water will be abstracted from and discharged to the R. Mtkvari with potential impacts to ichthyofauna if the discharge takes place during the spawning season.	For Impact "a" the proposed mitigation measures are 8, 10, 11, 12 and 14. For Impact "b" the proposed mitigation measure is 11. For Impact "c" the proposed mitigation measure is 10.	a) Return to baseline conditions after 12 months. Score 2, low for consequence. b) Disturbance of behaviour of species of regionally (in the country context). Score 3, medium for consequence. c) Disturbance to reproductive behaviour (spawning activity). Score 2, very low for consequence. All these residual impacts are ranked as score 2, unlikely but may occur.	a) 2 x 2 = 4 (Low) b) 3 x 2 = 6 (Low) c) 2 x 2 = 4 (Low)
Noise and vibrations	N Horizontal Directional Drilling, E Trenching.	Indirect impact on Fauna, particularly avian fauna present in the area.	Impacts associated with noise emissions in this unit will consist of short-term disturbance of avian fauna populations present in the riparian habitats.	The proposed mitigation measures are 6, 7 and 19.	The area of the crossing is industrial and it is assumed that the avian fauna has become accustomed to construction noises. On this basis the consequence is considered to be low, score 2. The residual impact is very likely to occur, score 4 for likelihood.	2 x 4 = 8 (Low)
Air Quality		Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a.	
Soil	n.a.		n.a.	n.a.	n.a.	
Landscape and visual intrusion	N Horizontal Directional Drilling	The setting is industrial and the current landscape value is low.	The construction of the river crossing will cause short-term visual intrusion.	Mitigation is not applicable.	Few receptors will be affected as the location is industrial in nature. Score 2, low for consequence. The residual impact will occur, score 5 for	2 x 5 = 10 (Medium)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
					likelihood.	
Contamination of land	L Fuelling, Q Waste Generation.	Both the River Mtkvari and the aquifer present in the floodplain are sensitive receptors although in both cases, bacteriological and chemical contamination has diminished the value of the resource.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and Cultural Heritage	n.a.		n.a.	n.a.	n.a.	

KPs 29.4-53.2: Kumisi plain



Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of Residual Impacts
Water Resources (Surface and Groundwater):	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, P AGI and Facilities Construction, Q Waste Generation.	The following Surface Water crossings are present in this area: KP 33.7, Stream; KP 36.6, Stream; KP 38.3, Stream; KP 38.7, Stream; KP 39.0, Stream; KP 41.0, Stream; KP 42.1, Stream; KP 42.2, Stream; KP 43.6, Stream; KP 44.7, Stream; KP 47.4, Stream; KP 49.4, Stream; KP 49.9, Stream; KP 50.6, Stream; KP 51.7, Stream; KP 53.1, Stream. • Shallow aggressive groundwater is also present (Sulphate and Chloride). • Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality at crossings and ephemeral watercourses. Deterioration of water quality would be the direct result of the release of suspended solids during crossing construction. b) Discharges of sanitary wastewater from CV-GC04 and BV-GB05 construction site and from the proposed pipe storage yards could also potentially affect local surface water quality. c) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measure is 9. For impact "c" the proposed mitigation measures are 13 and 22.	No	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, M Hydrotesting.	Populations of rare snake eyed lizard (*Ophisops elegans*) are known to occur in this area.	a) Groundwater extracted from the trench during construction could cause adverse impacts to freshwater ecology if it has aggressive chemistry (ph, Chloride content etc) and is discharged to streams. b) Clearance and ROW preparation activities may disturb or adversely impact population of rare lizards.	For impact "a" the proposed mitigation measure is 14. For impact "b" the proposed mitigation measure is to undertake a site specific faunal survey prior to clearance of the ROW.	a) Baseline ecological conditions are expected to return after 12 months. Score 2, low for consequence. This residual impact is unlikely but may occur, score 2. b) Disruption of a nationally important species score 4, very high. This residual impact is very likely to occur, score 4 for likelihood.	a) 2 x 2 = 4 (Low) b) 4 x 4 = 16 (Medium)
Noise and vibrations	E Trenching, O Horizontal boring, P AGI and Facilities Construction.	Noise receptors are present at: KP 30.7, Village (231 m); KP 31.5, Farm (210 m); KP 34.3, Factory (300 m); KP 35, Farm (463 m); KP 36.3, Farm (459 m); KP 36.3-39, Village (low density) (75 m); KP 39.1, Farm (55 m); KP39.3, Farm (590 m); KP 40.5, Industrial area (100 m); KP 42.5, Farm (444 m); KP 42-45.5, Village (404 m); KP 52.8, Houses (650 m); KP 53, Village (950 m).	Impacts associated with noise emissions in this unit consist of short-term disturbance of human and faunal receptors present in the area.	The proposed mitigation measures are 6, 7 and 19.	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed	3 x 5 = 15 (Medium)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of Residual Impacts
		Sensitive wildlife receptors include the avian populations present on the riparian island in the River Mtkvari (KP 29-34.5).			taking account of mitigation due to local topography natural sound barriers and dwellings not occupied.	
Air Quality	A Haulage, C ROW Clearance, D ROW Preparation, E Trenching, G Backfilling, P AGI and Facilities Construction.	Human receptors are located at: KP 30.7, Village (231 m); KP 31.5, Farm (210 m); KP 36.3-39, Village (low density) (75 m); KP 39.1, Farm (55 m); KP 40.5, Industrial area (100 m).	Impacts associated with air quality relate to dust impacts on human receptors arising from construction activities.	The proposed mitigation measures are 17 and 18.	No.	
Soil		No significant soil erosion or soil fertility issues are applicable to this area.	n.a.	n.a.	n.a.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste Generation.	Landscape is low-medium quality.	Pipeline, Ball Valve Station GB05 and Check Valve GC04 construction activities will result in short-term visual intrusion.	The proposed mitigation measure is 15.	Many viewers will be affected by moderate changes in view, score 3, medium. This residual impact is certain to occur, score 5 for likelihood.	3 x 5 = 15 (Medium)
Contamination of land	L Fuelling, Q Waste Generation.	Shallow phreatic aquifer present in the area.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	n.a.		n.a.	n.a.	n.a.	

KPs 53.2-53.8: Algeti river crossing

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, Q Waste Generation.	River Algeti, crossing width 8.8m. Shallow groundwater within the river floodplain.	a) All activities listed have the potential to deteriorate surface water quality at the Algeti River crossing. Deterioration of water quality would be the direct result of the release of suspended solids to the Algeti River (during crossing construction). b) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measures are 13 and 22.	No	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching.	A fragment of riparian forest is present on the floodplain of the Algeti river. The habitat includes poplar (*Populus spp.*) and willow (*Salix spp.*) and understorey shrub species such as sea buckthorn (*Hipopphaë rhamnoides*) and tamarisk (*Tamarix ramosissima*). The habitat also supports avian and terrestrial fauna although no rare species are recorded at this site. The Algeti river supports several species of fish including commercially and ecologically sensitive species.	a) Clearance of the riparian forest at this river crossing will result in the permanent loss of habitat at this location and associated disturbance of faunal populations. b) Construction of the crossing with open cut technique may adversely impact the freshwater ecosystem supported by the river.	For impact "a" the proposed mitigation measures are 1, 2, 3 and 4. For impact "b" the proposed mitigation measure is 8.	a) Reduction in integrity of habitat in regional (in the country context) score 3, for consequence. This residual impact is certain to occur, score 5 for likelihood. b) The ecology will return to the baseline after 12 months. Score 2, low. This residual impact is unlikely to occur, score 2 for likelihood.	a) 3 x 5 = 15 (Medium) b) 2 x 2 = 4 (Low)
Noise and vibrations	E Trenching, O Horizontal boring.	Human receptors are located at KP 53.4, Houses (600 m). Wildlife in riparian forest would also be considered a receptor to construction noise.	Impacts associated with noise emissions in this unit consist of short-term disturbance of human receptors and faunal receptors present in the area.	The proposed mitigation measure is 19.	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied.	3 x 5 = 15 (Medium)
Air Quality		Not applicable as no human receptors are located in this unit	n.a.	n.a.	n.a	
Soil	C ROW Clearance, D ROW Preparation, E Trenching.	The topsoil in the floodplain and within the riparian forest fragment contains a seed bank of high conservation value.	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure.	The proposed mitigation measures are 3, 11 and 12.	Impact largely not discernable, score 1. This residual impact is certain to occur, score 5 for likelihood.	1 x 5 = 5 (Low)
Landscape and visual	C ROW Clearance, D ROW Preparation, E	Landscape is of medium value and includes	Clearance of the ROW and consequent	Mitigation measure 15 will partially	There will be	3 x 5 = 15 (Medium)

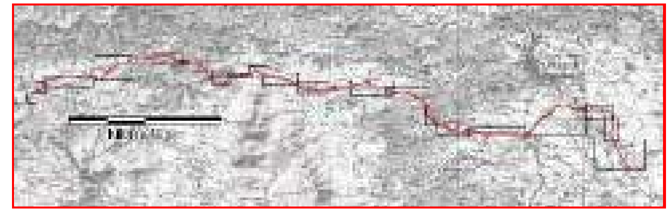
Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
intrusion	Trenching, F Pipelaying, G Backfilling, Q Waste Generation.	riparian forest.	changes to the Algeti River crossing related habitat will result in landscape impacts.	restore the landscape but the restrictions on trees planting above the pipe will result in a permanent modification of the site appearance.	moderate changes in the localized area, score 3. This residual impact is certain to occur, score 5 for likelihood.	
Contamination of land	L Fuelling, Q Waste Generation.	Shallow groundwater within the river floodplain.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	C ROW Clearance, D ROW Preparation, E Trenching.	Potential archaeological sites are located in this area.	Earth moving operations may confirm the presence of archaeological sites.	The proposed mitigation measure is 16.	No.	

KPs 53.8-72.8: Marneuli West

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, P AGI and Facilities Construction, Q Waste Generation.	Surface water courses are present at the following locations: KP 54.1, Stream; KP 57.1, Stream; KP 59.2, Stream; KP 62.0, Stream; KP 70.4, Stream. Medium depth groundwater aquifers Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality at water crossings and ephemeral watercourses. Deterioration of water quality would be the direct result of the release of suspended solids to the streams (during crossing construction). b) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater. c) Discharges of sanitary wastewater from CV-GC06 construction site and from the proposed pipe storage yards could also potentially affect local surface water quality.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measures are 13 and 22. For impact "c" the proposed mitigation measure is 9.	No.	
Ecology (Flora, Fauna, biodiversity)		No significant ecological issues occur in this area	n.a.	n.a.	n.a.	
Noise and vibrations	E Trenching (in rock), O Horizontal boring, P AGI and Facilities Construction.	Human receptors are present at: KP 54.2, Houses (260 m); KP 56.8, Railway yard (700 m); KP 57-59.6, Village (low density) (134 m).	Impacts associated with noise emissions in this unit consist of short-term disturbance of human receptors present in the area.	The proposed mitigation measure is 19.	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied.	3 x 5 = 15 (Medium)
Air Quality	A Haulage, C ROW Clearance, D ROW Preparation, E Trenching, G Backfilling, P AGI and Facilities Construction.	Human receptors are found at: KP 54.2, Houses (260 m); KP 57-59.6, Village (low density) (134 m).	Impacts associated with air quality relate to dust impacts on human receptors arising from construction activities.	The proposed mitigation measures are 17 and 18.	No.	
Soil	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	The local land use is predominantly agricultural (crops and grazing pastures).	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure.	The proposed mitigation measures are 3, 11 and 12.	No.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste Generation	The landscape value in the area is low.	Pipeline and Check Valve Station GC06 construction activities will result in short-term visual intrusion.	The proposed mitigation measure is 15.	Many viewers will be affected by minor changes in view, score 3. This residual impact	3 x 5 = 15 (Medium)

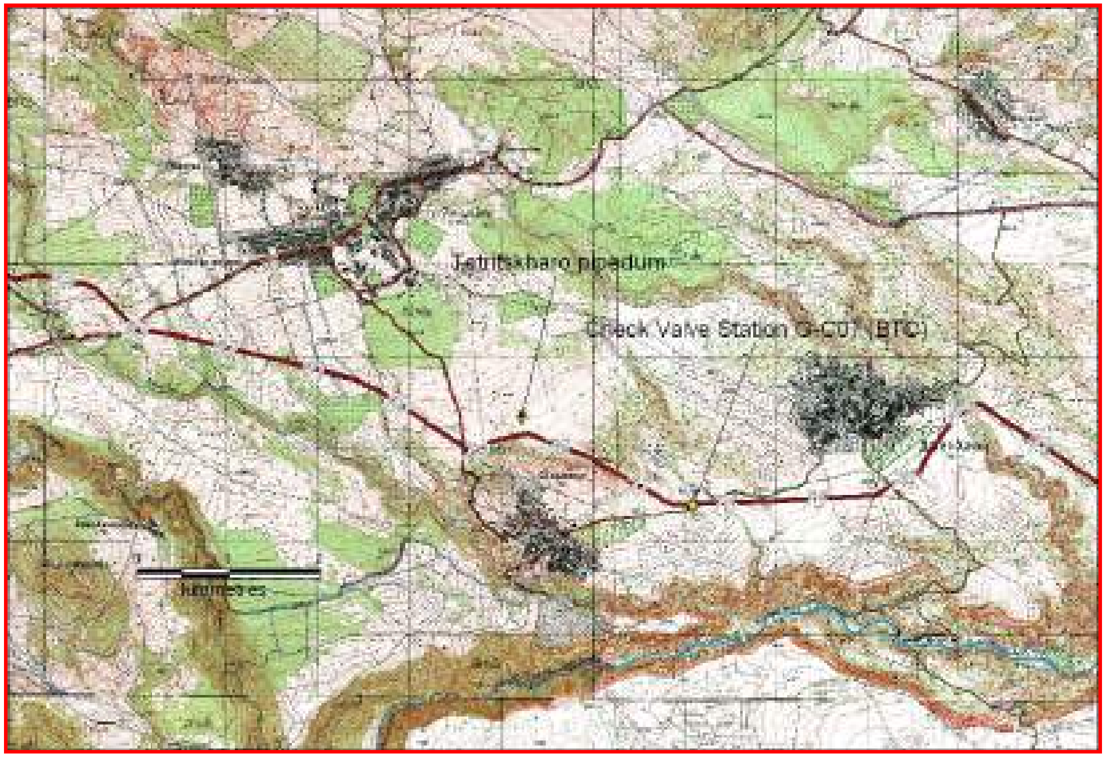
Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
					will occur, score 5.	
Contamination of land	L Fuelling, Q Waste Generation.	Groundwater aquifer present in this area at medium depth.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and Cultural heritage	D ROW Preparation, E Trenching, P AGI and Facilities Construction.	Potential archaeological sites are located in this area.	Earth moving operations may confirm the presence of archaeological sites.	The proposed mitigation measure is 16.	No.	

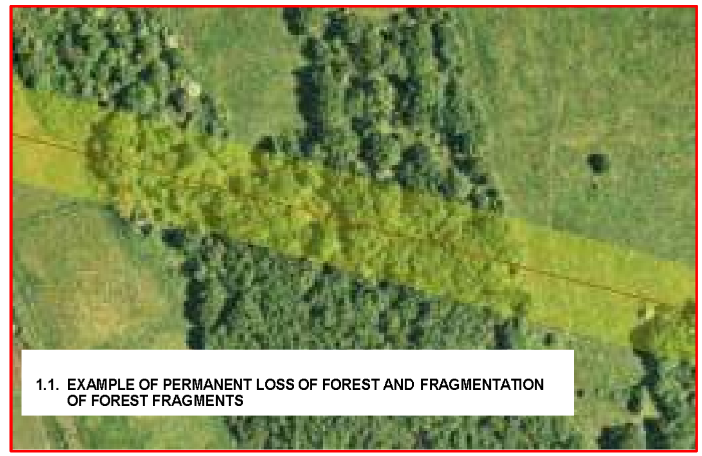
KPs 72.8: Geti river crossing



Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, Q Waste Generation.	River Geti crossing. Groundwater at medium depth.	a) All activities listed have the potential to deteriorate surface water quality at the Geti River crossing. Deterioration of water quality would be the direct result of the release of suspended solids to the River Geti (during crossing construction). b) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigations are 13 and 22.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching.	The river banks are populated by degraded Georgian oak (*Quercus iberica*) forest with components of floodplain vegetation (willows and shrubs such as hazelnut (*Corylus avellana*) and *Prunus spinosa*. The habitat also supports wildlife although no rare species were recorded. The river Geti also supports populations of fish.	a) The clearance of the ROW at the Geti River crossing will result in the permanent loss of the riparian habitat. b) Potential adverse effect on fish populations could occur as a result of increased sediment load in the river.	For impact "a" the proposed mitigation measures are 8, 11, 12 and 14. For impact "b" the proposed mitigation measure is 8.	a) Reduction in integrity of regionally (in the country context) important habitats, score 3. This residual impact will occur, score 5. b) The ecology will return to the baseline after 12 months, score 2. This residual impact is very likely to occur, score 4.	a) 3 x 5 = 15 (Medium) b) 2 x 4 = 8 (Low)
Noise and vibrations	E Trenching (in rock), O Horizontal boring.	Wildlife receptors would be present in the riparian habitat.	Impacts associated with noise and vibrations emissions in this unit will consist of short-term disturbance of faunal populations present in the area.	The proposed mitigation measure is 19.	Reduction in integrity of regionally (in the country context) important habitats, score 3. This residual impact is very likely to occur, score 4.	3 x 4 = 12 (Medium)
Air Quality	n.a.	Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a	
Soil	C ROW Clearance, D ROW Preparation, I Final Reinstatement.	Steep river banks.	The construction of the river crossing will potentially trigger erosive processes along the river banks until full site reinstatement will have been carried out.	The proposed mitigation measures are 3, 11 and 12.	Visible sediments present for over three weeks and obscuration of the riverbed. Score 4, high. This residual impact is unlikely but may occur, score 2.	4 x 2 = 8 (Low)
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, Q Waste Generation.	Steep river banks and inability to reinstate the pre-existing topography. Landscape is of low-medium quality and includes riparian forest.	Clearance of the ROW and the consequent change to Geti river banks slope and appearance will result in landscape impacts.	Mitigation measure 15 will partially restore the landscape but the restrictions on trees planting above the pipe will result in a permanent modification of the site appearance.	There will be moderate changes in the localized area. Score 3, medium. This residual impact will occur, score 5.	3 x 5 = 15 (Medium)
Contamination of land	L Fuelling, Q Waste Generation.	Groundwater present at medium depth.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No	
Archaeology and cultural heritage	n.a.		n.a.	n.a.	n.a.	

KPs 72.8-84: Tetritskaro South





1.1. EXAMPLE OF PERMANENT LOSS OF FOREST AND FRAGMENTATION OF FOREST FRAGMENTS

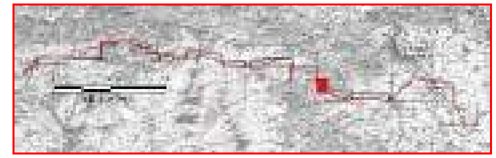
Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Significant residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, P AGI and Facilities Construction, Q Waste Generation.	Surface water crossings are present at: KP 79.8, Stream; KP 80.6, Stream; KP 81.1, Stream; KP 81.4, Stream; KP 82.1, Stream; KP 82.4, Stream. Groundwater is present at considerable depth. Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality at the surface water crossings including ephemeral streams. Deterioration of water quality would be the direct result of the release of suspended solids to watercourses (during crossing construction). b) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater. c) Discharges of sanitary wastewater from CV GC07 construction site and from the proposed pipe storage yards could also potentially affect local surface water quality.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measures are 13 and 22. For impact "c" the proposed mitigation measure is 9.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	The area is characterised by the presence of relatively well-preserved patches of Georgian oak (*Quercus iberica*) forest.	The clearance of the ROW in isolated forest fragments will cause the permanent loss of the local habitat This could in turn have adverse impacts on the large and medium-sized mammal populations that are known to be present in this area.	The proposed mitigation measures are 1, 2, 3, 4, 5, 6 and 7.	Disruption to species will be discernable using standard techniques, score 2. The residual impact will occur, score 5.	2 x 5 = 10 (Medium)
Noise and vibration	E Trenching, O Horizontal boring, P AGI and Facilities Construction.	Human receptors are present at: KP 73.7, Village (507 m); KP 77.4, Industrial area (517m); KP 77.9, Village (low density) (493 m); KP 79.3, Industrial area (808 m); KP 80.2-82, Village (135 m); KP 83-84.2, Village (667 m). Wildlife that is known to be present in the forest fragments would also be considered a sensitive receptor to noise.	Impacts associated with noise and vibrations in this unit include short-term disturbance of human and faunal populations present in the area.	The proposed mitigation measures are 6, 7 and 19.	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied.	3 x 5 = 15 (Medium)
Air Quality	A Haulage, C ROW Clearance, D ROW Preparation, E Trenching, G Backfilling, P AGI and Facilities Construction.	Human receptors are located at: KP 80.2-82, Village (135 m).	Impacts associated with air quality relate to dust impacts on human receptors arising from construction activities.	The proposed mitigation measures are 17 and 18.	No.	
Soil	C ROW Clearance, D ROW Preparation, P AGI and Facilities Construction.	The area is characterised by fertile forest subsoil and is locally used for agriculture and grazing.	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure.	The proposed mitigation measures are 3, 11 and 12.	Impact largely not discernable, score 1. This residual impact is certain to occur, score 5 for likelihood.	1 x 5 = 5 (Low)
Landscape and visual	C ROW Clearance, D ROW Preparation, E	The area has medium to high landscape	Pipeline, and Check Valve Station GC07	The proposed mitigation measure is	Many viewers will be	3 x 5= 15 (Medium)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Significant residual impacts
intrusion	Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste Generation.	value.	construction activities will result in visual intrusion.	15.	affected by minor changes in view, score 3. This residual impact is certain to occur, score 5 for likelihood.	
Contamination of land	L Fuelling, Q Waste Generation.	Groundwater aquifer present at medium depth.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No	
Archaeology and cultural heritage	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	Known and suspected sites of archaeological interest are present in this general area.	Grading and E Trenching activities could adversely impact the sites of archaeological interest and/or confirm the presence of sites previously unknown.	The proposed mitigation measure is 16. One known medieval site (Daget Khachini) will be part of the agreed Archaeological management strategy and will be studied in detailed prior to commencement of the construction activities.	Beneficial impact would occur as a result of the investigations and subsequent preservation of the medieval archaeological site.	

KPs 84-92: Tetritskaro forest

Pulsatilla georgica

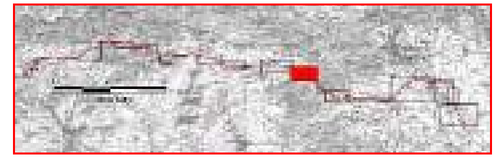
Oak forest



Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater).	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, P AGI and Facilities Construction, Q Waste Generation.	Surface water courses are present at: KP 84.1, River Chiv Chavi; KP 87.8, Stream; KP 90.1, Stream; KP 90.2, Stream; KP 91.1, Stream; KP 91.4, Stream. Groundwater is found at considerable depth. Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality at stream crossing including ephemeral streams. Deterioration of water quality would be the direct result of the release of suspended solids during construction of the Chiv Chavi river crossing or any other stream crossing. b) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater. c) Discharges of sanitary wastewater from CV GC07 construction site and from the proposed pipe storage yards could also potentially affect local surface water quality.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measures are 13 and 22. For impact "c" the proposed mitigation measure is 9. In addition, no hydrotest discharges or abstractions will be made to/from lake Cherepanovka.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, M Hydrotesting.	The area is characterised by important fragments of forest dominated by high-mountainous oak (*Quercus macranthera*) and beech (*Fagus orientalis*) with understorey and ground vegetation. Impacts to forest habitats could in turn have adverse impacts on the wildlife that is known to be present in this area. The forest is continuous in some areas whilst in other areas is characterised by a Park like appearance (sparse trees and interspersed meadows). A population of rare pasque flower (*Pulsatilla georgica*) is present within the area. The forest is important wildlife habitat for Wolf (*Canis lupus*); Brown bear (*Ursus arctos*); Fox (*Vulpes vulpes*); Hare (*Lepus europeaus*), Badger (*Meles meles*); Marten (*Martes sp.*). The presence of Wild cat (*Felis silvestris*), Lynx (*Felis (Lynx) lynx*), Roe deer (*Capreolus capreolus*) and Wild boar (*Sus scrofa*) was also detected. Lake Cherepanovka with its freshwater habitat that includes a rare species of water lily (*Nymphaea alba*) is also located in the general area.	a) The clearance of the ROW in forest areas will cause the permanent loss of the forest and the fragmentation of the habitat. This could in turn have detrimental impacts on the wildlife in the area. b) Clearance of the ROW would also impact the riparian habitat present on the floodplain of the Chiv Chavi river. c) Park like forest will also be deteriorated by the construction activities. d) Construction activities will potentially impact the population of pasqueflower. e) Discharges of sanitary water from Check Valve GC07 construction site to local surface water bodies there could potentially impact the freshwater ecosystems (Cherepanovka lake and Chiv Chavi river).	For impact "a" the proposed mitigation measures are 1, 2, 3, 4, 5, 6 and 7. For impact "b" the proposed mitigation measures are 1, 2 and 3. For impact "c" the proposed mitigation measures are 1 and 4. For impact "d" the proposed mitigation measures are 1 and 4. For impact "e" the proposed mitigation measure is 9. Additional mitigation measures will include the reduction of the ROW width to 22 m through patches of high conservation value forests and to 16m at four locations, each 40m long, to encourage mammals migration across the ROW.	a) Reduction in integrity of nationally (in the country context) important habitats, score 4. This residual impact will occur, score 5. b) Reduction in integrity of regionally (in the country context) important habitats, score 3. This residual impact will occur, score 5. c) Reduction in integrity of regionally (in the country context) important habitats, score 3. This residual impact will occur, score 5. d) Reduction in nationally important habitat, score 4. This residual impact is very likely to occur, score 4. e) Return to baseline conditions in less than 12 months, score 2. This residual impact is unlikely but may occur, score 2.	a) 4 x 5 = 20 (High) b) 3 x 5 = 15 (Medium) c) 3 x 5= 15 (Medium) d) 4 x 4= 16 (Medium) e) 2 x 2= 4 (Low)
Noise and vibration	E Trenching, O Horizontal boring, P AGI and Facilities Construction.	Sensitive wildlife receptors are present in this area.	Impacts associated with noise emissions in this unit will consist of short-term disturbance	The proposed mitigation measures are 6, 7 and 19.	Return to baseline conditions in less than	2 x 4 = 8 (Low)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
			of faunal populations present in the area.		12 months, score 2. This residual impact is very likely to occur, score 4.	
Air Quality	n.a.	Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a	
Soil	C ROW Clearance, D ROW Preparation, P AGI and Facilities Construction.	Seed bank in topsoil of forest areas has a high conservation value.	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure.	The proposed mitigation measures are 3, 11 and 12.	Impact largely not discernable. Score 1, very low. This residual impact will occur, score 5.	1 x 5 = 5 (Low)
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste Generation.	Forest and meadow landscape is of medium - high value.	a) Pipeline, and Pump Station PS-G2 construction activities will result in visual intrusion. b) The loss of forest habitat will result in modification of the landscape.	For impacts “a” and “b” the proposed mitigation measure is 15.	a) There will be moderate changes in the localized area, score 3. This residual impact will occur, score 5. b) There will be permanent intensive change over an extensive area, score 5. This residual impact will occur, score 5.	a) 3 x 5 = 15 (Medium) b) 5 x 5 = 25 (High)
Contamination of land	L Fuelling, Q Waste Generation.	Groundwater at medium depth.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No	
Archaeology and cultural heritage	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	Numerous known and suspected sites of archaeological interest occur in this area.	Clearance, ROW preparation and E Trenching activities could adversely impact the sites of archaeological interest and/or unearth new finds.	The proposed mitigation measure is 16. Three known site (Tke mlana, Nadarbazevi II and Takhtitskaro) will be part of the agreed Archaeological management strategy and will be studied in detail prior to commencement of the construction activities.	Beneficial impact would occur as a result of the investigations and subsequent preservation of the archaeological sites.	

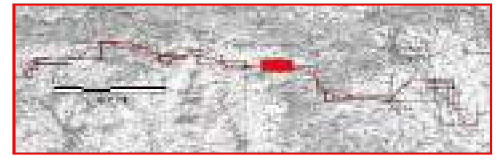
KPs 92-108: Bedeni Plateaux

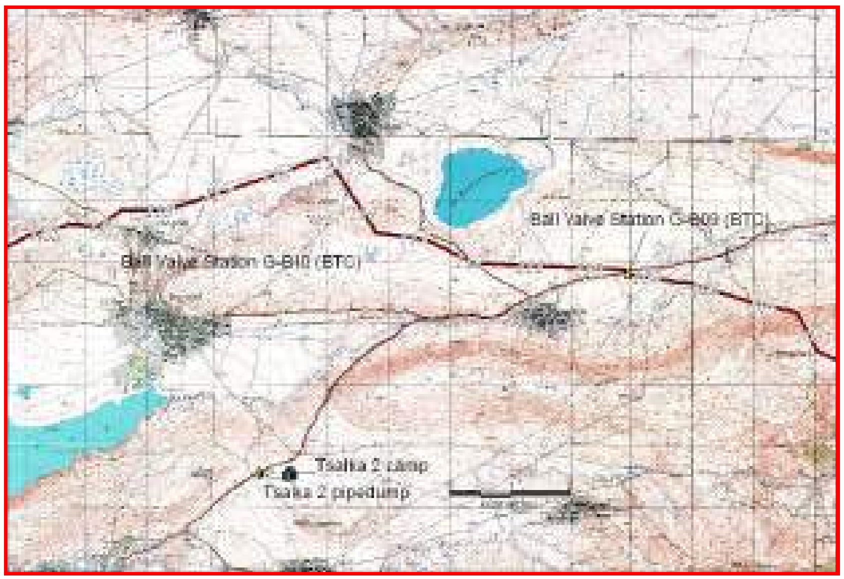


Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, P AGI and Facilities Construction, Q Waste Generation.	Stream crossings occur at KPs: 92.8, Stream; 97.0, Stream. Groundwater is present at considerable depth. Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality at stream crossing including ephemeral streams. Deterioration of water quality would be the direct result of the release of suspended solids during crossing construction. b) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater. c) Discharges of sanitary wastewater from CV GC08 construction site and from the proposed pipe storage yards could also potentially affect local surface water quality.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measures are 13 and 22. For impact "c" the proposed mitigation measure is 9.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	High mountain meadows occur in this area and include populations of high conservation value such as the marsh orchid (*Dactylorhiza urvelliana*) remarkably abundant within this section of pipeline.	a) The clearance of the ROW in high-mountain meadow will cause the impoverishment of high biodiversity characteristic to the meadow communities. b) Clearance of the ROW could also impact the population of marsh-orchid.	For impact "a" the proposed mitigation measures are 1, 3 and 4. For impact "b" the proposed mitigation measures are 1 and 4.	a) Reduction in integrity of regionally (in the country context) important habitats, score 3. The likelihood of the impact to occur is certain (score 5). b) Reduction in integrity of regionally (in the country context) important habitats, score 3. This is likely to happen (score 4).	a) 3 x 5= 15 (Medium) b) 3 x 4 = 12 (Medium)
Noise and Vibration	E Trenching, O Horizontal boring, P AGI and Facilities Construction.	The area is a relatively undisturbed habitat for avian and terrestrial fauna.	Impacts associated with noise emissions in this unit will consist of short-term disturbance of faunal populations present in the area.	The proposed mitigation measure is 19.	Reduction in integrity of regionally (in the country context) important habitats, score 3. Noise will be generated and disturbance may happen (score 4, likely).	3 x 4 = 12 (Medium)
Air Quality	n.a.	Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a	
Soil	C ROW Clearance, D ROW Preparation, P AGI and Facilities Construction.	The area is characterised by sub alpine meadows with high biodiversity.	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure.	The proposed mitigation measures are 3, 11 and 12.	Impact largely not discernable. Score 1, very low. Impact is certain (Score 5 for likelyhood)	1 x 5 = 5 (Low)
Landscape and visual intrusion	C ROW Clearance, D ROW preparation E Trenching, P AGI and Facilities Construction, F Pipelaying, G Backfilling, Q Waste Generation.	The area has a medium to high landscape value but is scarcely visible from any inhabited area or road. Steep slope descending from Bedeni plateaux.	a) Pipeline and Check Valve GC08 construction activities will result in visual intrusion. b) Due to the steep slope (from KP 105.5 to KP 108), the restoration of pre-existing topography will be difficult and the	For impact "a" the proposed mitigation measure is15.	a) There are few receptors, Score 2, low. Impacts will certainly occur (Score 5, likely). b) Permanent	a) 2 x 5 = 10 (Medium) b) 3 x 5 = 15 (Medium)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
			presence of erosion control features will have detrimental effects on the overall appearance of the site.		modification of the landscape in a small area. Score 3 medium. Impact is certain (score 5),	
Contamination of land	L Fuelling, Q Waste Generation.	Groundwater is present in the area at considerable depth.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No	
Archaeology and cultural heritage	D ROW Preparation, E Trenching, P AGI and Facilities Construction.	Several suspected sites of archaeological interest occur in this area.	Grading and E Trenching activities could adversely impact sites of archaeological interest.	The proposed mitigation measure is 16.	No	

KPs 108-120: Beshtasheni outskirts

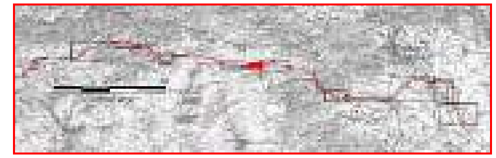


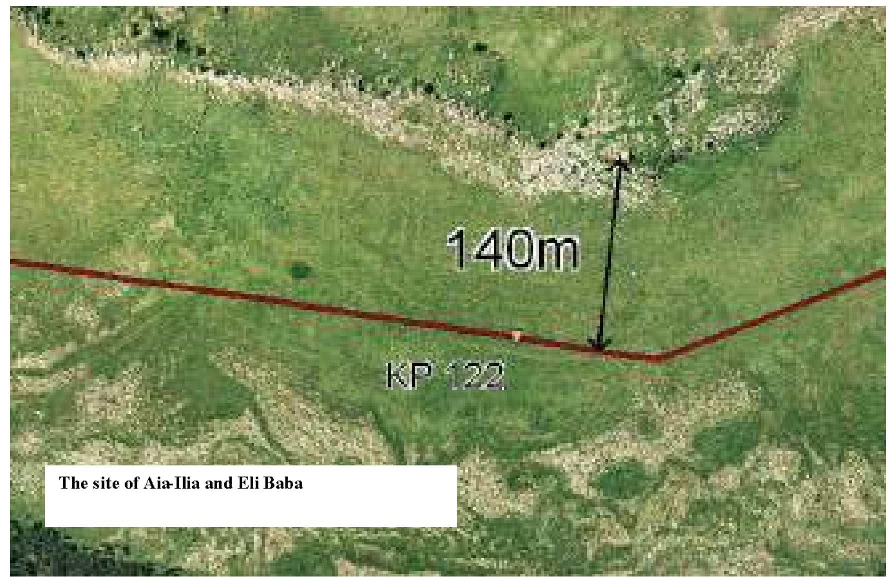


Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, P AGI and Facilities Construction, M Hydrotesting, Q Waste Generation;	Surface water crossings occur at: KP 115.4, River Beukchai, width 20.9m; KP 119.9, Stream. Groundwater occurs at shallow to medium depth, Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality at the crossing of streams and ephemeral wetlands (SW of KP 114). Deterioration of water quality would be the direct result of the release of suspended solids during crossing construction. b) Spill of fuel or other liquid waste from general construction could also result in contamination of groundwater. c) Discharges of sanitary wastewater from BV GB09 and BV GB10 construction site and from the proposed pipe storage yards could also potentially affect local surface water quality.	For impact "a" the proposed mitigation measures are 8 and 11 For impact "b" the proposed mitigation measures are 13 and 22. For impact "c" the proposed mitigation measure is 9. In addition, there will be no hydrotest abstraction or discharge to lake north of KP113.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, M Hydrotesting.	Hydrotest water will be abstracted from the Tsalka reservoir. The Beukchai river discharges to the Tsalka reservoir which is an important habitat and feeding ground for a high number of migratory birds including two species of Georgian Red Data Book -Black stork (*Ciconia nigra*) and Great white heron (*Egretta alba*).	a) Deterioration of the water quality of the Beukchai river may result in disturbance to wildlife habitats and feeding grounds on Tsalka lake. b) Hydrotest water will be abstracted from and discharged to the Tsalka reservoir and this could cause potential adverse impact to the freshwater ecosystems.	For impact "a" the proposed mitigation measures are 6 and 7. For impact "b" the proposed mitigation measure is 10.	No.	
Noise and vibrations	E Trenching, O Horizontal boring, P AGI and Facilities Construction.	Human receptors are located at: KP 111.8, Village (low density) (459 m); KP 112.2, Farm (115 m); KP 115-115.8, Village (324 m); KP 118.8-119.5, Village (low density) (148 m); KP 119.8, Farm (840 m).	Impacts associated with noise emissions in this unit include short-term disturbance of human and faunal populations present in the area.	The proposed mitigation measure is 19.	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied.	3 x 5 = 15 (Medium)
Air Quality	A Haulage, C ROW Clearance, D ROW Preparation, E Trenching, G Backfilling, P AGI and Facilities Construction.	Human receptors include: KP 112.2, Farm (115 m); KP 118.8-119.5, Village (low density) (148 m).	Impacts associated with air quality relate to dust impacts on human receptors arising from construction activities.	The proposed mitigation measures are 17 and 18.	No.	
Soil	n.a.	No significant issues associated with soil erosion or loss of fertility.	n.a.	n.a.	n.a.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P	Landscape is of medium value.	Pipeline and Ball Valves GB09 and GB10 construction will result in visual intrusion.	The proposed mitigation measure is 15.	There are many receptors	3 x 5 = 15 (Medium)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
	AGI and Facilities Construction, Q Waste Generation.				experiencing a minor change in view, Score 3, medium. The residual noise impact will occur, score 5.	
Contamination of land	L Fuelling, Q Waste Generation.	Groundwater aquifers at medium depth.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	n.a.		n.a.	n.a.	n.a.	

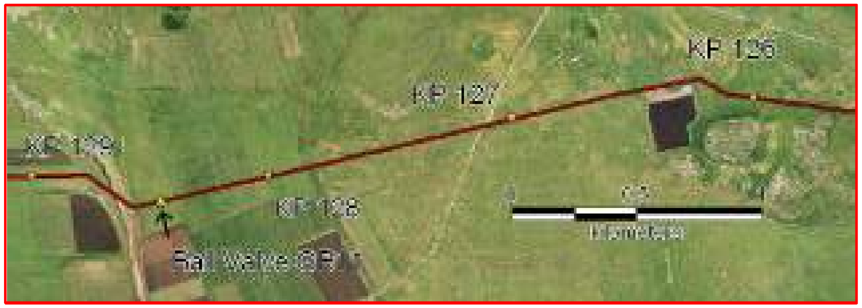
KPs 120-126: Tsalka ridge

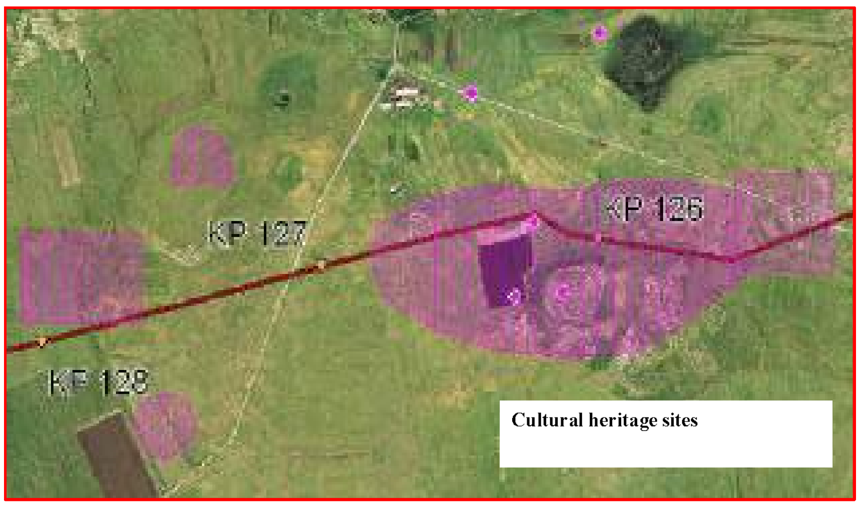




Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	
Water Resources (Surface and Groundwater)		No water features are directly crossed by the pipeline in this unit. Hydrotest water impacts on Tsalka reservoir have been covered in previous unit.	n.a.	n.a.	n.a.	
Ecology (Flora, Fauna, biodiversity)		The unit does not include sensitive ecological receptors.	n.a.	n.a.	n.a.	
Noise and vibrations		The unit does not include human or faunal receptors.	n.a.	n.a.	n.a.	
Air Quality		Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a	
Soil		No significant issues	n.a.	n.a.	n.a.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, Q Waste Generation.	Landscape is low-medium quality.	Pipeline construction activities will result in short-term visual intrusion.	No mitigation measures are applicable.	Few receptors experiencing a minor change in view, Score 2, low. Impact is certain, Score 5.	2 x 5 = 10 (Medium)
Contamination of land	L Fuelling, Q Waste Generation.		The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	D ROW Preparation, E Trenching.	Known medieval site at KP 122.7.	Grading and trenching activities could adversely impact the sites of archaeological interest.	The proposed mitigation measure is 16. The known site (Aia-Ilia and Eli Baba) will be part of the agreed Archaeological management strategy and will be studied in detailed prior to commencement of the construction activities.	Beneficial impact would occur as a result of the investigations and subsequent preservation of the archaeological sites.	

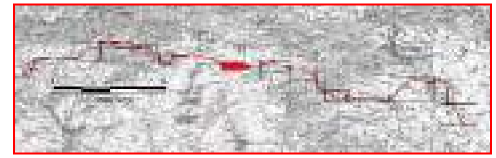
KPs 126-129: Santa

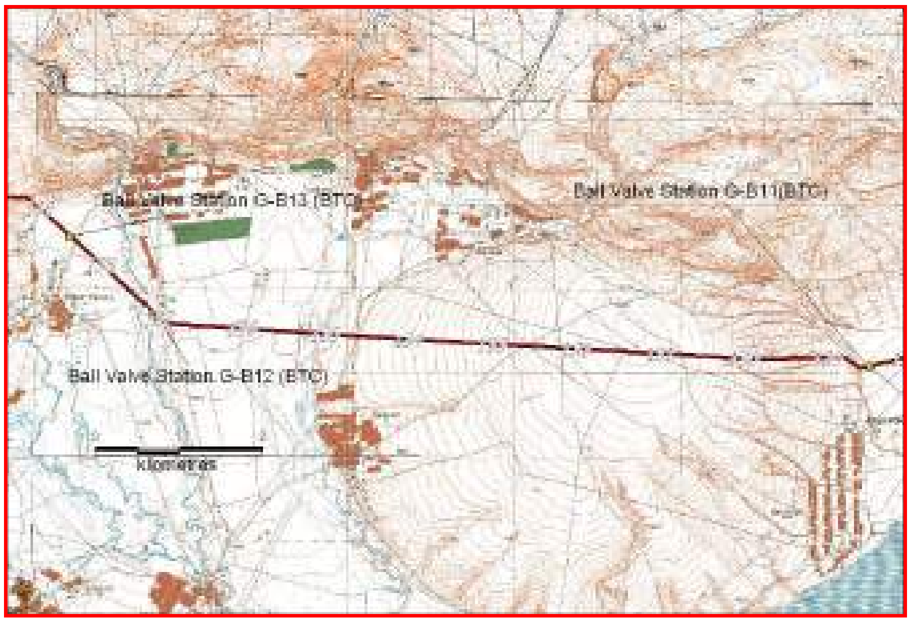


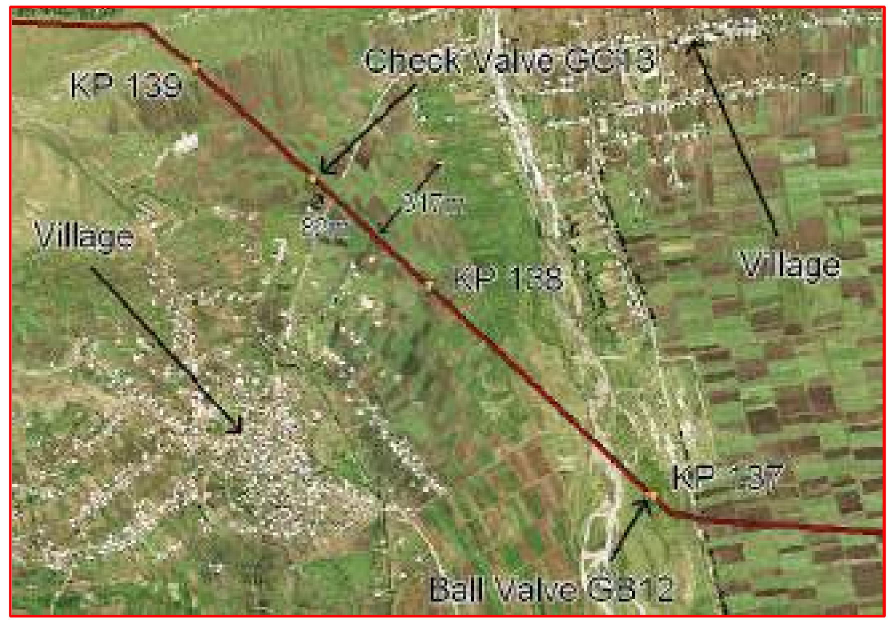


Environmental Receptors affected and key issues	Project Activity		Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)		No water features identified in this unit.	n.a.	n.a.	n.a.	
Ecology (Flora, Fauna, biodiversity)		No significant ecological features identified in this unit.	n.a.	n.a.	n.a.	
Noise and vibrations	E Trenching, O Horizontal boring, P AGI and Facilities Construction.	Human receptors present at KP 127.3, Village (low density) (403 m) KP 127.5, House (168 m)	Impacts associated with noise emissions in this unit consist of short-term disturbance of human receptors present in the area.	The proposed mitigation measure is 19.	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied.	3 x 5= 15 (Medium)
Air Quality	A Haulage, C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, G Backfilling.	Human receptors at: KP 127.5, House (168 m).	Impacts associated with air quality relate to dust impacts on human receptors arising from construction activities.	The proposed mitigation measures are 17 and 18.	No.	
Soil	C ROW Clearance, D ROW Preparation, P AGI and Facilities Construction.	Land use in the area is predominantly agricultural.	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure.	The proposed mitigation measure is 12.	No.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, F Pipelaying, G Backfilling, Q Waste Generation.	Landscape of medium value, high visual intrusion.	Pipeline and Ball Valve GB11 construction activities will result in visual intrusion.	The proposed mitigation measure is 15.	Few receptors experiencing a minor change in view, Score 2, medium. Impact is certain, Sore 5 for likelihood.	2 x 5 = 10 (Medium)
Contamination of land	L Fuelling,Q Waste Generation.	Groundwater is present at shallow depth.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	D ROW Preparation, E Trenching.	Suspected archaeological sites between KP 126 and KP128.	Grading and trenching activities could adversely impact the sites of archaeological interest.	The proposed mitigation measure is 16.	No.	

KPs 129-139.5: Tsalka - Kizil Kilisa

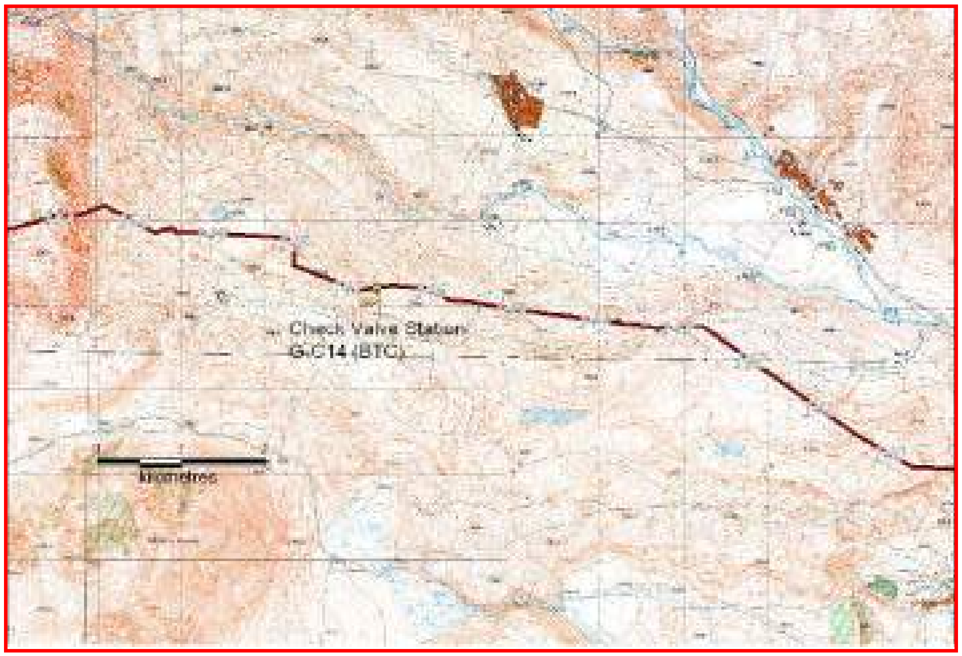


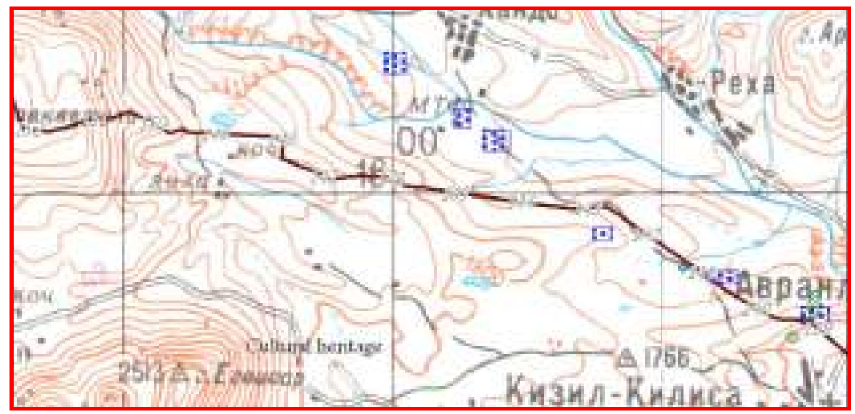




Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater).	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, P AGI and Facilities Construction, Q Waste Generation.	Stream crossings are located at KP 129.2, Stream; KP 130.0, Stream; KP 135.9, River Gumbati; KP 137.9: River Ktsia. Several additional agricultural drains are present in the area. Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality at streams and ephemeral streams and therefore Tsalka Reservoir. Deterioration of water quality would be the direct result of the release of suspended solids or other contaminants during crossing construction. b) Spill of fuel or other liquid waste from pipeline construction activities could also result in contamination of groundwater. c) Discharges of sanitary wastewater from BV GB12 and CV-GC13 construction site and from the proposed pipe storage yards could also potentially affect local surface water quality.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measures are 13 and 22. For impact "c" the proposed mitigation measures is 9.	No.	
Ecology (Flora, Fauna, biodiversity)		No significant ecological issues occur in this area	n.a.	n.a.	n.a.	
Noise and vibrations	D ROW Preparation, E Trenching, P AGI and Facilities Construction.	Human Receptors: KP 129.3, Village (low density) (593 m); KP 134.3, Village (low density) (938 m); KP 138-139.5, Village (low density) (317 m); KP 138.2-139.6, Village (83 m).	Impacts associated with noise emissions in this unit consist of short-term disturbance of human receptors present in the area.	The proposed mitigation measure is 19.	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied.	3 x 5 = 15 (Medium)
Air Quality	A Haulage, C ROW Clearance, D ROW Preparation, E Trenching, G Backfilling, P AGI and Facilities Construction.	KP 138.2-139.6, Village (83 m).	Impacts associated with air quality relate to dust impacts on human receptors arising from construction activities.	The proposed mitigation measures are 17 and 18.	No.	
Soil	C ROW Clearance, D ROW Preparation, P AGI and Facilities Construction.	Land use is predominantly agricultural.	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure.	The proposed mitigation measures are 11 and 12.	No.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste Generation.	Landscape of medium to low value.	Pipeline, Ball Valve GB12 and Check Valve GC13 construction activities will result in short-term visual intrusion.	The proposed mitigation measure is 15.	Many receptors experiencing a minor change in view, Score 3, medium. Likelihood is certain (Score 5).	3 x 5 = 15 (Medium)
Contamination of land	L Fuelling, Q Waste Generation.	Groundwater at shallow depth.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	n.a.		n.a.	n.a.	n.a.	

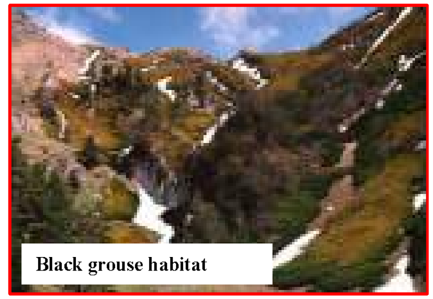
KPs 139.5-151: Ktsia Ridge East

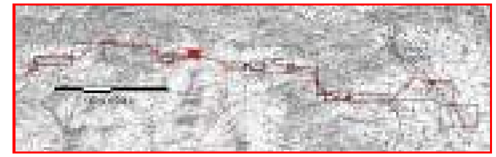




Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, L Fuelling, O Horizontal boring, Q Waste Generation.	Numerous springs in the vicinity of the ROW. Potable groundwater aquifer of high quality. Construction sites will generate sanitary effluent.	a) Spill of fuel or other liquid waste from the construction activities could result in contamination of groundwater. b) Discharges of sanitary wastewater from CV-GC14 construction site could also potentially affect local surface water quality.	For impact "a" the proposed mitigation measures are 13 and 22. For impact "b" the proposed mitigation measure is 9.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	The ROW crosses a pine plantation and associated wildlife habitat.	Clearance of the ROW in the plantation areas will cause fragmentation of the habitat.	The proposed mitigation measures are 1, 2 and 3.	Reduction in integrity of regionally (in the country context) important habitats, score 3. The likelihood of the impact is certain (Score 5).	3 x 5 = 15 (Medium)
Noise and vibrations	n.a.	No sensitive receptors are located in this area.	n.a.	n.a.	n.a.	
Air Quality	n.a.	Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a	
Soil	n.a.	No significant soil erosion issues occur in this area and the loss of fertility is of no consequence in light of the land use in this section (grazing).	n.a.	n.a.	n.a.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, F Pipelaying, G Backfilling, Q Waste Generation.	Medium to high landscape value, low intrusion with exception of KP 139.5 142.	a) Clearance of the ROW in the plantation area will result in landscape modification. b) Pipeline and Check Valve GC14 construction activities will result in short-term visual intrusion.	For impacts "a" and "b" the proposed mitigation measure is 15.	There will be a landscape modification as a result of the clearance through the plantation, score 5. The likelihood of the impact is certain (Score 5).	5 x 5 = 25 (High)
Contamination of land	L Fuelling, Q Waste Generation.	Sensitive groundwater aquifer.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No	
Archaeology and cultural heritage	C ROW Clearance D ROW Preparation, E Trenching, P AGI and Facilities Construction.	Known and presumed sites along the ROW.	Grading and trenching activities could adversely impact the sites of archaeological interest.	The proposed mitigation measure is 16.	Beneficial impact would occur as a result of the investigations and subsequent preservation of the archaeological sites.	

KPs 151-157: Mt Taukvetili

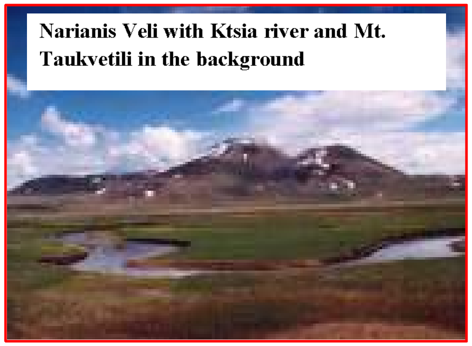


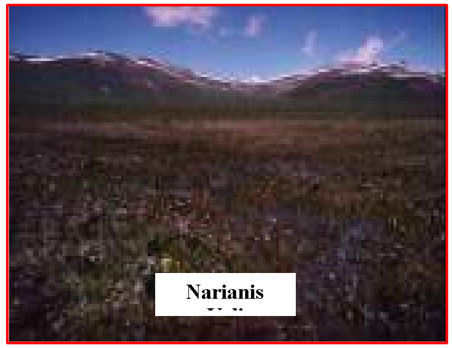


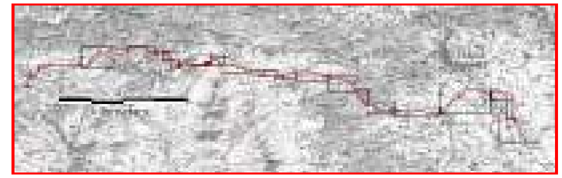
Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, P AGI and Facilities Construction, Q Waste Generation.	Sensitive high mountain wetlands with delicate surface and shallow grou8ndwater balance. Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality of wetlands. Deterioration of water quality would be the direct result of the release of suspended solids to the wetland. b) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater. c) Discharges of sanitary wastewater from BV-GB15 construction site could also potentially affect local surface water quality.	For impact "a" the proposed mitigation measures is to avoid the wetlands and to minimise alterations to surface and groundwater drainage in the area. For Impact "b" the proposed mitigation measures are 13 and 22. For impact "c" the proposed mitigation measure is 9.	a) Reduction on the integrity of nationally important habitat, score 4. Construction in the proximity of the wetlands is unlikely but may alter the local drainage regime and potentially cause the loss of the wetlands, score 2 for likelihood.	4 x 2 = 8 (Low)
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	The scrub vegetation of the slopes of Mt Taukvetili provides a habitat for the protected Caucasian black grouse (*Tetrao mlokosiewiczi*) that are known to be present in this area. The unit is within the Ktsia Tabatskuri Managed Reserve.	Clearance of the ROW in dense scrub will cause the temporary loss of the *Rhododendron caucasicum* communities and the potential fragmentation of the habitat. This could in turn have adverse impacts on the populations of black grouse.	The proposed mitigation measures are 1, 2, 3, 5, 6 and 7. In addition, clearance of the rhododendron scrub will take place prior to the spring season to "force" the local population of grouse to seek an alternative habitat.	Reduction on the integrity of nationally important habitat, score 4. The scrub will be certainly removed (Score 5).	4 x 5 = 20 (High)
Noise and vibrations	E Trenching, P AGI and Facilities Construction.	Blasting may be required. The population of black grouse is a sensitive receptor within and around the ROW.	Impacts associated with noise emissions in this unit consist of short-term disturbance of faunal populations present in the area.	The proposed mitigation measure is 19.	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied	3 x 5 = 15 (Medium)
Air Quality	n.a.	Not applicable as no human receptors are located in this unit	n.a.	n.a.	n.a	
Soil	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	Area subject to severe erosion risk.	The steep slopes to the east and west of Mt Taukvetili and the virtual absence of topsoil cover could facilitate erosive processes.	The proposed mitigation measures are 3, 11 and 12.	Soil erosion predicted to be visible. Score 3, medium. The occurrence of soil erosion is very unlikely (Score 2).	3 x 2 = 6 (Low)
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste Generation.	High landscape value. High visual intrusion although with few receptors due to remoteness of area. Mt. Tavkvetili is a designated Landscape monument in the Georgian Red Data Book.	a)The steep slopes, the virtual absence of topsoil and the rocky nature of the terrain will make permanent landscaping of this area very difficult to achieve.	For impact "a" the proposed mitigation measures are 3, 11, 12 and 15. For impact "b" the proposed mitigation measure is 15.	a) An intensive and permanent change in landscape. Score 5, very high. The likelihood of the	5 x 5 = 25 (High)

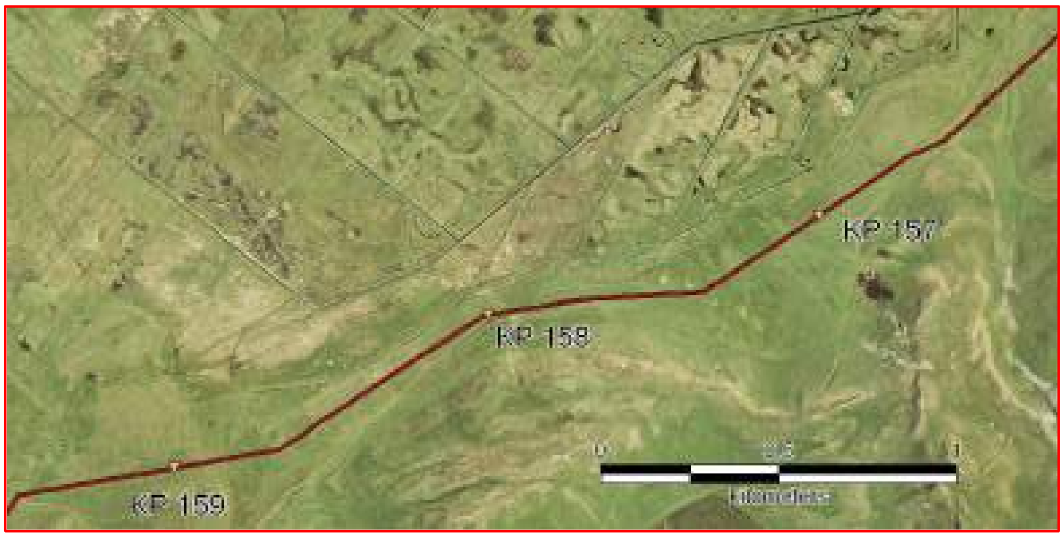
Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
			b) Ball Valve GB15 and pipeline construction activities will result in short-term visual intrusion.		impact is certain (Score 5).	
Contamination of land	L Fuelling, Q Waste Generation.	Sensitive surface and groundwater due to high mountain wetlands.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	Known and presumed sites along the ROW.	Grading and trenching activities could adversely impact the sites of archaeological interest.	The proposed mitigation measure is 16.	No.	

KPs 157-160: Narianis Veli


Narianis Veli with Ktsia river and Mt. Taukvetili in the background

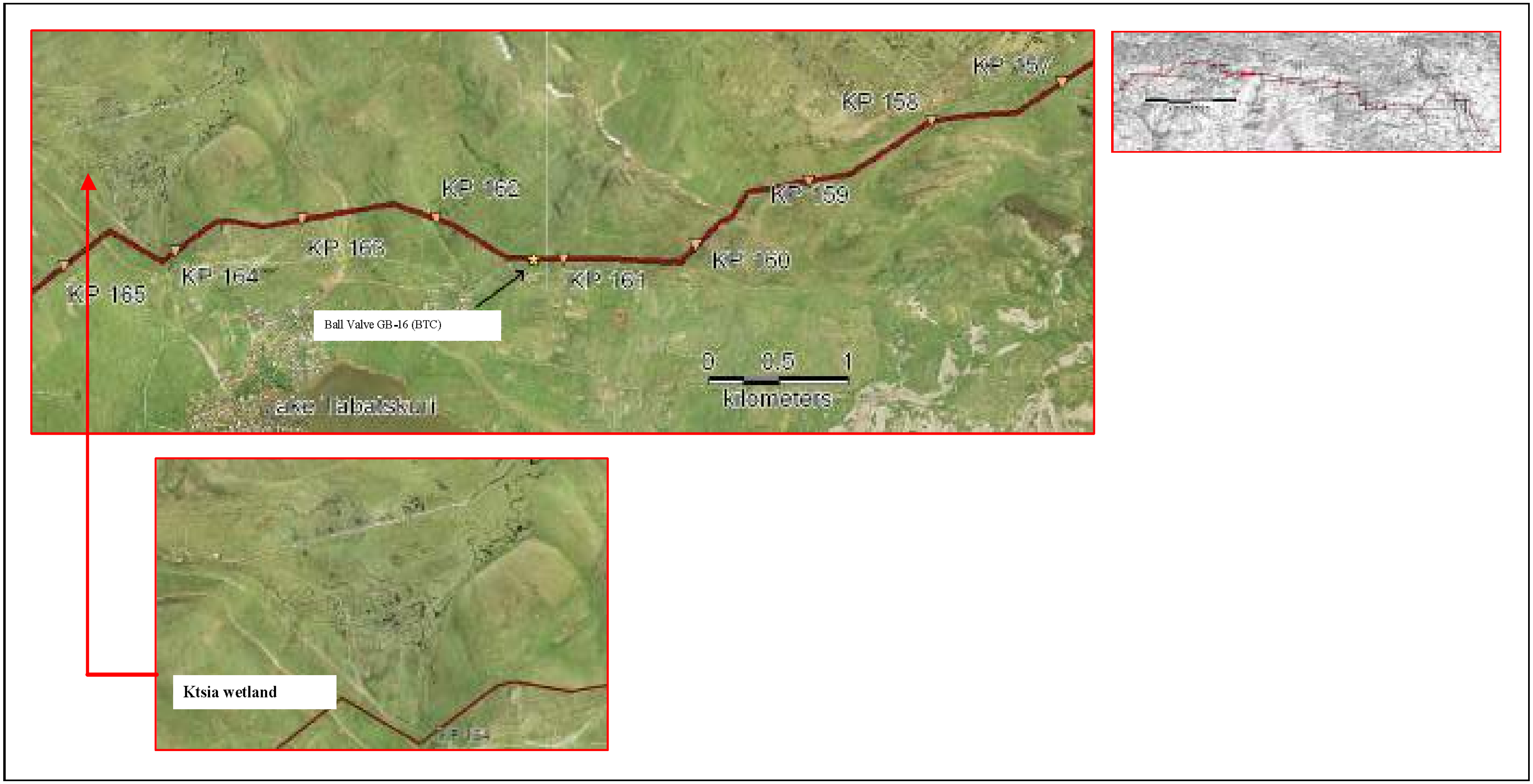

Narianis





Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater).	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, Q Waste Generation.	The ROW is adjacent to the Narianis Veli high mountain wetland. Potable groundwater aquifer of high quality;	a) All activities listed have the potential to deteriorate surface water quality of wetlands. Deterioration of water quality would be the direct result of the release of suspended solids or other pollutants to the wetland b) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater.	For impact "a" the proposed mitigation measures is to avoid the wetlands and to minimise alterations to surface and groundwater drainage in the general area. In addition mitigation measure 8 will be applied. For impact "b" the proposed mitigation measures are 13 and 22.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching.	The wetland also has an important botanical value although this will not be directly affected by the pipeline construction operations. The wetland is a habitat for Weasel (*Mustela nivalis*), Fox (*Vulpes vulpes*), Brown bear (*Ursus arctos*), Badger (*Meles meles*) and Wolf (*Canis lupus*) that come down to Narianis veli from the surrounding forests for food. Narianis veli is also very important ornithological site where Georgian Red Data Book species - Grey partridge (*Perdix perdix*), Common crane (*Grus grus*); and Corncrake (*Crex crex*) have been recorded. The unit is within the Ktsia Tabatskuri Managed Reserve.	a) Construction activities will create disturbance to the larger mammals that populate the area and to a lesser degree to the avian fauna. b) Potential impacts to botanical associations could result from the discharge of sediments or other pollutants to the wetland (see Water resources).	For impact "a" the proposed mitigation measures are 6 and 7. For impact "b" the proposed mitigation measures are 6, 7 and 8. In addition, no trenching or blasting will take place during the months of April and May (nesting/breeding time for avian fauna).	No.	
Noise and vibrations	E Trenching.	Sensitive faunal habitat (see previous point).	Impacts associated with noise emissions in this unit will consist of short-term disturbance of faunal populations present in the area.	The proposed mitigation measure is 19.	Disturbance of behaviour of species of national importance, score 4, for consequence. The residual impact is very likely to occur, score 4.	4 x 4 = 16 (Medium)
Air Quality	n.a.	Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a	
Soil	n.a.	This section does not have soil erosion or soil fertility issues of significance.	n.a.	n.a.	n.a.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, Q Waste Generation.	High landscape value and high visual intrusion, although few permanent receptors.	Pipeline construction activities will result in short-term visual intrusion.	The proposed mitigation measure is 15.	No.	
Contamination of land	L Fuelling, Q Waste Generation.		The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22. In addition, no fuel storage will be allowed in this area.	No.	
Archaeology and cultural heritage	C ROW Clearance, D ROW Preparation, E Trenching.	Known and presumed sites along the ROW.	Grading and trenching activities could adversely impact the sites of archaeological interest.	The proposed mitigation measure is 16.	No.	

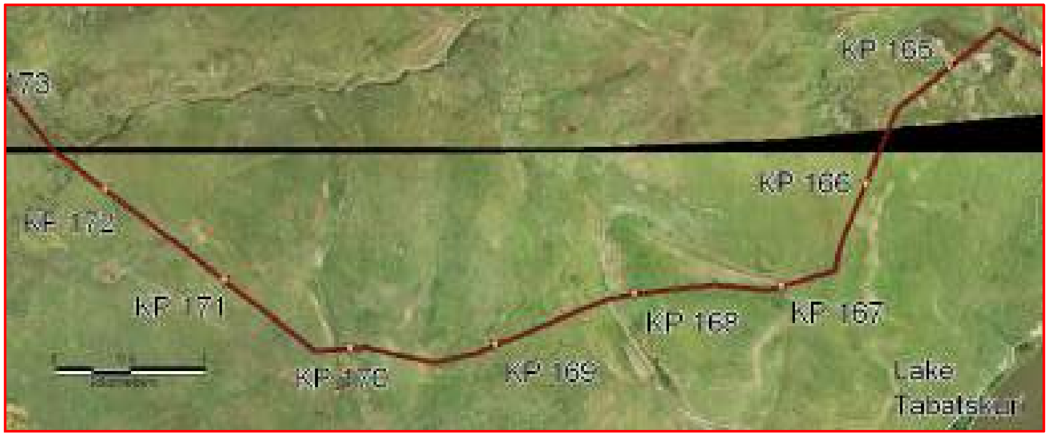
KPs 160-165: Tabatskuri lake

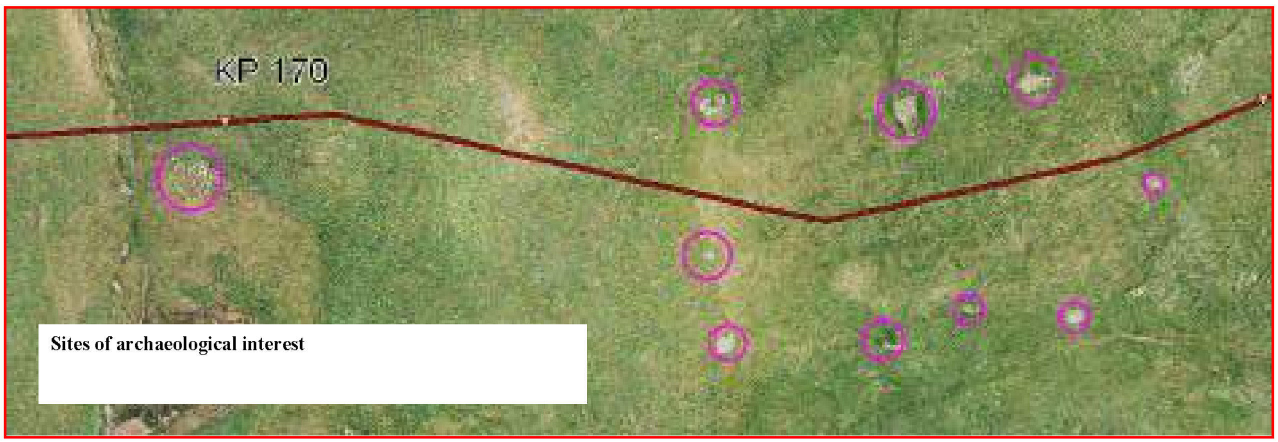


Environmental Receptors affected and key issues	Project Activity	Environmental Aspects	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, P AGI and Facilities Construction, M Hydrotesting, Q Waste Generation.	Lake Tabatskuri is located approximately 1km to the South of the ROW. The Lake will likely be used for abstraction and potentially discharge of hydrotest water. Lake Tabatskuri is an important surface water body. It acts as a buffer reservoir for a large drinking water aquifer and provides a habitat for fish and avian fauna. Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality of the Lake through the release of suspended solids or other contaminants. b) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater. c) Hydrotest water will be abstracted from and discharged to the Lake and there may therefore be a potential impact on water resource quantity and quality. d) Discharges of sanitary wastewater from BV-GB16 construction site could also potentially affect local surface water quality.	For impact "a" the proposed mitigation measures are 8, 9 and 11. For impact "b" the proposed mitigation measures are 13 and 22. For impact "c" the proposed mitigation measures are 9 and 10. For impact "d" the proposed mitigation measure is 9.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, M Hydrotesting.	The ecological issues of significance in this unit are associated with Lake Tabatskuri and the Ktsia wetland (KP 165), along with the terrestrial and avian wildlife that use these areas as a temporary habitat. The unit is within the Ktsia Tabatskuri Managed Reserve.	a) Deterioration of surface water quality in the lake or in the wetland may have negative impacts on freshwater ecology. b) Hydrotest water will be abstracted from and discharged to lake Tabatskuri and this may have potential adverse impacts to the freshwater ecosystems.	For impact "a" the proposed mitigation measures are 6, 7 and 8. For impact "b" the proposed mitigation measure is 10.	b) Reduction on the integrity of nationally important habitat, score 4. The likelihood of the residual impact, degradation of the water quality is unlikely but may occur, score 2 for likelihood.	2 x 4 = 8 (Low)
Noise and vibrations	E Trenching, O Horizontal boring, P AGI and Facilities Construction.	Human receptors are located at KP 163.6-164.5, Village (low density) (535 m). Faunal receptors include the groups mentioned above (Ecology).	Impacts associated with noise emissions in this unit include short-term disturbance of human and faunal populations present in the area.	The proposed mitigation measure is 19.	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied	3 x 5 = 15 (Medium)
Air Quality	n.a.	No human receptors.	n.a.	n.a.	n.a	
Soil	n.a.	The land is used predominantly for grazing and therefore no issue s of significance are associated with this.	n.a.	n.a.	No.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste	The area has a high landscape value and is highly intrusive.	Ball Valve GB16 and pipeline construction activities will result in short-term visual intrusion.	The proposed mitigation measure is 15.	Many receptors experiencing a minor change in view,	3 x 5 = 15 (Medium)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspects	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
	Generation.				Score 3, medium. Visual intrusion will occur during construction (Score 5, certain).	
Contamination of land	L Fuelling, Q Waste Generation.	Groundwater sensitivity associated with Lake Tabatskuri.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	D ROW Preparation, E Trenching, P AGI and Facilities Construction.	There are a number of known sites of archaeological interest and it is therefore possible that chance finds are encountered whilst trenching in this area.	Grading and trenching activities could adversely impact the sites of archaeological interest.	The proposed mitigation measure is 16.	No.	

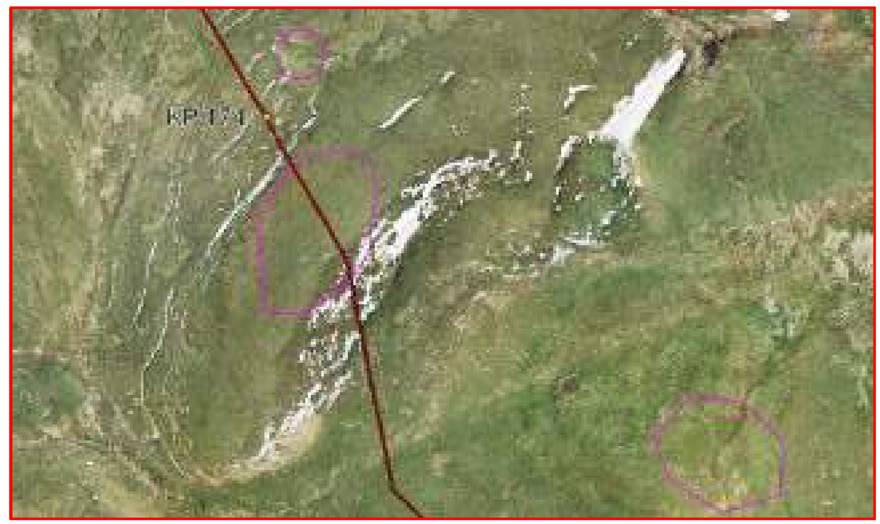
KPs 165-172: Ktsia Ridge





Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, M Hydrotesting, Q Waste Generation.	The proximity to Lake Tabatskuri is as significant as in the previous unit. A drinking water groundwater aquifer outcrops in the area and several springs are located in the proximity of the ROW.	a) All activities listed have the potential to deteriorate surface water quality of the Lake through the release of suspended solids or other contaminants. b) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater. c) Hydrotest water will be abstracted from and discharged to the Lake and there may therefore be a potential impact on water resource quantity and quality.	For impact "a" the proposed mitigation measures are 8, 9 and 11. For impact "b" the proposed mitigation measures are 13 and 22. For impact "c" the proposed mitigation measures are 9 and 10.	No.	n.a.
Ecology (Flora, Fauna, biodiversity)		With the exception of Lake Tabatskuri (addressed in previous unit) the unit does not have issues of ecological significance. The unit is within the Ktsia Tabatskuri Managed Reserve.	n.a.	n.a.	n.a.	n.a.
Noise and vibrations	E Trenching, O Horizontal boring.	No human receptors are present in this area. No significantly vulnerable wildlife receptors are present in this area.	n.a.	n.a.	n.a.	n.a.
Air Quality	n.a.	Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a	n.a.
Soil	C ROW Clearance, D ROW Preparation, I Final Reinstatement.	Steep slopes between KP 165 and 169.	The steepness of the ground between KP 165 and 169 may trigger erosive processes.	The proposed mitigation measures are 3, 11 and 12.	No.	n.a.
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, Q Waste Generation.	Steep slopes between KP 165 and 169 will require erosion control terracing and change in topography.	a) Pipeline construction activities will result in short-term visual intrusion. b) Due to the steep slope, the restoration of pre-existing topography will be difficult and the presence of erosion control features will have detrimental effects on the overall appearance of the site.	For impact "a" the proposed mitigation measure is 15. For impact "b" the proposed mitigation measures are 3 and 11.	a) Few receptors experiencing a minor change in view, Score 2. This residual impact will occur, score 5 for likelihood. b) An intensive and permanent change in landscape in a small area. Score 3, medium This residual impact will occur, score 5 for likelihood.	a) 5 x 2 = 10 (Medium) b) 5 x 5 = 25 (High)
Contamination of land	L Fuelling, Q Waste Generation.	Proximity to Lake Tabatskuri is covered in previous unit. Groundwater aquifer of high potable value is present in the area.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No	
Archaeology and cultural heritage	D ROW Preparation, E Trenching.	There are a number of known sites of archaeological interest and it is therefore possible that chance finds are encountered whilst trenching in this area.	Grading and trenching could adversely impact the sites of archaeological interest.	The proposed mitigation measures are 16. Three known sites will be part of the agreed Archaeological management strategy and will be studied in detail prior to commencement of the construction activities.	Beneficial impact would occur as a result of the investigations and subsequent preservation of the archaeological sites.	

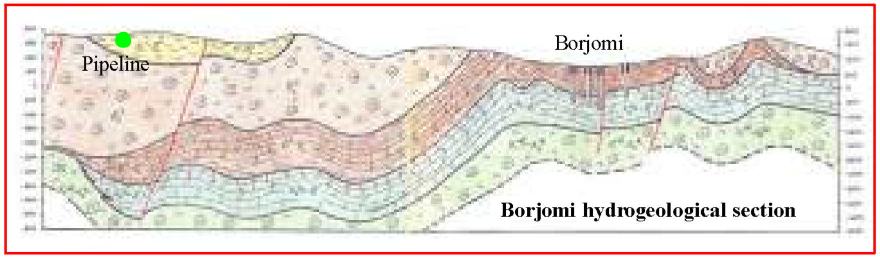
KPs 172-175.5: R. Ktsia upper reaches

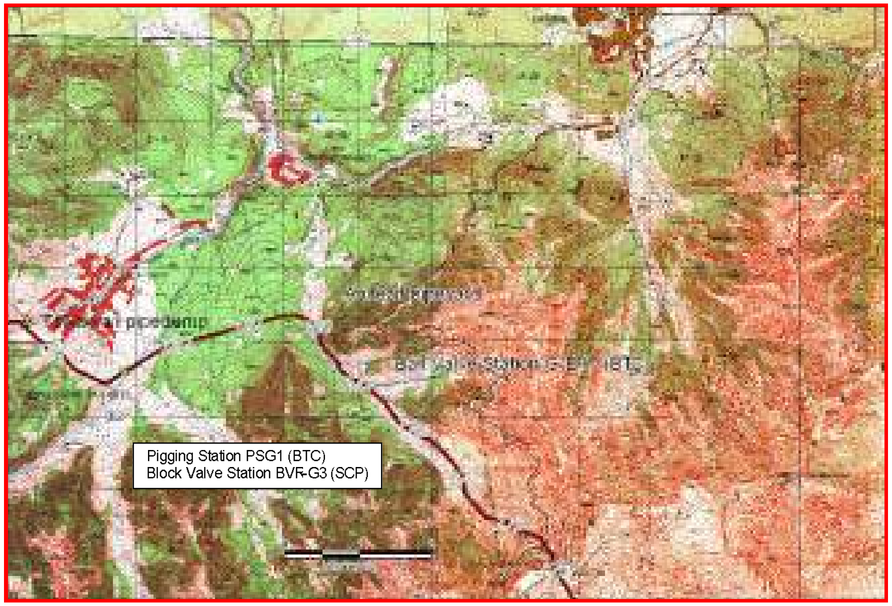


Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, M Hydrotesting, Q Waste Generation.	This unit is characterised by the crossing of the upper Ktsia valley, with the river crossing located at KPs 172.8. A drinking water groundwater aquifer outcrops in the area and several springs are located in the proximity of the ROW.	a) All activities listed have the potential to deteriorate surface water quality at the Ktsia River crossing. Deterioration of water quality would be the direct result of the release of suspended solids to the Ktsia River during crossing construction and during construction on the steep valley flanks. b) Spill of fuel or other liquid waste from the construction activities could result in contamination of the Ktsia and Narianis Veli wetlands, downstream of the river or of groundwater. c) Should hydrotest water be discharged to the Ktsia River there may be a potential impact on the river's hydraulic regime.	For impact "a" the proposed mitigation measures are 8, 10 and 11. For impact "b" the proposed mitigation measures are 9, 13 and 22. For impact "c" the proposed mitigation measure is to avoid discharge of hydrotest water to the Ktsia river.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching, G Backfilling.	The issues of ecological significance in this area are associated to the indirect impacts to the wetlands downstream of the Ktsia crossing (addressed above) and faunal sensitivity both in the wetlands and in the general area covered by this unit. Sensitive species occurring in this unit include Weasel (*Mustela nivalis*), Fox (*Vulpes vulpes*), Brown bear (*Ursus arctos*), Badger (*Meles meles*) and Wolf (*Canis lupus*) that come down at snowmelt to the Ktsia valley and to the wetlands for food. The unit is within the Ktsia Tabatskuri Managed Reserve.	Disturbance to faunal species could occur as a result of the listed activities.	The proposed mitigation measures are 6 and 7.	Reduction in integrity of regionally (in the country context) important habitats, score 3. This residual impact may occur but is improbable score 2 for likelihood.	3 x 2 = 6 (Low)
Noise and vibrations	D ROW Preparation, E Trenching.	Wildlife receptors are present in this area.	Impacts associated with noise emissions in this unit will consist of short-term disturbance of faunal populations present in the area.	The proposed mitigation measure is 19.	Disturbance of species behaviour discernable using standard techniques, score 2 for consequence. The residual impact is very likely to occur, score 4.	2 x 4 = 8 (Low)
Air Quality	n.a.	Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a	
Soil	C ROW Clearance, D ROW Preparation.	Steep slopes between KPs 174 and 175.5	The steepness of the ground between KP 174 and 175.5 may trigger erosive processes.	The proposed mitigation measures are 3, 11 and 12.	No.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, Q Waste Generation.	Steep slopes between KPs 174 and 175.5 High landscape value and high visual intrusion.	a) Pipeline construction activities will result in short-term visual intrusion. b) Due to the steep slope, the restoration of pre-existing topography will be difficult and the presence of erosion control features will have detrimental effects on the overall appearance of the site.	Fort both impacts the proposed mitigation measure is 15.		
Contamination of land	L Fuelling, Q Waste Generation.	Sensitive drinking water aquifer in the unit area.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Archaeology and cultural heritage	D ROW Preparation, E Trenching.	There are a number of known sites of archaeological interest and it is therefore possible that chance finds will be encountered whilst trenching in this area.	Grading and trenching could have an adverse impact on sites of archaeological interest.	The proposed mitigation measure is 16.	No..	

KPs 175.5-180.6: Tkhratskharo pass



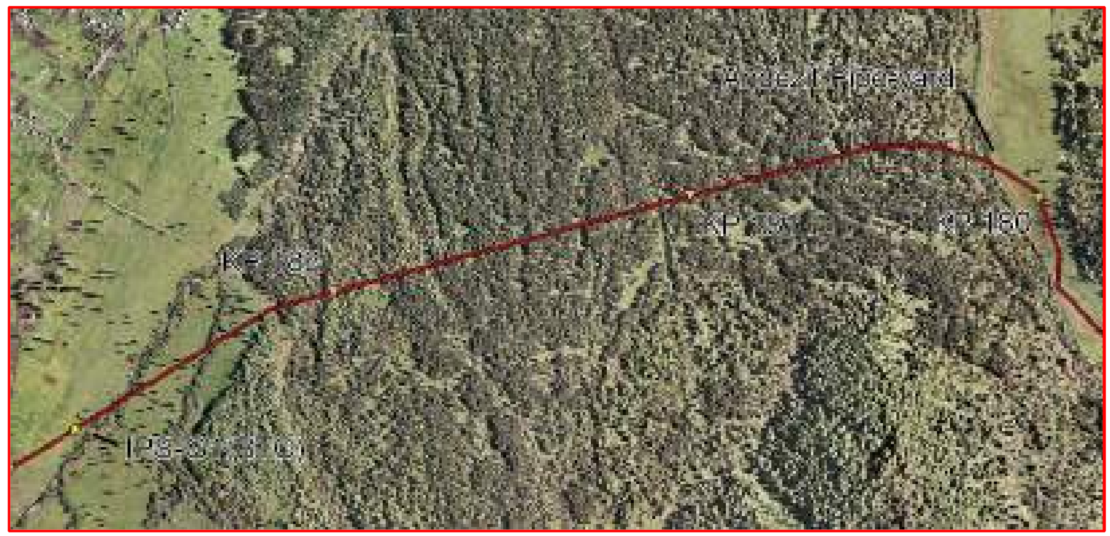


Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, L Fuelling, O Horizontal boring, Q Waste Generation.	Surface water crossings at: KP 176.5, Stream; KP 177.4, Stream; KP 178.0, Stream; KP 178.1, Stream; KP 178.8, Stream; KP 179.1, Stream; KP 179.9, Stream. This unit is within the catchment of the Borjomola river that flows through the Borjomi Mineral water park. Within the Borjomola catchment there are also fresh water springs used for domestic and commercial use that outcrop at lithological discontinuities. The area is within Sanitation Zone III of the Borjomi Mineral Water field. Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality of streams and ephemeral watercourses. Deterioration of water quality would be the direct result of the release of suspended solids or contaminants during crossing construction. b) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater. c) Discharges of sanitary wastewater from BV-GB17 construction site could also potentially affect local surface water quality.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measures are 13 and 22. For impact "c" the proposed mitigation measure is 9.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	Patches of dense crook-stem forest of rowan (*Sorbus caucasigena*) dominated communities. This unit is characterised by the presence of sparse scrub vegetation with endemic squill (*Scilla rosenii*) and gentian (*Gentiana angulosa*) and high mountain meadow vegetation with abundant biodiversity. The area is regarded as a sensitive wildlife habitat with regard to both avian and terrestrial species. The unit is within the Buffer Zone of the Borjomi National Park.	The clearance of the ROW will cause the loss of patches of rowan dominated communities and high-mountain meadows. Construction activities will also potentially impact the populations of endemic squill and gentian.	The proposed mitigation measures are 1, 2, 3, 4, 6 and 7. .	Reduction in integrity of regionally (in the country context) important habitats, score 3. There is certain (Score 5) that there will be loss of some communities of rowan.	3 x 5 = 15 (Medium)
Noise and vibrations	E Trenching, O Horizontal boring, P AGI and Facilities Construction.	Wildlife receptors are abundant in this area.	Impacts associated with noise emissions in this unit will consist of short-term disturbance of faunal populations present in the area.	The proposed mitigation measure is 19.	Disturbance of species behaviour discernable using standard techniques, score 2 for consequence. The residual impact is very likely to occur, score 4.	2 x 4 = 8 (Low)
Air Quality		Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a	
Soil	C ROW Clearance, D ROW Preparation, P AGI and Facilities Construction.	High biodiversity in high mountain meadow communities. Steep slopes between KP175.5 and 178.	a) Steep slopes may trigger erosive processes. b) The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure. This will result in a loss of	For impact "a" the proposed mitigation measures are 3 and 11. For impact "b" the proposed mitigation measures are 3, 11 and 12.	b) Impact is largely not discernable. Score 1, very low. Impact is certain (Score 5).	1 x 5 = 5 (Low)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
			biodiversity within the ROW.			
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, F Pipelaying, G Backfilling, H Temporary Reinstatement, Q Waste Generation.	Steep slopes between KP175.5 and 178High landscape value, high visual intrusion.	a) Pipeline and Ball Valve GB17 construction activities will result in short-term visual intrusion. b) Due to the steep slope, the restoration of pre-existing topography will be difficult and the presence of erosion control features will have detrimental effects on the overall appearance of the site.	The proposed mitigation measure for both impacts is 15.	a) Few receptors experiencing a minor change in view, Score 2, low. This residual impact will occur, score 5 for likelihood. b) An intensive and permanent change in landscape, score 5 for consequence. This residual impact will occur, score 5 for likelihood.	a) 2 x 5 = 10 (Medium) b) 5 x 5 = 25 (High)
Contamination of land	L Fuelling, Q Waste Generation.	Sensitive surface and groundwater.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measuresare 13 and 22.	No.	
Archaeology and cultural heritage		No sensitive archaeological issues occur in this area.	n.a.	n.a.	n.a.	

KPs 180.6-183.3: Tsikisjvari forest

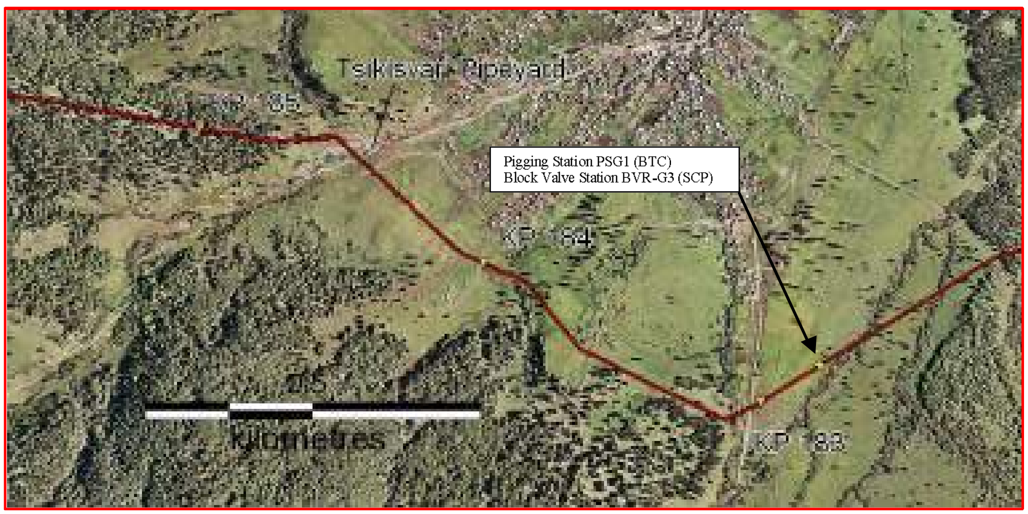
Landscape simulation of ROW after final reinstatement



Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual Impacts
Water Resources (Surface and Groundwater	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, P AGI and Facilities Construction, Q Waste Generation.	Stream crossings at: KP 180.7, Stream KP 181.7, Stream This unit is within the catchment of the Borjomola river that flows through the Borjomi Mineral water park. Within the Borjomola catchment there are also fresh water springs used for domestic and commercial use that outcrop at lithological discontinuities. The unit is within Sanitation Zone III of the Borjomi Mineral Water field Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality of the system of small streams and ephemeral watercourses in the forest. Deterioration of water quality would be the direct result of the release of suspended solids or other contaminants to surface water courses. b) Discharges of sanitary wastewater from the Intermediate Pigging Station IPG1 construction site could also potentially affect local surface water quality. c) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation is 9. For impact "c" the proposed mitigation measures are 13 and 22.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	The area is characterised by a continuous section of primary forest dominated by pine (*Pinus sylvestris*) and beech (*Fagus orientalis*) with admixture of hornbeam (*Carpinus caucasica*). The forest has a very high conservation value. The forest is important habitat for large and medium-sized mammals such as Wolf (*Canis lupus*); Brown bear (*Ursus arctos*); Fox (*Vulpes* vulpes); Hare (*Lepus europeaus*); Marten (*Martes sp.*), Wild cat (*Felis silvestris*), Lynx (*Felis* (*Lynx*) *lynx*) and Roe deer (*Capreolus capreolus*). The listed activities will also impact the populations of birds including those of Corncrake (*Crex crex*), a globally threatened species and black grouse (*Tetrao mlokosiewiczi*) - endemic of the Caucasus. The habitat also supports a number of Georgian Red Data Book and endemic species of amphibians and reptiles such as Caucasian salamander (Mertensiella caucasica), Banded newt (*Triturus vittatus*), toad (*Bufo verrucossimus*); Viper (*Vipera kaznakovi*). The unit is within the Buffer Zone of the Borjomi National Park.	The clearance of the ROW in forest areas will cause the permanent loss of the forest habitat within the ROW and the fragmentation of a marginal forest habitat. This could have adverse impacts on the large mammals populations that are known to be present in this area and on the amphibians and reptiles also present in the area.	The proposed mitigation measures are 1, 2, 3, 5, 6 and 7.	Disruption of behaviour or interactions of nationally important species, score 4. Construction will result in loss of forest, score 5, certain.	4 x 5 = 20 (High)
Noise and vibrations	E Trenching, O Horizontal boring, P AGI and Facilities Construction.	The area is characterised by sensitive wildlife receptors.	Impacts associated with noise emissions in this unit will consist of short-term disturbance of faunal populations present in the area.	The proposed mitigation measure is 19.	Disturbance of species behaviour discernable using standard techniques, score 2 for consequence. The residual impact is very likely to occur, score 4.	2 x 4 = 8 (Low)
Air Quality	n.a.	Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a	
Soil	C ROW Clearance, D ROW Preparation, P AGI and Facilities Construction.	Forest and high mountain meadows with high biodiversity.	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility	The proposed mitigation measures are 3, 11 and 12.		

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual Impacts
			of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure. This will have the effect of decreasing the biodiversity in the meadows and the forest after reinstatement of the ROW.			
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, H Temporary Reinstatement, Q Waste Generation	High landscape value and high visual intrusion.	a) Pipeline and IPS construction activities and the operation of the pipe storage yards will result in short-term visual intrusion. b) The clearance and partial restoration of the ROW in the forest areas will result in the permanent modification of the landscape in this unit.	For impacts “a” and “b” the proposed mitigation measure is 15.	a) Few receptors experiencing a minor change in view, Score 2, low. This residual impact will occur, score 5. b) An intensive and permanent change in landscape. Score 5, very high l This residual impact will occur, score 5.	a) 2 x 5 = 10 (Medium) b) 5 x 5 = 25 (High)
Contamination of land	L Fuelling, Q Waste Generation.	Sensitive surface and groundwater in this area.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	n.a.	No sensitive archaeological issues occur in this area.	n.a.	n.a.	n.a.	

KPs 183.3-185.2: Tsikisjvari outskirts



Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, O Horizontal boring, L Fuelling, Q Waste Generation.	Stream crossing are located at: KP 182.8, Stream; KP 183.1, Stream; KP 183.6, Canal; KP 183.6, Stream; KP 184.4, Stream; KP 185.0, Stream. This unit is within the catchment of the Borjomola river that flows through the Borjomi Mineral water park. The area is within Sanitation Zone III of the Borjomi Mineral Water field	a) All activities listed have the potential to deteriorate surface water quality at crossing and ephemeral watercourses. b) Spill of fuel or other liquid waste from the construction activities could also result in contamination of surface water.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measures are 13 and 22.	No.	
Ecology (Flora, Fauna, biodiversity)	n.a.	The area is characterised by the presence of degraded meadows of low conservation value. Due to proximity with the town of Tsikisjvari the wildlife sensitivity in this area is reduced. The unit is within the Buffer Zone of the Borjomi National Park.	n.a.	n.a.	n.a.	
Noise and vibrations	A Haulage, D ROW Preparation, E Trenching.	Human receptors at: KP 184.7-185.3, Village (123 m).	Impacts associated with noise emissions in this unit include short-term disturbance of human populations present in the area.	The proposed mitigation measure is 19.	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied.	3 x 5 = 15 (Medium)
Air Quality	A Haulage, C ROW Clearance, D ROW Preparation, E Trenching, G Backfilling.	Human receptors at KP 184.7-185.3, Village (123 m).	Impacts associated with air quality relate to dust impacts on human receptors arising from construction activities.	The proposed mitigation measures are 17 and 18.	No.	
Soil		No significant soil erosion or fertility issues affect this area.	n.a.	n.a.	n.a.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, Q Waste Generation	High landscape value	Pipeline construction activities will result in short-term visual intrusion.	The proposed mitigation measure is 15.	Many receptors experiencing a minor change in view, Score 3, low. The residual impact will occur, score 5.	3 x 5 = 15 (Medium)
Contamination of land	n.a.	No sensitive groundwater aquifers outcrop in this area. The potential for surface water	n.a.	n.a.	n.a.	

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
		contamination is addressed above (water resources).				
Archaeology and cultural heritage	n.a.	No sensitive archaeological issues occur in this area.	n.a.	n.a.	n.a.	

KP 185.2-197: Kodiana

Gentiana angulosa

Scilla rosenii

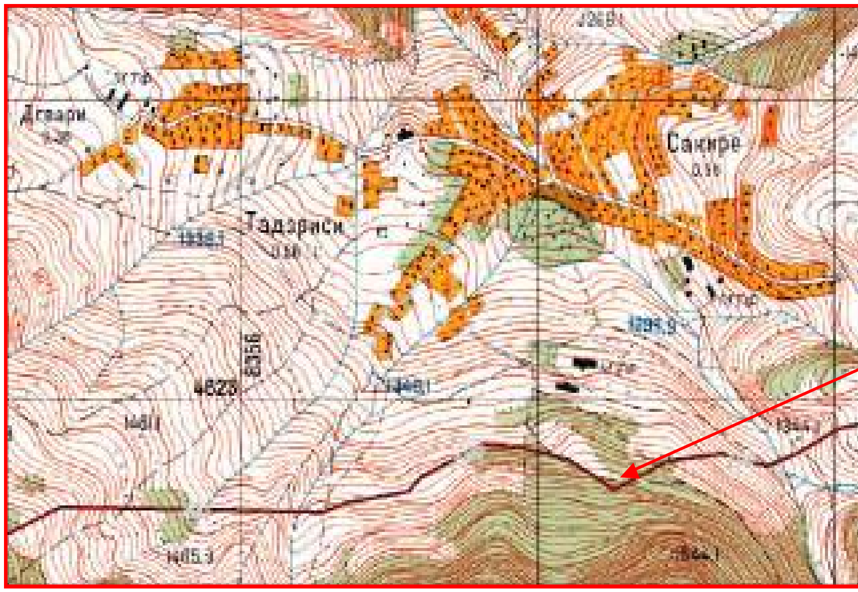
Pinus sylvestris

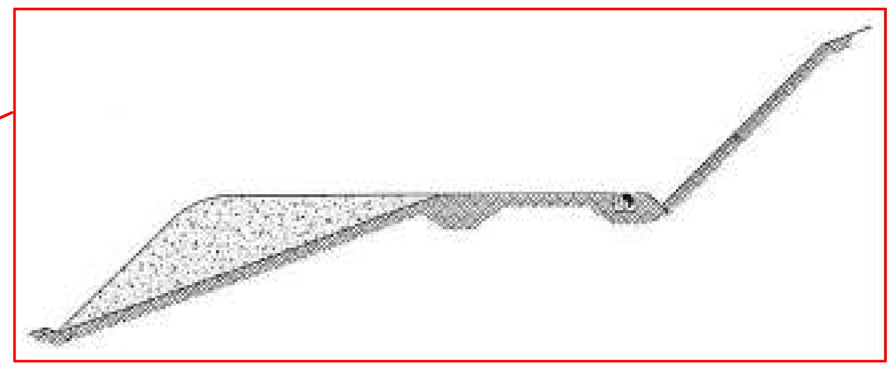
Pyrus caucasica

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater).	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, L Fuelling, O Horizontal boring, Q Waste Generation.	Stream crossing are located at: KP 189.5, Stream; KP 190.0, Stream; KP 191.2, Stream; KP 191.4, Stream; KP 194.1, Stream; KP 194.7, Stream; KP 195.3, Stream. Construction sites will generate sanitary effluent. The area is within Sanitation Zone III of the Borjomi Mineral Water field	a) All activities listed have the potential to deteriorate surface water quality of the system of small streams and ephemeral watercourses in the forest. Deterioration of water quality would be the direct result of the release of suspended solids or other contaminants to surface water courses. b) Spill of fuel or other liquid waste from the construction activities could result in contamination of groundwater. c) Discharges of sanitary wastewater from the Check Valve GC18 and Ball Valve GB19 could also potentially affect local surface water quality.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measures are 13 and 22. For impact "c" the proposed mitigation measure is 9.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	The area is characterised by important fragments of forest dominated by pine (*Pinus sylvestris*) and beech (*Fagus orientalis*) with admixture of hornbeam (*Carpinus caucasica*), birch (*Betula pendula*) and pear (*Pyrus caucasica*). The following endemic species are also found in the area: squill (*Scilla rosenii*), gentian (*Gentiana angulosa*) and snowdrop (*Galanthus caucasicus*). The forest is an important habitat for large and medium-sized mammals such as Wolf (*Canis lupus*); Brown bear (*Ursus arctos*); Fox (*Vulpes vulpes*); Hare (*Lepus europeaus*); Marten (*Martes sp.*), Wild cat (*Felis silvestris*), Lynx (*Felis (Lynx) lynx*) and Roe deer (*Capreolus capreolus*). Avian fauna is also represented in this unit with the Corncrake (*Crex crex*), a globally threatened species and black grouse (*Tetrao mlokosiewiczi*) - endemic of the Caucasus. The habitat also supports a number of Georgian Red Data Book and endemic species of amphibians and reptiles such as Caucasian salamander (*Mertensiella caucasica*), Banded newt (*Triturus vittatus*), toad (*Bufo verrucossisimus*); Viper (*Vipera kaznakovi*). The unit is within the Buffer Zone of the Borjomi National Park.	Clearance of the ROW will cause permanent loss of the forest within the ROW and potential fragmentation of associated habitat. This could in turn have adverse impacts on the wildlife that is known to be present in the area.	The proposed mitigation measures are 1, 2, 3, 5, 6 and 7. .	Disruption of behaviour or interactions of nationally important species, score 4. Construction will result in loss of forest, score 5, certain.	4 x 5 = 20 (High)
Noise and vibrations	D ROW Preparation, E Trenching, P AGI and Facilities Construction.	Sensitive wildlife habitat (see above).	Impacts associated with noise emissions in this unit will consist of short-term disturbance of faunal populations present in the area.	The proposed mitigation measure is 19.	Disturbance of species behaviour discernable using standard techniques, score 2 for consequence. The residual impact	2 x 4 = 8 (Low)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
					is very likely to occur, score 4.	
Air Quality		Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a	
Soil	C ROW Clearance, D ROW Preparation, P AGI and Facilities Construction.	Forest and high mountain meadows with abundant biodiversity.	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure. This will have the effect of decreasing the biodiversity in the meadows and the forest after reinstatement of the ROW.	The proposed mitigation measures are 3, 11 and 12.	Impact largely not discernable. Score 1, very low. The likelihood of this impact is certain.	1 x 5 = 5 (Low)
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, H Temporary Reinstatement, Q Waste Generation.	High landscape value and high visual intrusion A very deep trench (>6m) is required in this area to avoid unstable land. This may necessitate a wider ROW.	a) Pipeline, Check Valve GC18 and Ball Valve GB19 construction activities may result in temporary visual intrusion. b) Clearance and partial restoration of the ROW in the forest as well as restoration of the deep trench will result in the permanent modification of the landscape in this unit.	The proposed mitigation measure is 15.	a) Many receptors experiencing a minor change in view, Score 3, moderate. Likelihood is certain (score 5) b) Reinstatement in the area of deep trenching will result in a permanent modification of the landscape. Score 5, high. The likelihood of clearance of forest fragments is certain, score 5.	a) 3 x 5 = 15 (Medium) b) 5 x5 = 25 (High)
Contamination of land	L Fuelling, Q Waste Generation.	No groundwater aquifers outcrop in this area.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	n.a.	
Archaeology and cultural heritage	n.a.	No sensitive archaeological issues occur in this area.	n.a.	n.a.	n.a.	

KPs 197-204: Sakire outskirts

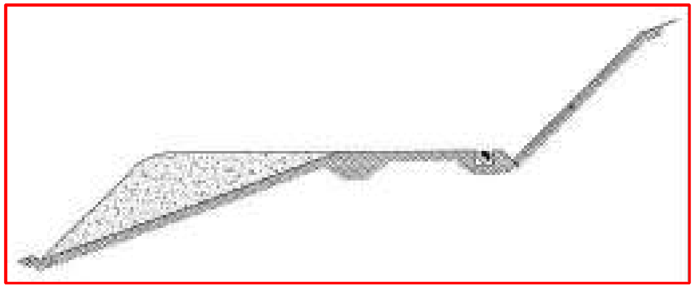




Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, Q Waste Generation.	Stream crossings are located at: KP 198.0, Stream; KP 199.8, Stream; KP 200.1, Stream; KP 203.3, Stream. The area is within Sanitation Zone III of the Borjomi Mineral Water field	a) All activities listed have the potential to deteriorate surface water quality at crossing and ephemeral watercourses. Deterioration of water quality would be the direct result of the release of suspended solids or other contaminants to the streams. b) Spill of fuel or other liquid waste from the construction activities could result in contamination of groundwater.	For impact "a" the proposed mitigation measures are 8, 10, 11 and 12. For impact "b" the proposed mitigation measures are 13 and 22.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching.	This unit is characterised primarily by agricultural land, alpine meadows and grazing pasture. Few fragments of forest are located on the ROW. The species and significance of the limited forest habitats are as per the previous unit. The unit is within the Buffer Zone of the Borjomi National Park.	The clearance of the ROW in forest areas will cause the permanent loss of the forest within the ROW. This could in turn have adverse impacts on the wildlife that is known to be present in this area.	The proposed mitigation measures are 1, 2, 3, 5, 6 and 7. .	Disruption of behaviour or interactions of nationally important species, score 4. Construction will result in loss of forest, score 5, certain.	4 x 5 = 20 (High)
Noise and vibrations	E Trenching, O Horizontal boring.	Human receptors at: KP 197.8-199.8, Village (Sakire) (124 m).	Impacts associated with noise emissions in this unit include short-term disturbance of human and faunal populations present in the area.	The proposed mitigation measure is 19.	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied.	3 x 5 = 15 (Medium)
Air Quality	A Haulage, C ROW Clearance, D ROW Preparation, E Trenching, G Backfilling.	Air quality receptors located at the Sakire village.	Impacts associated with air quality relate to dust impacts on human receptors arising from construction activities.	The proposed mitigation measures are 17 and 18.	No.	
Soil	C ROW Clearance, D ROW Preparation.	The unit includes fertile agricultural land and forest soils that support a high biodiversity of understorey species.	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure.	The proposed mitigation measures are 3, 11 and 12.	Soil will be stockpiled, leading to impoverishment. Impact largely not discernable. Score 1, very low. The likelihood of the impact is certain (Score 5).	1 x 5 = 5 (Low)
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, H Temporary Reinstatement, Q Waste	High landscape value and high visual intrusion.	a) Pipeline construction activities will result in short-term visual intrusion.	For impacts "a" , "b" and "c" the proposed mitigation measure is 15.	a) Many receptors experiencing a minor change in view, Score	a) 3 x 5 = 15 (Medium)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
	Generation.	The pipeline ROW lies on a side slope for approximately 1km.	b) The clearance and partial restoration of the ROW in the forest areas will result in the permanent modification of the landscape in this unit. c) Side benching will be required in the side slope at KP 199 to 200 and the ROW will not be reinstated to its original topography.		3, moderate. Likelihood is certain (score 5). b and c) An intensive and permanent change in landscape. Score 5, very high. Likelihood is certain (score 5).	b) 5 x 5 = 25 (High) c) 5 x 5 = 25 (High)
Contamination of land	L Fuelling, Q Waste Generation.		The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No	
Archaeology and cultural heritage	D ROW Preparation, E Trenching.	The western part of this unit includes sites of archaeological interest and it is therefore possible that chance finds are encountered whilst trenching in this area.	Grading and trenching could have an adverse impact on sites of archaeological interest.	The proposed mitigation measure is 16. One site located in the proximity of Sakire will be part of the agreed Archaeological management strategy and will be studied in detail prior to commencement of the construction activities.	Beneficial impact would occur as a result of the investigations and subsequent preservation of the medieval archaeological site.	

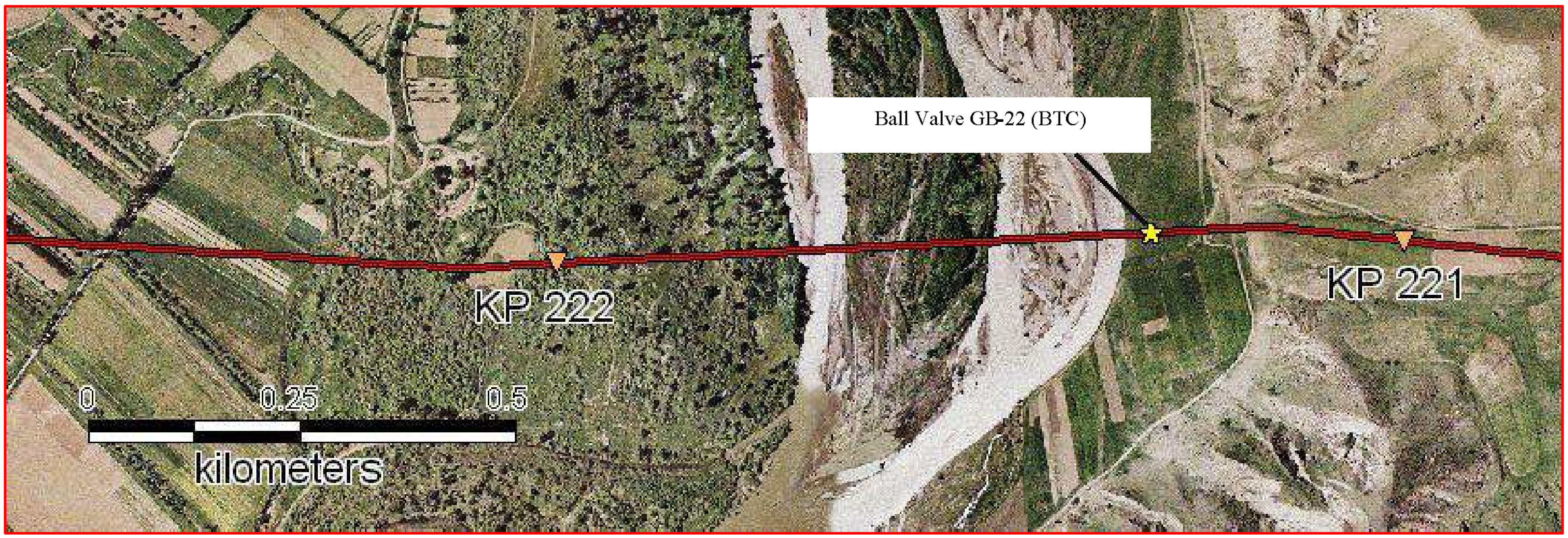
KPs 204-221: Tiseli – Mtkvari



Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, P AGI and Facilities Construction, Q Waste Generation.	Surface water courses are located at: KP 205.3, Stream; KP 206.0, Stream; KP 210.6, Stream; KP 211.1, Stream; KP 212.7, Stream; KP 213.5, Stream; KP 214.0, Stream; KP 214.4, Stream; KP 217.8, Stream. In addition, the proposed ROW is located approximately 200m from the R. Mtkvari right bank at KP 212.8. Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality at stream crossings and when work is in the proximity of the Mtkvari floodplain.. Deterioration of water quality would be the direct result of the release of suspended solids or other contaminants to the stream/river. b) Discharges of sanitary wastewater from BV GB20 and BV-GB21 construction site could also potentially affect local surface water quality. c) Spill of fuel or other liquid waste from the construction activities could result in contamination of groundwater.	For impact “a” the proposed mitigation measures are 8 and 11. For impact “b” the proposed mitigation measure is 9. For the impact “c” the proposed mitigation measures are 13 and 22.	No.	
Ecology (Flora, Fauna, biodiversity)		No significant ecological issues occur in this area.	n.a.	n.a.	n.a.	
Noise and vibrations	D ROW Preparation, E Trenching, O Horizontal boring, P AGI and Facilities Construction.	Human receptors at: KP 205.2, Houses (492 m); KP 209.3-211.8, Village (low density) (320 m); KP 213.6-215.1, Village (321 m).	Impacts associated with noise emissions in this unit consist of short-term disturbance of human receptors present in the area.	The proposed mitigation measure is 19.	Predicted residual noise levels will exceed the “High” criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied.	3 x 5bb = 15 (Medium)
Air Quality		Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a	
Soil	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction.	Agricultural land use in part of this unit.	Topsoil removal and stockpiling will result in decreased productivity of the soil.	The proposed mitigation measure is 12.	n.a.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste Generation.	Landscape of medium value.	Pipeline, Ball Valve GB20 and GB21 construction activities will result in visual intrusion and landscape impact.	The proposed mitigation measure is 15.	Many receptors would experience a moderate change in view, Score 3, moderate. The likelihood of the impact is certain (score 5).	3 x 5 = 15 (Medium)
Contamination of land	P AGI and Facilities Construction, Q Waste Generation.	No significant groundwater aquifers outcrop in this area.	n.a.	n.a.	n.a.	

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Archaeology and cultural heritage	D ROW Preparation, E Trenching, P AGI and Facilities Construction.	This unit includes sites of archaeological interest and it is therefore possible that chance finds are encountered whilst trenching in this area.	Grading and trenching could have an adverse impact on sites of archaeological interest.	The proposed mitigation measure is 16.	No.	

KPs 221-222.5: Mtkvari West crossing

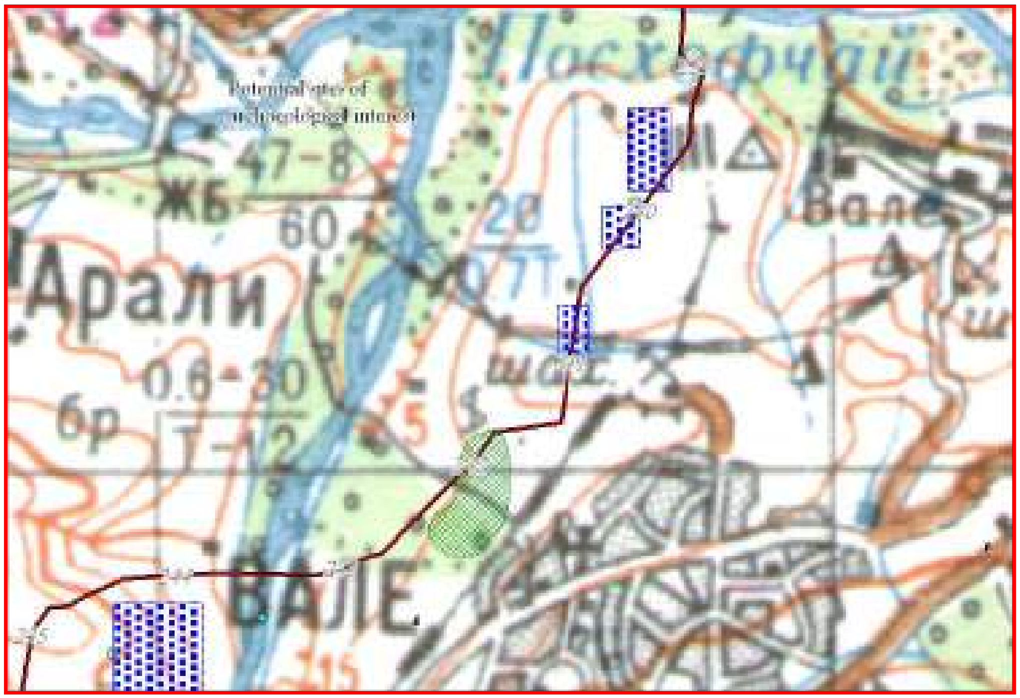


Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, O Horizontal boring, P AGI and Facilities Construction, M Hydrotesting, Q Waste Generation.	The crossing of the river Mtkvari, (Width of floodplain approximately 650m) is the only sensitive issue in this area. The river crossing will be constructed with open cut technique. A shallow groundwater aquifer is present within the floodplain of the R. Mtkvari. Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality of the Mtkvari river. Deterioration of water quality would be the direct result of the release of suspended solids or other contaminants b) Spill of fuel or other liquid waste from the construction activities could result in contamination of groundwater. c) Discharges of sanitary wastewater from BV GB22 construction site could also potentially affect local surface water quality.	For impact “a” the proposed mitigation measures are 8 and 11. For impact “b” the proposed mitigation measures are 13 and 22. For impact “c” the proposed mitigation measure is 9.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, P AGI and Facilities Construction, M Hydrotesting.	The banks of the river, the left bank in particular, are characterised by riparian vegetation of medium to high conservation value. The species present in the area include willows (*Salix alba*, *S. triandra*), poplar (*Populus nigra*) and alder (*Alnus barbata*). Additional sensitive issues include the presence of fish in the Mtkvari river and the presence of breeding and migratory birds within the floodplain.	a) The river crossing construction will result in the loss of riparian habitat for an overall width of approximately 100m. The habitat will be permanently lost within the immediate vicinity (5m either side) of the installed pipeline b) Hydrotest water may be abstracted from and discharged to the R. Mtkvari with potential impacts to ichthyofauna if the discharge takes place during the spawning season.	For impact “a” the proposed mitigation measures are 1, 2, 3 and 6. For impact “b” the proposed mitigation measure is 10.	a) Reduction in integrity of regionally (in the country context) important habitat, score 3. The riparian habitat will be lost (Score 5, certain). b) Disruption to species discernable using standard techniques, score 2. This residual impact is unlikely Score 2.	a) 3 x 5 = 15 (Medium) b) 2 x 2 = 4 (Low)
Noise and vibrations	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	The riparian habitat supports avian and terrestrial wildlife.	Impacts associated with noise emissions in this unit will consist of short-term disturbance of avian fauna populations present in the riparian habitats.	The proposed mitigation measures are 6, 7 and 19.	Disruption to species discernable using standard techniques, score 2. This residual impact is very likely to occur, score 4.	2 x 4 = 8 (Low)
Air Quality	n.a.	Not applicable because no human receptors are located in this area.	n.a.	n.a.	n.a.	
Soil	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	Fertile soils in the riparian forest support high biodiversity.	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure.	The proposed mitigation measures are 3 and 12.	The effects largely not discernable. Score 1, very low. The impact is certain (Score 5).	1 x 5 = 5 (Low)
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste Generation.	Medium to high value landscape, high visual intrusion.	a) The construction of the river crossing and Ball Valve GB22 will cause short term visual intrusion. b) The permanent loss of riparian habitat will cause a permanent modification of the landscape.	For impacts “a” and “b” the proposed mitigation measures are 3, 12 and 15. For impact “c” the proposed mitigation measure is 15.	a) Many receptors would experience a moderate change in view, Score 3, moderate. The likelihood of the impact is certain (score 5). b) Permanent change in landscape. Score 5, very high. The loss of riparian habitat is certain (Score 5),	a) 3 x 5 = 15 (Medium) b) 5 x 5 = 25 (High)
Contamination of land	L Fuelling, Q Waste Generation.	Both the River Mtkvari and the aquifer present in the floodplain are sensitive receptors.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	n.a.	n.a.	n.a.	n.a.	n.a.	

KPs 222.5-238: Akhaltsike

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW preparation, E Trenching, L Fuelling, O Horizontal boring, P AGI and Facilities Construction, M Hydrotesting, Q Waste Generation.	Approximately 25 small water courses occur in this area. Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality at the stream crossing and ephemeral streams. Deterioration of water quality would be the direct result of the release of suspended solids or other contaminants. b) Spill of fuel or other liquid waste from the construction activities could result in contamination of groundwater. c) Discharges of sanitary wastewater from CV GC23 and BV GB24 construction site could also potentially affect local surface water quality.	For the impact "a" the proposed mitigation measures are 8 and 11. For the impact "b" the proposed mitigation measures are 13 and 22. For the impact "c" the proposed mitigation measure is 9.	No.	
Ecology (Flora, Fauna, biodiversity)	No significant ecological issues occur in this area.		n.a.	n.a.	n.a.	
Noise and vibrations	D ROW Preparation, E Trenching, O Horizontal boring, P AGI and Facilities Construction.	Human receptors are located at: KP 223.6-224.8, Village (320 m); KP 225, Industrial area (735 m); KP 226.5, Village (663 m); KP 228.4, Houses (212 m); KP 231.4, Farm (419 m); KP 237.4, House (172 m).	Impacts associated with noise emissions in this unit consist of short-term disturbance of human receptors present in the area.	The proposed mitigation measure is 19.	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied.	3 x 5 = 15 (Medium)
Air Quality	A Haulage, C ROW Clearance, D ROW Preparation, E Trenching, G Backfilling, P AGI and Facilities Construction.	Human receptors are at: KP 228.4, Houses (212 m); KP 237.4, House (172 m).	Impacts associated with air quality relate to dust impacts on human receptors arising from construction activities.	The proposed mitigation measures are 17 and 18.	No.	
Soil	n.a.	No significant erosive or soil fertility issue	n.a.	n.a.	n.a.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste Generation.	Landscape of medium aesthetic value.	Pipeline, Check Valve GC23 and Ball GB24 construction activities will result in short-term visual intrusion.	The proposed mitigation measure is 15.	Many receptors experiencing a moderate change in view, Score 3, moderate. The likelihood of the impact is certain (Score 5).	3 x 5 = 15 (Medium)
Contamination of land	L Fuelling, Q Waste Generation.	No groundwater aquifers outcrop in this unit.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	D ROW Preparation, E Trenching, P AGI and Facilities Construction.	This unit includes sites of archaeological interest and it is therefore possible that chance finds are encountered whilst trenching in this area.	Grading and trenching could have an adverse impact on sites of archaeological interest.	The proposed mitigation measure is 16.	No.	

KPs 238-238.5: Potskhovi North Crossing



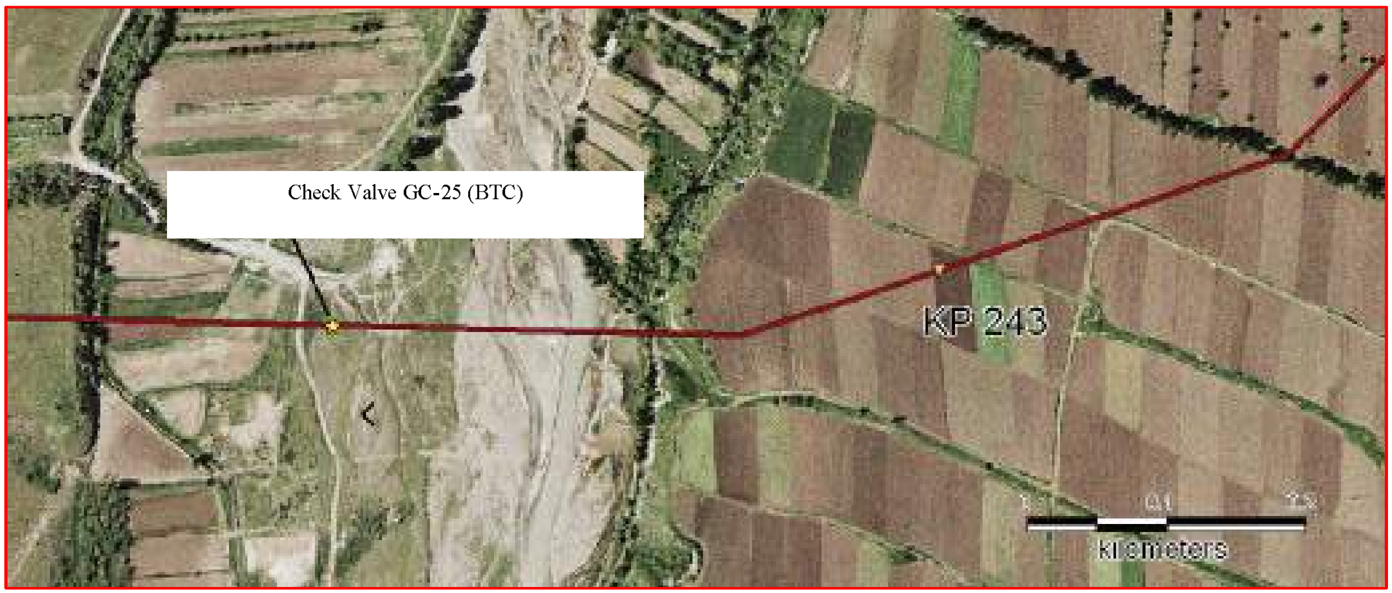
Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, Q Waste Generation.	The crossing of the river Potskovi, (width of floodplain approximately 200m) is the only sensitive issue in this area The river crossing will be constructed with open cut technique. A shallow groundwater aquifer is present within the floodplain of the R. Potskovi.	a) All activities listed have the potential to deteriorate surface water quality of the Potskovi river. Deterioration of water quality would be the direct result of the release of suspended solids or other contaminants b) Spill of fuel or other liquid waste from the construction activities could result in contamination of groundwater.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measures are 13 and 22.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching.	The banks of the river, the left bank in particular, are characterised by riparian vegetation of medium to high conservation value. The species present in the area include willows (*Salix alba*, *S. triandra*), poplar (*Populus nigra*) and alder (*Alnus barbata*). A population of the Georgian Red Data Book species globe-daisy (*Globularia trichosantha*) is also present The area is also known as an important feeding ground for bird populations. The River Potshkovi is an important habitat for ichthyofauna and deterioration of water quality could adversely impact the fish populations. These potential impacts are however addressed above (Water resources)	River crossing construction will result in the loss of riparian habitat for an overall width of approximately 100m. The habitat will be permanently lost within the immediate vicinity (4m either side) of the installed pipeline.	The proposed mitigation measures are 1, 2, 3 and 6.	Reduction in integrity of nationally important habitat Score 4. The riparian habitat will be lost (score 5, certain).	4 x 5 = 20 (High)
Noise and vibrations	D ROW Preparation, E Trenching, G Backfilling, O Horizontal boring.	The avian and terrestrial fauna in this area would be sensitive receptors to noise.	Impacts associated with noise emissions in this unit include short-term disturbance of faunal populations present in the area.	The proposed mitigation measure is 19.	Disruption to species discernable using standard techniques, score 2. This residual impact is very likely to occur, score 4.	2 x 4 = 8 (Low)
Air Quality	n.a.	Not applicable because no human receptors are located in this area.	n.a.	n.a.	n.a.	
Soil	C ROW Clearance, D ROW Preparation, E Trenching.	Fertile soils in the riparian forest support high biodiversity.	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure.	The proposed mitigation measures are 3 and 12.	The impact is largely not discernable. Score 1, very low. The impact is certain (Score 5).	1 x 5 = 5 (Low)
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, H Temporary Reinstatement, G Backfilling, Q Waste Generation.	Medium to high value landscape, high visual intrusion.	a) The construction of the river crossing will cause short term visual intrusion. b) The permanent loss of riparian habitat will cause permanent modification of the landscape.	For impacts "a" and "b" the proposed mitigation measures are 3, 12 and 15.	a) Many receptors would experience a moderate change in view, score 3. The likelihood of the impact is certain (score 5). b) The loss of riparian habitat will result in a permanent change in landscape, score 5,	a) 3 x 5 = 15 (Medium) b) 5 x 5 = 25 (High)

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
					The likelihood of the impact is certain (Score 5).	
Contamination of land	L Fuelling, Q Waste Generation.	Both the River Potskovi and the aquifer present in the floodplain are sensitive receptors.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	n.a.		n.a.	n.a.	n.a.	

KPs 238.5-243: Vale uplands

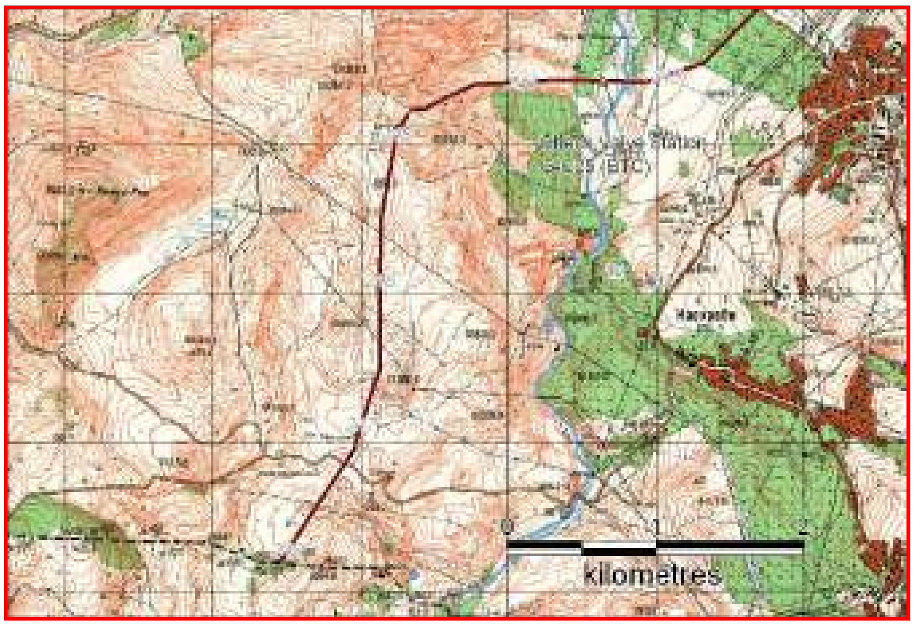
Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, Q Waste Generation.	A canal crossing occurs at KP 240.3. Sensitive groundwater aquifer outcrops in this area at medium depth.	a) All activities listed have the potential to deteriorate surface water quality at the stream crossing. Deterioration of water quality would be the direct result of the release of suspended solids (during crossing construction). b) Discharges of sanitary wastewater from the proposed pipe storage yards could also potentially affect local surface water quality. c) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measure is 9. For impact "c" the proposed mitigation measures are 13 and 22.	No.	
Ecology (Flora, Fauna, biodiversity)	n.a.	No significant ecological issues occur in this area.	n.a.	n.a.	n.a.	
Noise and vibrations	D ROW Preparation, E Trenching, O Horizontal boring.	Human receptors at: KP 239.4, Farm (780 m); KP 241, Farm (661 m); KP 241.8, Farm (367 m); KP 241.2-242.6, Village (456 m).	Impacts associated with noise emissions in this unit consist of short-term disturbance of human receptors present in the area.	The proposed mitigation measure is 19.	The noise level is predicted to exceed the "Low" criteria based on simple worst-case modelling. The impact is certain (Score 5). This will be reviewed taking account of mitigation due to local topography, natural sound barriers and dwellings not occupied Score 2, low.	2 x 5 = 10 (Medium)
Air Quality	n.a.	Not applicable as no human receptors are located in this unit.	n.a.	n.a.	n.a	
Soil	C ROW Clearance, D ROW Preparation	Land use in this area is predominantly agricultural.	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure.	The proposed mitigation measures are 3, 11 and 12.	Impact is largely not discernable. Score 1, very low. The likelihood of the impact is certain (Score 5).	1 x 5 = 5 (Low)
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, Q Waste Generation.	Landscape of medium value.	Pipeline construction activity will result in temporary visual intrusion.	Mitigation measures are not applicable.	Many receptors experiencing a moderate change in view, Score 3, medium. Impact is certain (score 5 for likelihood)	3 x 5 = 15 (Medium)
Contamination of land	L Fuelling, Q Waste Generation.	Sensitive groundwater aquifer outcrops in this area at medium depth.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	D ROW Preparation, E Trenching.	Known and potential sites of archaeological interest may be exposed through the grading and trenching process.	Grading and trenching could have an adverse impact on sites of archaeological interest.	The proposed mitigation measure is 16.	No.	

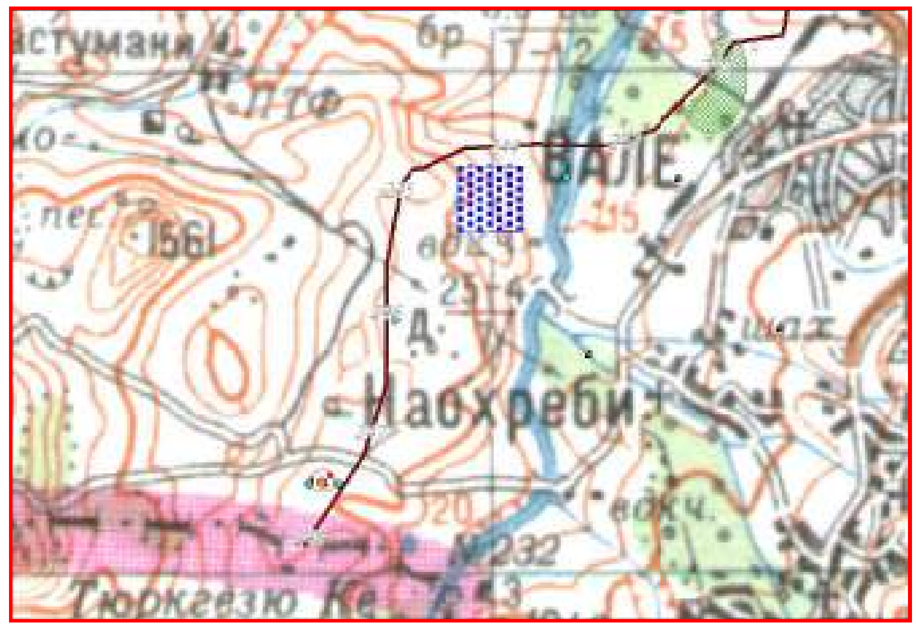
KPs 243-243.8: Potshkovi South crossing



Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction, L Fuelling, Q Waste Generation.	The crossing of the river Potshkovi, (width of floodplain approximately 300m) is the only sensitive issue in this area The river crossing will be constructed with open cut technique. A shallow groundwater aquifer is present within the flood plain of the R. Potskovi. Construction sites will generate sanitary effluent.	a) All activities listed have the potential to deteriorate surface water quality of the Potskovi river. Deterioration of water quality would be the direct result of the release of suspended solids or other contaminants b) Spill of fuel or other liquid waste from the construction activities could result in contamination of groundwater. c) Discharges of sanitary wastewater from CV GC25 construction site could also potentially affect local surface water quality.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measures are 13 and 22. For impact "c" the proposed mitigation measure is 9.	No.	
Ecology (Flora, Fauna, biodiversity)	C ROW Clearance, D ROW Preparation, E Trenching, P AGI and Facilities Construction.	The River Potskovi is an important habitat for ichthyofauna and deterioration of water quality could adversely impact the fish populations. These potential impacts are however addressed above (water resources). An individual specimen of oriental thorn (*Crataegus orientalis*) is located on the western bank of the river.	See above. Construction activities may result in the loss of the individual of oriental thorn.	See above. The proposed mitigation measures are 1,3 and 4.	The loss of the single specimen of the oriental thorn, score 5. The likelihood of the impact is unlikely but may occur score 2.	5 x 2 = 10 (Medium)
Noise and vibrations		No sensitive receptors in this area.	n.a.	n.a.	n.a.	
Air Quality		No sensitive receptors in this area.	n.a.	n.a.	n.a.	
Soil		No significant erosive or soil fertility issues.	n.a.	n.a.	n.a.	
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste Generation.	Medium to high value landscape, high visual intrusion.	a) The construction of the river crossing and Check Valve GC25 will cause short term visual intrusion.	The proposed mitigation measure is 15.	Few receptors experiencing a moderate change in view, Score 2, low. The impact is certain (Score 5).	2 x 5 = 10 (Medium)
Contamination of land	L Fuelling, Q Waste Generation.	Both the River Potskovi and the aquifer present in the floodplain are sensitive receptors.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could cause localised soil or groundwater contamination.	The proposed mitigation measures are 13 and 22.	No.	
Archaeology and cultural heritage	n.a.		n.a.	n.a.	n.a.	

KPs 243.8-247.79: Turkish Border uplands





Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
Water Resources (Surface and Groundwater)	C ROW Clearance, D ROW Preparation, E Trenching, L Fuelling, P AGI and Facilities Construction, Q Waste Generation.	Surface water crossing occur at: 243.9, Stream; 243.9, Stream; 246.4, Stream; 246.5, Stream. A sensitive groundwater aquifer outcrops in this area at medium depth.	a) All activities listed have the potential to deteriorate surface water quality at the stream crossing. Deterioration of water quality would be the direct result of the release of suspended solids (during crossing construction). b) Discharges of sanitary wastewater from the proposed pipe storage yards could also potentially affect local surface water quality. c) Spill of fuel or other liquid waste from the construction activities could also result in contamination of groundwater.	For impact "a" the proposed mitigation measures are 8 and 11. For impact "b" the proposed mitigation measure is 9. For impact "c" the proposed mitigation measures are 13 and 22.	No.	
Ecology (Flora, Fauna, biodiversity)	No significant ecological issues occur in this area.		n.a.	n.a.	n.a.	
Noise and vibrations	E Trenching, O Horizontal boring, P AGI and Facilities Construction.	Human receptors at: KP 247.2, Houses (124 m); KP 247.7, Border house (135 m).	Impacts associated with noise emissions in this unit consist of short-term disturbance of human receptors present in the area.	The proposed mitigation measure is 19.	Predicted residual noise levels will exceed the "High" criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur, score 5. This will be reviewed taking account of mitigation due to local topography natural sound barriers and dwellings not occupied.	3 x 5 = 15 (Medium)
Air Quality	A Haulage, D ROW Preparation, E Trenching, P AGI and Facilities Construction, G Backfilling.	KP 247.2, Houses (124 m); KP 247.7, Border house (135 m).	Impacts associated with air quality relate to dust impacts on human receptors arising from construction activities.	The proposed mitigation measures are 17 and 18.	n.a	
Soil	C ROW Clearance, D ROW Preparation.	Land use in this area is predominantly agricultural.	The removal and stockpile of topsoil will result in some loss of topsoil, reduced fertility of the soil, impoverishment of the seed bank, changes in pH and soil chemistry and structure.	The proposed mitigation measuresare 3, 11 and 12.	Impact is largely not discernable. Score 1, very low. The impact is certain (Score 5.)	1 x 5 = 5 (Low)
Landscape and visual intrusion	C ROW Clearance, D ROW Preparation, E Trenching, F Pipelaying, G Backfilling, P AGI and Facilities Construction, Q Waste Generation.	Landscape of medium value with significant anthropogenic degradation.	The pipeline construction activities may result in temporary visual intrusion.	The proposed mitigation measure is 15.	Many receptors experiencing a moderate change in view, Score 3, moderate. The impact is certain (score 5).	3 x 5bb= 15 (Medium)
Contamination of land	L Fuelling, Q Waste Generation.	A sensitive groundwater aquifer outcrops in this area at medium depth.	The accidental spill of fuels, lubricants, liquid waste and runoff from solid waste could	The proposed mitigation measures are 13 and 22.	No.	

Environmental Receptors affected and key issues	Project Activity	Environmental Aspect	Potential Impacts	Mitigations as per general table in Section 9.3.2	Residual Impacts	Ranking of residual impacts
			cause localised soil or groundwater contamination.			
Archaeology and cultural heritage	D ROW Preparation, E Trenching.	Sites of archaeological interest may be exposed through the grading and trenching process.	Grading and trenching have the potential to disturb and possibly damage sites of archaeological interest.	The proposed mitigation measure is 16. One known sites (Orchosani) will be part of the agreed Archaeological management strategy and will be studied in detail prior to commencement of the construction activities.	Beneficial impact would occur as a result of the investigations and subsequent preservation of the medieval archaeological site.	

10.2.4 Activities outside the pipeline route

This section of the ESIA addresses impacts and mitigation at sites located outside the pipeline route where construction related activities will take place. The activities identified are as follows:

- Establishment of a supply base at the port(s) used for shipping materials into Georgia (Section 10.2.4.1)
- Establishment of pipe storage yards and camps for construction workers (Section 10.2.4.2)
- Development of borrow pits and inert material disposal sites (Section 10.2.4.3)
- Development of waste disposal sites (Section 10.2.4.4)

The following sections detail potential impacts and mitigation measures at these sites. Within each unit, the following issues are identified:

- The sensitive environmental receptors
- Project activities that would take place at the specific location
- Potential impacts to the receptors associated with the activities and proposed mitigation measures
- Residual impacts and assessment of significance

10.2.4.1 Supply base at the ports

Pipe sections and construction and operational equipment will be imported to Georgia via either Poti or Batumi Port. Both ports have been inspected by BP. The quantity of pipe and equipment to be imported and the associated port activities are detailed in Section 5, Project Description. Table 10-4 details the potential environmental impacts and mitigation measures associated with port activities.

Table Error! No text of specified style in document.**-1 Impacts and mitigation at port supply base**

Environmental Receptors	Project Activities	Impacts	Mitigations	Residual Impacts	Residual Impact Ranking (Consequence /severity x Likelihood)
Surface Waters	Shipping movements; fuelling	Fuel spillage to port waters	Adopt strict fuelling and spill control procedures. Construction contractor to prepare spill response plan	No	
Residential buildings neighbouring the port	Pipe & equipment off-loading and onward rail transport	Noise nuisance	Off-loading will take place during daylight hours only, current noise and activity levels at the port will not change significantly	No	
Port surface waters and surface waters during ship transit	Ballasting	Ballast discharge to port waters and transit waters	Ships used for the project will use water ballast only. On arrival at the port, they will have little or no ballast thus there will be minimal ballast discharge on arrival. Water ballast taken on board from the Black Sea is regarded as polluted water therefore any ballast discharged in return waters will be regarded as wastewater and treated and disposed of accordingly. All ships used for the BTC project will be registered with Lloyds or similar shipping register and will therefore conform to all international maritime conventions	No	

10.2.4.2 Establishment of pipe storage yards and camps for construction workers

The bcation, environmental baseline condition and sensitive environmental receptors at the proposed pipe storage yards and construction worker camps are discussed in Section 8 *Environmental Baseline.* Table 10-5 details potential impacts and mitigation measures at these sites.

Table Error! No text of specified style in document.**-2 Impacts and mitigations at pipe storage yards and worker camps**

Receptor	Project Activities	Impacts	Mitigations	Residual Impacts	Residual Impact Ranking (Consequence /severity x Likelihood)
Ecology (Flora, Fauna, biodiversity)	Clearance of lay down and camp areas	Habitat loss	Site selection: all sites except two (see below) are characterized by habitats of little or no conservation value. Andezit and Tsikisjvari are characterized by the presence of degraded meadows of high conservation value at Andezit and low conservation value at Tsikisjvari.	Yes at Andezit. Consequence score 3. The likelihood is certain, score 5.	3 x 5 = 15 (Medium)
Landscape	Establishment and operation of storage yards & worker camps	Visual intrusion in areas of high landscape quality	All sites, with the exception of Andezit and Tsikisjvari, are located in areas of low to medium landscape quality; Implementation of reinstatement plan (Appendix A)	Consequence score 3.The likelihood is certain, score 5; changes in natural landscape are localized in the area	3 x 5 = 15 (Medium)

Receptor	Project Activities	Impacts	Mitigations	Residual Impacts	Residual Impact Ranking (Consequence /severity x Likelihood)
Noise & vibration	Increased vehicle and personnel movements	Noise emissions resulting in disturbance to nearby human and wildlife receptors	Limiting the working hours of noisy activities to normal daytime working hours. Provision of warnings of impeding works to all potential receptors within a one kilometre radius of the sites	Predicted residual noise levels will exceed the “High” criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks (this ranking cannot be a 5 consequence if duration is less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur where the receptors are within 1 km of the site; consequence score 5. This will be reviewed taking account of mitigation owing go local topography natural sound barriers and dwellings not occupied	3 x 5 = 15 (Medium)
Contamin-ation of land	Sanitary waste generation at workers camps	Accidental spillage of waste and potential impact on surface and ground water	At all worker camps, a sewage treatment package will be established to treat waste. The package will meet the project discharge standards	No	

10.2.4.3 Development of borrow pits and spoil disposal sites

Over 100 sites have been investigated as possible locations for use as borrow pits and spoil disposal sites. The methodology used to assess sites and details of preferred site locations are given in Section 8, Environmental Baseline. Table 10-6 details potential impacts and mitigation measures associated with the use of these sites.

Table Error! No text of specified style in document.**-3 Impacts and mitigations at borrow pit and spoil disposal sites**

Receptor	Project Activities	Impacts	Mitigations	Residual Impacts	Residual Impact Ranking (Consequence /severity x Likelihood)
Groundwater & hydrological conditions	Excavation; opening or closing discontinuities (ie joints, fractures, fissures) in rock masses	Change in either the rate of rainwater percolation or groundwater flow paths and directions	Stringent site selection and screening; Additional specialised studies of the hydrology and hydrogeology will be undertaken in sensitive areas	No	
Surface water courses or aquifers	Vehicle movements; vehicle fuelling	Potential for pollutants to enter surface water courses or aquifers	Stringent site selection and screening; The base and sides of spoil disposal sites will be lined with impermeable material; All vehicle fuelling will be done on contained hard-standing areas	No	
Noise & vibration	Increased vehicle and personnel movements	Noise emissions resulting in disturbance to nearby human and wildlife receptors	Limiting the working hours of noisy activities to normal daytime working hours. Provision of warnings of impeding works to all potential receptors within a one kilometre radius of the sites	Predicted residual noise levels will exceed the “High” criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks therefore Consequence score 3, medium. The residual noise impact will occur	3 x 5 = 15 (Medium)

Receptor	Project Activities	Impacts	Mitigations	Residual Impacts	Residual Impact Ranking (Consequence /severity x Likelihood)
				where the receptors are within 1km of the site, score 5. This will be reviewed taking account of mitigation owing go local topography natural sound barriers and dwellings not occupied	
Archaeology	Clearance, excavation	Earth moving operations may reveal the presence of archaeological sites	Site selection: no known archaeology located in proximity to all preferred sites; Implementation of Heritage Management Plan (Appendix E, Annex III)	Positive benefit	
Landscape	Establishment of sites; vehicle and personnel movements	Visual intrusion in areas of high landscape quality	Implementation of Reinstatement Plan (Appendix A)	Changes in natural landscape are localized in area, consequence score 3. The likelihood is certain, score 5	3 x 5 = 15 (Medium)

10.2.4.4 Development of waste disposal sites

Potential landfill sites have been identified through a screening process. A summary of the findings of the selection process along with the project waste management strategy and associated environmental management is discussed in Section 5, Project Description. Table 10-7 details potential impacts and mitigation measures associated with the establishment and operation of these sites.

Table Error! No text of specified style in document.**-4 Impacts and mitigations at waste disposal sites**

Receptor	Project Activities	Impacts	Mitigations	Residual Impacts	Significance (Consequence /severity x Likelihood)
Surface and groundwater resources	Waste storage and containment	Leakage of contaminants to surface water & groundwater	Adoption of strict re-fuelling procedures	No	
Noise and nuisance	Haulage and handling of waste	Noise generation	Noisy work conducted only during daylight hours	Predicted residual noise levels will exceed the “High” criteria based on simple worst-case modelling. However the duration is expected to be less than 2 weeks. Consequence score 3, medium. The residual noise impact will occur where the receptors are within 1km of the site, Likelihood score 5. This will be reviewed taking account of mitigation owing go local topography natural sound barriers and dwellings not occupied	3 x 5= 15 (Medium)
Landscape	Site establish-ment & operation	Visual intrusion in areas of high landscape value	Implementa-tion of reinstatement (Appendix A)	Changes in natural landscape in localized area, consequence score 3. The likelihood is certain, score 5	3 x 5 = 15 (Medium)
Archaeology	Clearance, excavation	Earth moving operations may reveal the presence of archaeological sites	Site selection: no known archaeology located in proximity to all preferred sites. Implementa-tion of Heritage Management Plan (Appendix E, Annex III)	Positive benefit	

10.3 OPERATION

This section discusses potential impacts to the environment, and mitigation where appropriate, resulting from the operation of the proposed pipeline and associated facilities. Normal operation is addressed in this section whilst unplanned events are analysed in detail in Section 10.5.

Operation of the Georgian section of the pipeline will be achieved with relative few AGIs. The Georgian section of pipeline only has a crude export role (no oil will be conditioned and / or distributed within Georgia). Hence, operational activities are therefore limited to:

- Pumping the oil when the pressure requires boosting
- Carrying out routine pipeline maintenance through pigging
- Carrying out routine inspections to detect any potential malfunctions of the pipe itself or of any of the AGIs

The facilities, which deliver the above operations are the following:

- Pump Station PSG1 (KP 3.6)
- Pump Station PSG2 (KP 87.0)
- Intermediate Pigging Station IPSG1 (KP 182.8)
- All block valves along the proposed route

In addition to the above facilities that are located along the pipeline, non-route specific activities include vehicle use and waste generation and their potential impacts are discussed in later in this Section.

The operation of the pipeline facilities may cause impacts to a number of environmental receptors or resources:

- Water resources
- Ecology
- Noise
- Air quality
- Landscape and visual intrusion
- Contamination of land

Other environmental resources such as “archaeology” and “soil” will not be impacted by routine operations as the facility siting and design has taken into account any constraints associated with these issues.

The operational project activities that could result in environmental impacts are discussed in Section 10.3.1 below. Section 10.3.2 describes the general mitigation measures that have been developed to address these activities. Section 10.3 analyses the impacts and mitigations associated with the operation of each facility in the light of its actual geographical location. Residual impacts that cannot be mitigated are discussed in detail in Section 12.

10.3.4 Definition of activities

Table Error! No text of specified style in document.**-5 Summary of facilities and activities associated with operational phase**

Facility / Operation	Activity	Description	Potential Environmental Impacts
Pump stations PSG1 & PSG2 Major installations, which are required for pumping of exported crude downstream	Operation of mainline pumps by turbine drivers	At peak production, four mainline pumps will be mechanically driven by four turbines. A fifth pump and driver will remain on standby. The turbines will, individually, provide 8 MW power to the mainline pumps, and to achieve this, will need to operate on up to 32MW of fuel each. Turbines will be 'dual-fuel', and will operate on crude topped distillate (or diesel) until SD gas becomes available. Turbines will vent all combustion emissions through 28m stacks.	Deterioration of air quality. Local disturbances associated with noise. Generation of GHG. Wastewater discharges. Generation of solid and non-aqueous waste. Visual intrusion.
	Operation of crude topping plant	As no reliable sources of gas or electricity are available within Georgia, all major combustion plant (including the topping plant, turbines and generators) will operate on a distillate fuel generated from the exported crude oil (crude topped distillate, or CTD). Initially, a crude topping plant will operate at PSG1 only and CTD will be distributed to PSG2 by road tanker). Should SD gas not be available in 2006, a second crude topping plant will be installed at PSG2. An assessment will be made of supplying distillate fuel by road until SD gas is available, instead of building the crude topping plant.	Deterioration of air quality. Local disturbances associated with noise. Generation of GHG. Wastewater discharges. Generation of solid and non-aqueous waste. Visual intrusion.
	Generation of site electrical power	Site electrical power will be generated by 2x100% 1.2MW generators which will operate on either crude topped distillate or SD gas, should this become available.	Visual intrusion from stacks. GHG generation. Deterioration of air quality. Local disturbances associated with noise.
	Operation of waste water treatment system	A number of waste streams will be generated from the sites' waste water treatment system. These include: • sanitary wastes • rain water • process drains from the CTD plant, the pumps house,	Aqueous discharges to the environment.

Facility / Operation	Activity	Description	Potential Environmental Impacts
		pig launcher and receiver.	
	Operation of site vehicles	A small number of site vehicles will be used for delivery and distribution of materials on site.	Deterioration of air quality. Local disturbances associated with noise.
	Pigging	Pigging will involved the launching or receiving of de-waxing pigs (1-2 times per week) or intelligent pigs (typically every 5 years). De-waxing pigging will also lead to the generation of pigging waste which may be re-introduced into the pipeline or collected.	Generation of solid and non-aqueous waste.
	Site Storage	A number of storage tanks will be required during the operational phase. Storage of fuels and other hydrocarbons include: • Crude topped distillate • Naptha and crude residue tank (from the crude topping plant) • Mainline crude in flow 'surge' tanks (not used for permanent storage) • Other fuel, lubricant, and process chemical storage.	Fugitive emissions. Visual intrusion from tank size.
Intermediate pigging station IPS1 Required for de-waxing and inspection of the pipeline	Generation of site power	Site power will be generated through the operation of 2x100% 60kW generators, which will operate on diesel.	Visual intrusion from stacks. GHG generation. Deterioration of air quality. Local disturbances associated with noise.
	Pigging	See PSG1 + PSG2 above. Pigging will involve the launching or receiving of de-waxing pigs (1-2 times per week) or intelligent pigs (typically every 5 years). De-waxing pigging will also lead to the generation of pigging waste which may be re-introduced into the pipeline or collected.	Generation of solid and non-aqueous waste.
	Operation of waste water treatment system	A number of waste streams will be generated from the sites' waste water treatment system. These include: • sanitary wastes • rainwater runoff water • process drains from the CTD plant, the pumps house,	Aqueous discharges to the environment.

Facility / Operation	Activity	Description	Potential Environmental Impacts
		pig launcher and receiver.	
	Operation of site vehicles	A small number of site vehicles will be used for delivery and distribution of materials on site.	Deterioration of air quality. Local disturbances associated with noise.
Block Valves Minor installations, required for isolation of route sections for safety, or maintenance purposes	Generation of site power	Site power will be generated with up to a 7kw diesel generator.	GHG generation. Deterioration of air quality. Local disturbances associated with noise
	Site Storage	Storage of fuels and other hydrocarbons include: • Crude topped distillate; diesel • Pigging wax • Other fuel; lubricant; and process chemical storage.	Fugitive emissions. Visual intrusion from tank size.
.	Pipeline surveillance	Pipeline surveillance will be undertaken on foot (typically weekly, on horse back or very infrequently, by helicopter.	Noise
	Site Storage	Storage of liquid fuel for generator (CTD or diesel)	Fugitive emissions. Visual intrusion from tank size
Other Operations Although different activities, each requires the operation of road and off-road vehicles	Delivery and transport	General delivery and transport will include waste collection and transfer, and delivery of machinery or new plant (the pump station sites have a program of turbine, or potentially fuel gas system, installation).	Deterioration of air quality. Local disturbances associated with noise.
	CTD transport	As noted above, CTD will need to be transported to PSG2 from PSG1 until SD gas becomes available.	Disturbances associated with noise.

10.3.5 General operational mitigation measures

General mitigation measure applicable to one or more of the facilities or activities described above, are presented in Table 10-9. These mitigation measures have a numerical identifier, by which they are referred to throughout the remainder of this Section.

Table Error! No text of specified style in document.**-6 General operational mitigation measures for pipeline operation**

Project Activities / Environmental Aspects	Environmental Receptor and Potential Impact	Proposed Mitigation Measures
		Mitigation measure no.1
Operations of AGIs	Flora hydrology Soil erosion and habitat deterioration	Ongoing inspection and maintenance of drainage control and erosion control features. This would be undertaken during operation as part of pipeline inspection (discussed in Section 5 – Project Description).
		Mitigation measure no. 2
Pipeline inspection	Flora Soil erosion and habitat deterioration	No vehicular access on reinstated ROW other than in case of emergency, or inspection and maintenance. The majority of inspection will be done on horseback. The restriction to vehicles will be achieved by gates / restricted access and appropriate signs. Illegal access to the ROW will be discouraged by means of placing obstructions, such as fencing, large stones, logs, etc along key locations of reinstated ROW.
		Mitigation measure no.3
Maintenance of ROW	Flora Soil erosion and habitat deterioration	Maintenance of reinstated areas and areas damaged by third party vehicular access or by emergency access. Damaged areas will be identified through pipeline surveillance undertaken by horse or foot on a weekly basis.
		Mitigation measure no. 4
Operations of AGIs and pipeline	Flora hydrology hydrogeology Contamination of soil, water and plants	Undertake suitable clean up operations and reinstatement in case of oil spill. This will involve delineation of contaminated areas and excavation and disposal at an appropriate facility. Where appropriate, other methods of remediation will be applied (eg in-situ bioremediation).
		Mitigation measure no. 5
Operations of AGIs	Fauna Noise disturbance	Adopt noise suppression technologies for pump station drivers and valves generators. Techniques will include buffer zones such as re-forested areas or screening rows. In addition, periodic noise monitoring will be undertaken to determine the effectiveness of such measure.
		Mitigation measure no. 6
Operations of AGIs	Fauna	Adopt suitable lighting (vertical diffusion lighting) to minimise glow effect of pump stations

Project Activities / Environmental Aspects	Environmental Receptor and Potential Impact	Proposed Mitigation Measures
	Visual disturbance	(particularly PSG2) at night.
		Mitigation measure no. 7
Physical presence of AGIs	Fauna Impacts to bear populations	Implement fauna monitoring programme.
		Mitigation measure no. 8
Pipeline operation	Hydrology Scour or other source of damage to pipe and consequent oil spill	Undertake periodic monitoring of river crossings and gorge crossings for signs of instability. This will be undertaken as part of pipeline surveillance.
		Mitigation measure no. 9
Operations of AGIs	Hydrology, flora, fauna Contamination of Surface water	Monitor discharges of treated effluent. Monitoring requirements and frequency will be reflected in Environmental Management Plan (see Section 14, Management and Monitoring).
		Mitigation measure no. 10
Pipeline operation	Hydrogeology, hydrology Contamination of groundwater and surface water	Implement security/inspection programme along sections of the ROW crossing sensitive aquifers.
		Mitigation measure no. 11
Physical presence of pipeline ROW	Landscape Visual impact of ROW after reinstatement	Monitor and maintain reinstated planting. This will be undertaken as part of the pipeline surveillance. Continued erosion control will be implemented through the use of diverter berms, gabion mattresses, silt fences and trench breakers.
		Mitigation measure no. 12
Physical presence of AGIs	Landscape	A landscaping plan will be implemented which will use grass, shrubs and trees, where practicable, to screen the AGIs and associated access roads (as presented in Landscape

Project Activities / Environmental Aspects	Environmental Receptor and Potential Impact	Proposed Mitigation Measures
	Visual impact	Management Plan – see Appendix E, Annex I). These plans will be integrated at the design stage for major AGIs (pump stations and IPSs) and at construction stage for other AGIs. Screening will be subject to ongoing monitoring. Other mitigation measure applicable to all AGIs are: • Building and facility walls, and the perimeter wall will be finished in colour and style sympathetic to surrounding landscape where practicable; • The height and mass of buildings will be minimised, for example by using pitched roofs where possible; • Built structures, fences and gates will be painted using colours sympathetic to the surrounding environment; • Site lighting (where applicable) will be designed and located to reduce off-site glare to a minimum, and minimise the impact on visual amenity at night, having regard to security and safety requirements.
		Mitigation measure no.13
Pipeline operation	Heritage and Archaeology Contamination of monuments in case of oil spill	Include archaeological and heritage sites in list of resources to protect in Oil Spill Response Plan.
		Mitigation measure no.14
Operations of AGIs - Power Generation	Air quality Emissions from power generation units	Undertake emissions monitoring of combustion plant on an annual basis for NO_x, SO_2, CO, and particulate matter. Standards for major thermal plant (turbines) are presented in Section 7, Legislation and Policy Framework.
		Mitigation measure no.15
Operations of AGIs - Turbine driver and CTD operations	Air quality Emissions from major combustion plant	Emissions from major combustion plant to be released to atmosphere via an appropriately designed stack. Stack heights have been designed using two methodologies: • Major sources: Stack design achieved using a dispersion model, which considers local meteorological conditions, buildings and includes emissions from multiple points (see Air Quality Impact Assessment, Appendix E, Annex II). • Minor sources: Stack heights have been design using UK Environmental Agency's D1 methodology (see Appendix E, Annex II).

Project Activities / Environmental Aspects	Environmental Receptor and Potential Impact	Proposed Mitigation Measures
		Mitigation measure no.16
Operations of AGIs	Air quality Emissions of SO_2 from combustion plant	All combustion plant, where practicable, to operate on CTD with a maximum sulphur content of 0.2%. This will lead to a reduction in concentrations of SO_2 in combustion plant emissions, as compared to operation of commercially available diesel fuels within Georgia. It is very likely that CTD will be less than 0.1% sulphur, given the sulphur content of ACG crude oil (the mainline crude sulphur content is directly proportional to CTD sulphur content).
		Mitigation measure no. 17
Operations of AGIs	Emissions from major thermal combustion plant	Combustion plant to be dual-fuelled and will operate on natural gas as soon as practicable when an appropriate source becomes available. This will lead to a reduction in NO_x, SO_2, particulate matter, and achieve a greater operational efficiency that operation of CTD.
		Mitigation measure no.18
Operations of AGIs	Air quality Emissions from power generation units	Undertake preventive maintenance to minimise fugitive emissions and maintain performance of emission abatement technology. Fugitive losses from crude export are not normally associated with a significant environmental impact, however, this may be important for minimisation of nuisance from odour
		Mitigation measure no.19
Operations of AGIs	Waste management General	Ongoing training for site personnel. Training will comprise health and safety, hazardous materials handling, waste management, environmental compliance and reporting.
		Mitigation measure no.20
Operations of AGIs	Waste management Generation of operational waste at Pump Stations and other AGIs	Implement Waste Management plan (procedures for the classification storage and disposal of all operational wastes; training of employees who handle hazardous materials). This will include the correct storage, labelling, and segregation of waste for appropriate disposal.
		Mitigation measure no.21
Operations of AGIs	Soil and water contamination Spills and leaks at AGIs	Provide secondary containment for all petroleum containing tanks at Pump Stations and valve stations. Secondary containment will provide at least 110% of storage unit / tank capacity (particularly at sites of high rainfall).
		Mitigation measure no.22
Operations of AGIs	Soil and water contamination	ICSS and associated Leak Detection System. Leak detection systems for project operation are

Project Activities / Environmental Aspects	Environmental Receptor and Potential Impact	Proposed Mitigation Measures
	Spill from pipeline	currently under development.
		Mitigation measure no.23
Operations of AGIs	Soil and water contamination Spill from pipeline	Develop and implement an adequate Oil Spill Response Framework Plan (see Appendix E, Annex V).
		Mitigation measure no.24
Operations of AGIs	All Operational activity	Develop Environmental Management System (see Section 14, Management and Monitoring).

10.3.6 Assessment of impacts and mitigations

Potential impacts, and their proposed mitigation, are presented in detail by facilities or activities below in the following order:

- PSG1
- PSG2
- IPSG1
- Block Valves
- Other Activities

The mitigation measures, with numerical identifiers as presented in Table 10-9 above, are applied to the potential impacts in the discussion below as appropriate. Those impacts, which are deemed not to be fully mitigated are considered residual impacts and are discussed as a summary for each facility at the end of the relevant subsection.

10.3.6.1 PSG1

The operation of PSG1 presents potential environmental impact to the following receptors or environmental resources:

- Water resources
- Ecology
- Noise
- Air quality
- Landscape and visual intrusion
- Contamination of land

The potential impact on these receptors, and their corresponding mitigation measures, are discussed below.

Water resources

Pump Station PSG1 will be located close to a canal system and close to Jandara Lake. Contamination of the canal system as a result of operation may in turn cause the degradation of water quality and subsequently adversely impact aquatic fauna and flora. In addition the contamination of the canal system may have an indirect effect on agricultural activities in the area.

The activities associated with the operation of PSG1 that may give rise to potential impacts upon water resources are summarized as:

a. Discharge of sanitary effluent
b. Discharge of rainwater runoff
c. Discharge from process drains
d. Small spills of fuel or other contaminants

A number of mitigation measures will be applied to reduce both the likelihood and consequence of these potential impacts:

- For impact a, b and c the mitigation measures are: 9 and 20
- For impact d the mitigation measures are: 4, 10, 21, 22 and 23

It is expected that impacts presented above will be fully mitigated by measures noted.

Ecology

As noted above, the proposed site of PSG1 is close to a canal system and close to Jandara Lake, and, therefore, site operation may have an impact upon aquatic fauna and flora. Potential ecological impacts relate to contamination of the watercourses, and are discussed in the context of water quality above, or by noise generated by the operation of PSG1 (discussed below). Given the absence of sensitive ecological receptors in the immediate vicinity of the pump station it is not anticipated that significant impacts will occur as a result.

The general mitigation measures adopted will fully mitigate potential impacts upon the local ecology.

Noise

PSG1 will operate continuously and be a source of noise through the:

a. Operation of rotary and other heavy stationary plant
b. Operation of site
c. Delivery vehicles

The nearest occupied establishment is approximately 400m from the proposed site (a military barracks). No occupied residential dwelling exists within 1.6km of the proposed site of PSG1, and therefore it is highly unlikely that noise from stationary plant would represent a nuisance to those local residents exposed. In addition, project environmental standards (World Bank) will be met in terms of noise impact beyond the site boundary. These standards state that:

“Noise abatement measures should achieve either the levels given below or a maximum increase in background levels of $3dB_A$. Measurements are to be taken at noise receptors located outside the project property boundary.” (World Bank Group, Pollution Prevention and Abatement Handbook, General Environmental Guidelines, July 1998).

Table Error! No text of specified style in document.**-7 Project noise standards**

Maximum Allowable Log Equivalent – hourly measurements (dB_A)		
Receptor	**Day (07:00 – 22:00)**	**Night (22:00 – 07:00)**
Residential, institutional and educational	55	45
Industrial, commercial	70	70

Although the plant represents a major industrial site, it is highly unlikely that normal operations, through maintaining project standards, would represent a nuisance to receptors at 1.6km distance from the site.

The proposed site of PSG1 is not believed to be a faunally sensitive location.

Air quality

The operation of the pump station sites will result in the continuous release of potentially harmful atmosphere species, through the operation of:

a. Mainline pump drivers (combustion emissions from operation on CTD)
b. Crude topping plant and associated flare (fugitive losses and combustion emissions from operation on CTD)
c. Power generation by generator sets (combustion emissions from operation on CTD)
d. Fugitive losses of hydrocarbons (from process equipment handling or storing crude or CTD)

The significance of each is presented below with discussion of mitigation where appropriate.

a) Mainline pump drivers

The proposed mitigation measures for pump drivers are General Mitigation Measures 14, 15 (see below), 16, 17, and 18. The HGA does not include emission limits. The turbine plant is not expected to meet EU standards for NO_x for discharges from the stack whilst operating on CTD, but will meet World Bank (WB) standards. However, the turbine plant is expected to meet EU standards for ambient air quality with respect to SO_2, CO and PM.

Mitigation Measure 15 – Stack Height Determination

A dispersion modelling study has been undertaken to determine the appropriate stack height for turbine drivers. Methodological approach, assumptions, and addition details can be found in Appendix E, Annex II. Air dispersion modelling provides an estimate of ambient concentrations of potentially polluting species from a particular stack or number of stacks. The study demonstrates that potential impacts to air quality will be fully mitigated through the release of emissions through individual stacks of 28m above ground level.

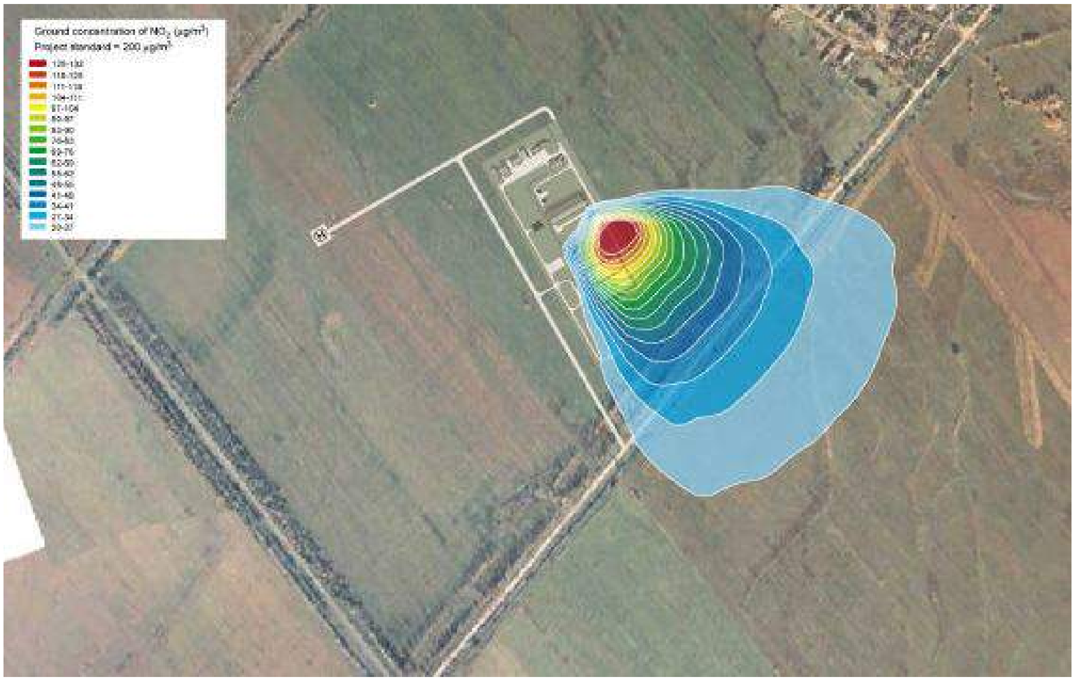
Dispersion modelling results are presented below in Table 10-11 for the operation of pump drivers. Project standards are presented for convenience, however additional details are available in Section 6 – Legislation and Policy Framework.

Table Error! No text of specified style in document.**-8 Summary of dispersion modelling data for PSG1**

Pollutant	Maximum Modelled Concentration ($\mu g/m^3$)	Project Standard ($\mu g/m^3$) (based upon EU Regulations)	Averaging Period	Percentile
Short term Ground Level Concentrations				
NO_2	136	200	1 hour	99.8th
CO	91	11,600	Running 8 hour	100th
PM_{10}	5	50	24 hour	90.4th
SO_2	138 57	350 125	1 hour 24 hour	99.7th 99.2th
Long term Ground Level Concentrations				
NO_2	8	40	Annual	Mean
SO_2	9	20	Annual	Mean
NO_2	8	30	Annual	Mean
PM_{10}	2	40	Annual	Mean

Short-term modelled ground level concentrations of NO_x (99.8th percentile) under such conditions are provided below (Figure 10-1) for example. Among the components of the discharged gases NO_2 (a constituent of NO_x) is normally considered the most toxic to humans and therefore the representation of its concentrations at ground level depicts the worst consequence associa ted with emissions to atmosphere.

Figure Error! No text of specified style in document.**-1 Short-Term (99.8th percentile of hourly average) NO_x modelled distribution from Pump Driver Operation at PSG1**



Modelled data demonstrates that despite the conservative nature of this assessment and number of worst-case assumptions made, modelled ground level concentrations comply with all relevant short and long term EU air quality standards. Therefore, as potential impacts to human health and vegetation will be fully mitigated through appropriate stack design, in conjunction with the other mitigation measures, there are no residual impacts associated with the release of harmful species.

b) Crude Topping Plant and Associated Flare

Potential impacts to air quality from the continuous operation of the crude topping plant would be mitigated through general mitigation measures 15, 16, 18 and 19.

Mitigation Measure 15 – Stack Height Determination

Although not representing a major source of emissions when compared to turbine drivers, the crude topping plant would be the subject of a dispersion modelling study, and an appropriate stack height determined, at a later design stage. This study will consider the additive impact of the turbine driver operation. Similarly, emissions from infrequent flaring, which may be involved with crude topping plant operation, will be assessed on a short term basis with other emission sources at this site.

As potential impacts to human health and vegetation will be fully mitigated through appropriate stack design, in conjunction the other mitigation measures, there are no residual impacts associated with the release of harmful air species.

c) Power generation by generator sets

Generator sets would operate continuously at PSG1. Although representing a relatively small contribution to overall plant releases, emissions will be mitigated through general mitigation measures 16, 17, 18 and 19. In addition, all emissions would be released to atmosphere via a vent standing at least 10m above the generator house.

As potential impacts to human health and vegetation will be fully mitigated through appropriate vent design, in conjunction the other mitigation measures, there are no residual impacts associated with the release of harmful air species.

Although representing a relatively small source of green house gas emissions, such releases cannot be fully mitigated, and are therefore considered a cumulative impact (to climate). Cumulative effect of project green house gas emissions is presented in Section 13, Cumulative Impacts.

d) Fugitive emissions

Fugitive emissions occur where hydrocarbon transfer, storage and distribution activities take place. A number of volatile organic compounds represent a potential impact to human health. Releases, however, will be mitigated through appropriate specification and maintenance of valves, seals and flanges, storage tanks. Fuel distribution and handling procedures and training will minimise fugitive losses. In addition, general mitigation measure 22 will be applied.

Landscape

Pump Station 1 is located in the Gardabani area. This is a flat, low lying industrial area. The landscape is modified to a significant extent by human activities. The setting is dominated by the Rustavi power station and associated infrastructure. Numerous large 220kV and 500kV pylons and power lines dominate the sky-line. Existing industrial buildings, many of which are derelict, surround the setting, particularly to the north. The significance of the impact of the facility on the landscape is reduced owing go the industrial setting within which it is located. The existing landscape is illustrated in Figure 10-2.

Figure Error! No text of specified style in document.**-2 Current landscape at PS-G1**

Plot plans, 3-D plans and visual simulation based on photographs and field annotations made by a specialist landscape architect have been used to develop a landscaping plan. The aim of the landscaping plan is to screen the facility from permanent receptors located approximately 350m to the north east and from temporary receptors including agricultural workers and passers by on the road to the east.

Mitigation measure 15 will be implemented. In addition, the landscape plan comprises the use of poplars around the perimeter wall to 'soften' the impact of the structure on the landscape. An area of approximately 0.5-1.5 hectares will be planted around the facility with poplars at an average spacing of 3.5m. Poplars planted will be of mixed age and height. As a result a mixed storey plantation will be created which will screen the perimeter wall effectively.

Figures 10-3 and 10-4 show a visual simulation of the Pump Station before and after the implementation of the landscaping plan. The view is taken from approximately 350m north of the site, looking in a north-north-west to south-south-east direction. It should be noted that there may be 'as build' variations in pump station design, in particular with regard to stacks associated with the processes. Final stack heights will be confirmed following additional modelling of the crude topped distillate plant (and associated flare) and of stacks associated with the main line pump driver, at a later design stage.

Figure Error! No text of specified style in document.**-3 Visual simulation of PS-G1 immediately after construction**

Figure Error! No text of specified style in document.**-4 Visual simulation of PS-G1 15-20 years after**

construction

Permanent landscape modification means that there will be residual impact as a result of the operation of PSG1. Residual impacts are however, minimised by setting, distance of site from permanent receptors and implementation of mitigation measures.

Contamination of land

Activities associated with normal operation of the Pump Station will not lead to the contamination of soils. However, the storage, distribution, and application of fuels, lubricants, and exported crude and crude topped distillate, present a potential risk to soils through the possibility of accidental spillage.

In order that the potential for contamination be mitigated during operation, general mitigation measures 21, 22 and 23 will be applied. It is reasonable to expect that potential impacts will be fully mitigated by these measures.

Residual impacts of PSG1

Residual impacts for PSG1 operation are limited to visual intrusion only, as a result of the presence of the pump station site. As few permanent receptors exist near to the site, and because the existing landscape is considered of low-medium quality, the consequence is considered as low.

Using the residual impact ranking methodology, the significance of residual impact for visual intrusion (given by consequence x likelihood) is considered Medium (a score of 2 x 5=10).

It is proposed that no additional mitigation to visual intrusion is provided beyond that presented in this Section.

10.3.6.2 PSG2

The operation of PSG2 presents potential environmental impact to the following receptors or environmental resources:

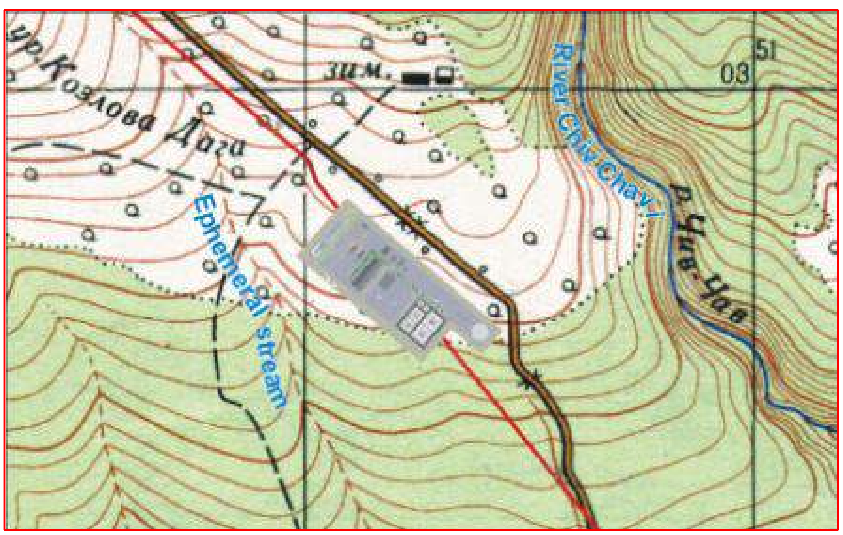
- Water resources
- Ecology
- Noise
- Air quality
- Landscape and visual intrusion
- Contamination of land

These receptors, and the potential environmental impacts upon caused by the project activities are discussed below.

Water resources

Pump Station PSG2 is in a forested area characterised by a moderate topographic gradient sloping in a southerly direction. No permanent watercourses are located in the immediate vicinity of the pump station although an ephemeral watercourse is located immediately to the south west of the site. The river Chiv Chavi flows from northwest to southeast at a distance of approximately 500m from pump station. Figure 10-5 shows the location of the site in relation to these surface water features.

Figure Error! No text of specified style in document.**-5 Surface water features in and around PSG2**



Both watercourses provide drinking water for the wildlife that populates the Tetritskharo forest and therefore are sensitive with regard to their chemical composition, bacteriological load and content of suspended solids.

The activities associated with the operation of PSG2 that may possibly give rise to potential impacts on water resources are listed below:

a) Discharge of sanitary effluent
b) Discharge of rain water
c) Discharge from process drains
d) Small spills of fuel or other contaminants

A number of mitigation measures will be applied to reduce both the likelihood and consequence of these potential impacts (from general mitigation measures):

- For impact a, b and c the mitigation measures are: 9 and 20
- For impact d the mitigation measures are: 4, 10, 21, 22 and 23

It is expected that these impacts will be fully mitigated by measures noted above.

Ecology

PSG2 is in the Tetritskharo forest, and therefore operational activity presents a potential impact upon the faunal species that populate the forest. The general area is an important wildlife habitat for Wolf (*Canis lupus)*; Brown bear (*Ursus arctos)*; Fox (*Vulpes vulpes)*; Hare (*Lepus europeaus)*, Badger (*Meles meles)*; Marten (*Martes sp*.). Wild cat (*Felis silvestris)*, Lynx (*Lynx lynx)*, Roe deer (*Capreolus capreolus)* and Wild boar (*Sus scrofa*) are also present. The operation of the pump station may lead to disturbance of these animals through:

a) Physical presence of the AGI
b) Operational noise from the AGI
c) Disturbance and noise from traffic movements

The mitigation of these impacts has been addressed in the relevant landscape and noise sections. There will however be residual impacts upon ecology as a result of operation of the AGI. Using the residual impact ranking methodology, the significance of residual impact for operational noise (given by consequence x likelihood) is considered Medium (a score of 3 x 5=15). It is proposed that no additional mitigation to noise impacts is undertaken beyond that presented in this Section.

Noise

As with PSG1, PSG2 will operate continuously and be a source of noise through the:

a) Operation of rotary and other heavy stationary plant
b) Operation of site and delivery vehicles

As no occupied dwellings exist within 500m of the proposed site of PSG2, it is highly unlikely that the plant would represent a nuisance to those residents exposed to operational noise, given the project standards presented earlier. Again, project environmental standards will be met in terms of noise, which will include noise control technology where appropriate.

PSG2 is located at an ecologically important area. Although project standards would be met to avoid potential impact to humans, such standards are not necessarily appropriate for assessment of impacts to fauna. The animal response to noise is a function of many variables including characteristics of the noise and duration, life history characteristics of the species, habitat type, season and current activity of the animal, sex and age, previous exposure and whether other physical stresses are present.

Based on the range of species that populate the Tetritskharo forest and their sensitivity to noise, a natural buffer around the pump station has been considered necessary to attenuate in the long term the propagation of noise and thus disturbance to wildlife. The buffer will consist of local species of trees and its extent and composition is discussed in detail in the landscape Section.

Given the timescale required for the reforestation scheme it is expected that residual impacts will occur as a result of the pump station operation. These impacts are discussed in detail in Section 12, Residual Impacts.

Air quality

The operation of the pump station sites will result in the release of potentially polluting air species, through the operation of:

- Mainline pump drivers (combustion emissions)
- Crude topping plant associated flare (fugitive losses and combustion emissions)
- Power generation by dual fuelled generator sets (combustion emissions)
- Fugitive losses of hydrocarbons from process equipment

The significance of each is presented below with discussion of mitigation where appropriate.

a) Mainline pump drivers

The proposed mitigation measures for pump drivers are General Mitigation Measures 14, 15 (see below), 16, 17 and 20.

Mitigation Measure 15 – Stack Height Determination

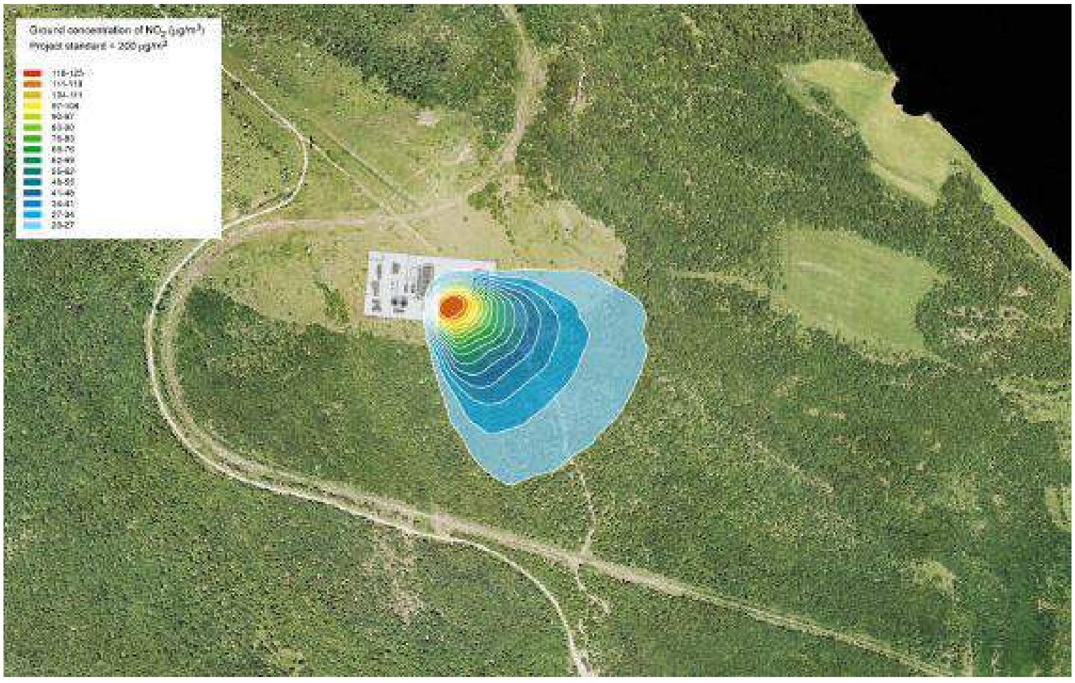
A dispersion modelling study has been undertaken to determine the appropriate stack height for turbine drivers. Methodological approach, assumptions, and addition details can be found in Appendix E, Annex II. Air dispersion modelling provides an estimate of ambient concentrations of potentially polluting species from a particular stack or number of stacks. The study demonstrates that potential impacts to air quality will be fully mitigated through the release of emissions through individual stacks of 28m above ground level.

Long-term modelled ground level concentrations of NO_x and SO_2 under such conditions are provided on the following pages.

Table Error! No text of specified style in document.**-9 Summary of dispersion modelling data for PSG2**

Pollutant	**Maximum Modelled Concentration ($\mu g/m^3$)**	**Project Standard ($\mu g/m^3$) (based upon EU Regulations)**	**Averaging Period**	**Percentile**
Short term Ground Level Concentrations				
NO_2	126	200	1 hour	99.8th
CO	87	11,600	Running 8 hour	100th
PM_{10}	5	50	24 hour	90.4th
SO_2	138 53	350 125	1 hour 24 hour	99.7th 99.2th
Long term Ground Level Concentrations				
NO_2	8	40	Annual	Mean
SO_2	9	20	Annual	Mean
NO_2	15	30	Annual	Mean
PM_{10}	2	40	Annual	Mean

Figure Error! No text of specified style in document.**-6 Short-Term (99.8th percentile of hourly average) NO_x modelled distribution from Pump Driver Operation at PSG2**



Modelled data demonstrates that despite the conservative nature of this assessment and number of worst-case assumptions made, modelled ground level concentrations comply with all relevant short and long term EU air quality standards. Therefore, as potential impacts to human health and vegetation will be fully mitigated through appropriate stack design, in conjunction the other mitigation measures, there are no residual impacts associated with the release of harmful air species.

b) Crude topping plant and associated flare

Potential impacts to air quality from the continuous operation of the crude topping plant would be mitigated through general mitigation measures 15, 16, 18, 19.

Mitigation Measure 15 – Stack Height Determination

Although not representing a major source of emissions when compared to turbine drivers, the crude topping plant would be the subject of a dispersion modelling study, and an appropriate stack height determined, at a later design stage. This study would consider the additive impact of the turbine driver operation. Similarly, emissions from infrequent flaring, which may be involved with crude topping plant operation, will be assessed on a short term basis with other emission sources at this site.

As potential impacts to human health and vegetation will be fully mitigated through appropriate stack design, in conjunction the other mitigation measures, there are no residual impacts associated with the release of harmful species.

c) Power generation by generator sets

Although representing a relatively small contribution to plant emissions, emissions will be mitigated through general mitigation measures 16, 17, 18, 19.

In addition, all emissions would be released to atmosphere via a vent standing at least 10m above the generator house.

As potential impacts to human health and vegetation will be fully mitigated through appropriate vent design, in conjunction the other mitigation measures, there are no residual impacts associated with the release of harmful air species.

Although representing a relatively small source of green house gas emissions, such releases cannot be fully mitigated, and are therefore considered a residual impact (to climate). Cumulative effect of project green house gas emissions is presented in Section 13, Cumulative Impacts.

d) Fugitive emissions

Fugitive emissions will be mitigated through appropriate specification and maintenance of valves, seals and flanges, storage tanks. Fuel distribution and handling procedures and training will minimised. In addition, general mitigation measure 19 will be applied.

Landscape

Pump Station G-2 is located in the northern edge of Tetriskaro forest. Operation of the facility will result in permanent modification of the landscape.

General mitigation measure 12 will be implemented. In addition, a landscape plan has been developed using plot plans, 3-D plans and visual simulations which build on field visits to the area made by a specialist landscape architect. The aim of the landscape plan is to screen the facility from passing receptors and to reduce the impact of the facility on the forest landscape. The landscape plan will be implemented alongside the reinstatement plan.

Currently, to the north and west of the facility, land use comprises fragments of even-aged oak and oak-hornbeam species of approximately 25 to 30 years of age, interspersed with large open meadow areas. There is no middle storey and ground cover is heavily grazed (Figure 10-7).

Figure Error! No text of specified style in document.**-7 Current landscape at PS-G2**

The landscape plan focuses on regenerating this part of Tetriskaro Forest. Planting of 3-4 year old oak and oak-hornbeam species, along with hawthorn will take place immediately after facility construction. Oak and oak-hornbeam species will be protected from grazing by protective tubing and parts of the new forest will be fenced to ensure further protection from grazing. Mixed age planting of a variety of species will give rise to the establishment of a lower, middle and upper storey forest. This will screen the facility from passing receptors such as agricultural workers and shepherds. Figures 10-8 and 10-9 illustrate views of the site immediately after construction and approximately 15-20 years after construction. The view is taken from approximately 250m north of the site, looking in a north-north-west to south-south-east direction.

FigureError! No text of specified style in document.**-8 Visual simulation of PSG2 immediately after construction**

FigureError! No text of specified style in document.**-9 Visual simulation of PSG2 15-20 years after construction**

It should be noted that there may be 'as build' variations in pump station design, in particular with regard to stacks associated with the processes. Final stack heights will be confirmed following additional dispersion modelling of crude topped distillate plant (and associated flare) and of stacks associated with the main line pump driver, during detailed design stage.

Permanent landscape modification means that there will be residual impact as a result of the operation of PS-G2. Residual impacts are however, minimised by the measures detailed above and the distance of the site from any permanent receptors.

Using the residual impact ranking methodology, the significance of residual impact for visual intrusion (given by consequence x likelihood) is considered Medium (a score of 3 x 5=15).

Contamination of land

During normal operation, activities will not lead to the contamination of soils. However, the storage, distribution, and application of fuels and lubricants, and exported crude and crude topped distillate, present a potential risk to soils through accidental spillage of the latter.

In order that the potential for contamination be mitigated during operation, general mitigation measures 21, 22 and 23 will be applied to PSG2, and therefore it is reasonable to expect that potential impacts will be fully mitigated by these measures.

Residual Impacts of PSG2

Residual impacts for PSG2 operation are considered to be:

- Visual intrusion of the site
- Operational noise and consequent impact to fauna

Each of these is discussed below.

Visual intrusion

The residual impact of visual intrusion, as a result of the presence of the pump station site, is recognised because the existing landscape is of high quality. As few permanent receptors exist near to the site, and because visual intrusion will be minimised through the proposed mitigation presented above, the consequence is considered as medium.

Using the residual impact ranking methodology, the significance of residual impact for visual intrusion (given by consequence x likelihood) is considered Medium (a score of 3 x 5=15).

It is proposed that no additional mitigation to visual intrusion is provided beyond that presented in this Section.

Operational noise

Operational noise will occur during normal operation of the site, however project standards will ensure no impact to humans arises. However, project standards cannot rule out possible impact to fauna, and therefore the consequence of operational noise is considered medium owing go the noise level or fauna mobility and therefore potential proximity to the source.

Using the residual impact ranking methodology, the significance of residual impact for operational noise (given by consequence x likelihood) is considered Medium (a score of 3 x 5=15). It is proposed that no additional mitigation to noise impacts is undertaken beyond that presented in this Section.

It is proposed that no additional mitigation to visual intrusion is provided beyond that presented in this Section.

10.3.7 IPSG1

The operation of IPSG1 presents potential environmental impact to the following receptors or environmental resources:

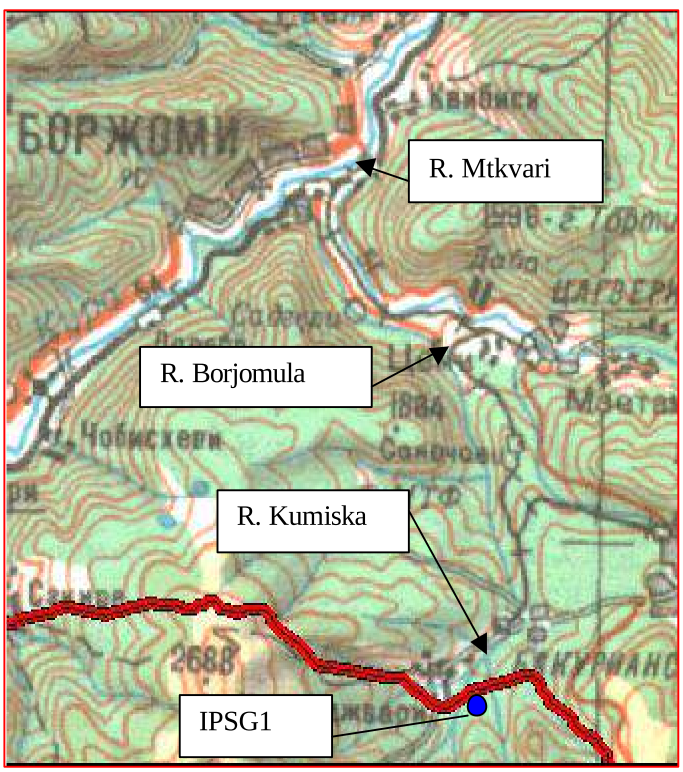
- Water resources
- Ecology
- Noise
- Air quality
- Landscape and visual intrusion
- Contamination of land

Each of these receptors in discussed in turn, including the potential impacts of the project activities and the applicable mitigation measures.

Water resources

The Intermediate Pigging Station IPSG1 is located at the edge of a forested area between the river Kumiska and a small surface water course that converges into the Kumiska approximately 350m to the North of the site. The Kumiska river in turn discharges into the Borjomula river that eventually flows through the Borjomi National Mineral Water Park. Figure 10-10 shows the location of the pigging station in relation to the above mentioned surface water features.

Figure Error! No text of specified style in document.**-10 Surface water features in the IPSG1 area.**



The activities associated with the operation of this intermediate pigging station that may possibly give rise to potential impacts on water resources are listed below:

a) Discharge of sanitary effluent
b) Discharge of rain water
c) Discharge from process drains (open and close)
d) Small spills of fuel, pigging wax or other contaminants

A number of mitigation measures will be applied to reduce both the likelihood and consequence of these potential impacts (from general mitigation measures):

- For impact a, b and c the mitigation measures are: 9 and 20
- For impact d the mitigation measures are: 4, 10, 21, 22 and 23

It is expected that these impacts will be fully mitigated by measures noted above.

Ecology

Intermediate Pigging Station IPSG1 is in a forested area and there may be a number of potential operational impacts. The forest is important wildlife habitat for large and medium-sized mammals such as Wolf (*Canis lupus*); Brown bear (*Ursus arctos*); Fox (*Vulpes* vulpes); Hare (*Lepus europeaus*); Marten (*Martes sp*.), Wild cat (*Felis silvestris*), Lynx (*Lynx lynx*) and Roe deer (*Capreolus capreolus*). The listed activities will also impact the populations of birds including those of Corncrake (*Crex crex*), a globally threatened species and black grouse (*Tetrao mlokosiewiczi*) - endemic of the Caucasus. The habitat also supports a number of Georgian Red Data Book and endemic species of amphibians and reptiles such as Caucasian salamander (*Mertensiella caucasica*), Banded newt (*Triturus vittatus*), toad (*Bufo verrucossimus*); Viper (*Vipera kaznakovi*). The operation of the Pigging Station may lead to disturbance of these animals through:

a) Physical presence of the AGI
b) Operational noise from the AGI (not expected to be significant)
c) Disturbance and noise from traffic movements

The mitigation of these impacts has been addressed above in the landscape and noise sections. There may be residual impacts on ecology as a result of operation of the AGI. Using the residual impact ranking methodology, the significance of impact (for operational noise (given by consequence x likelihood) is considered Medium (a score of 3 x 5=15). It is proposed that no additional mitigation to noise impacts is undertaken beyond that presented in this Section.

Noise

IPSG1 will operate continuously and be a source of noise through the:

- Operation of an electrical power generator and other minor plant
- Movement of vehicles to and from the site

Processes, which take place at IPSG1 are not likely to generate significant noise levels under normal operation, and rotary plant at this site is relatively small scale. Therefore operational noise is unlikely to represent a nuisance to human receptors (the nearest occupied dwelling is approximately 350m from the proposed site).

Based on the range of species that populate the proposed site area, and their sensitivity to noise, a natural buffer around the IPS has been considered necessary to attenuate in the long term the propagation of noise and thus disturbance to wildlife. The buffer will consist of local species of trees and its extent and composition is discussed in detail in the landscape Section.

Given the scale of stationary plant at this site, and the nature of operational activities (Section 5, Project Description), impacts to fauna are expected to be minor, however, given the timescale required for the reforestation scheme it is expected that residual impacts will occur as a result of IPSG1 operation. Using the residual impact ranking methodology, the significance of impact for operational noise (given by consequence x likelihood) is considered Medium (a score of 3 x 5=15). These impacts are discussed in detail in Section 12, Residual Impacts.

Air quality

Impacts to air quality resulting from the operation of the IPSG1 site arise from:

a) Site power generation (combustion emissions)
b) Pigging operations (fugitive losses of hydrocarbons)

a) Site power generation

Emissions from IPSG1 site power generation would be mitigated through General Mitigation Measures 16, 17, 18 and 19. In addition, emissions would be released by a vent not less than 1m above the generator house roof.

As potential impacts to human health and vegetation will be fully mitigated through appropriate vent design, in conjunction the other mitigation measures, there are no residual impacts associated with the release of harmful air species.

b) Fugitive emissions

Fugitive emissions will be mitigated through appropriate specification and maintenance of valves, seals and flanges, storage tanks. Fuel distribution and handling procedures and training will minimise fugitive losses. Appropriate wax handling and transfer procedures will be applied to minimise fugitive losses. In addition, general mitigation measure 19 will be applied.

Landscape

IPS1 is located on the edge of Tsikisjvari forest. The existence and operation of the facility will result in landscape impact and visual intrusion, particularly to inhabitants on the southern edge of Tsikisjvari village.

Mitigation measure 12 will be implemented. In addition, a landscape plan and reinstatement strategy have been developed using plot plans, 3-D plans and visual simulations which build on field visits to the area made by a specialist landscape architect. The aim of the landscape plan is to screen the facility from permanent receptors in Tsikisjvari and also from passing receptors including agricultural workers and shepherds.

The stream and associated forest to the west of the proposed site will screen the facility from permanent receptors in Tsikisjvari. As part of the landscape plan, the banks of the stream will be reinforced and planted with a mixture of goat willow and hawthorn. Oak, oak-hornbeam, pine and spruce will be planted alongside the stream at a distance of 8 – 10m from the river bank to minimise the likelihood of river bank erosion as a consequence of soil break-up from root development. At this location, early planting (by winter 2002) is proposed as the west side of the stream will not be disturbed by construction activities.

Alongside the facility perimeter wall, fast-growing shrubs including hawthorn will be established. A number of slower growing species including pine, spruce and hazelnut will be planted particularly to the south and east where the facility backs onto park like forest and meadow. Figure 10-11 illustrates a plan view of the site before construction and 15-20 years after the implementation of the landscaping plan.

FigureError! No text of specified style in document.**-11 Plan View of IPSG1 before and after implementation of landscape plan**

Permanent landscape modification means that there will be residual impact as a result of the operation of IPS-G1. Appling ESIA methodology, the significance of residual impact for visual intrusion (given by consequence x likelihood) is considered Medium (a score of 3 x 5 = 15). Residual impacts are minimised by the measures detailed above.

Contamination of land

Activities associated with normal operation of the facility will not lead to the contamination of soils. However, the storage, distribution, and application of fuels and lubricants, exported crude and crude topped distillate, and pigging wax handling, present a potential risk to soils through the possibility of accidental spillage.

In order that the potential for contamination be mitigated during operation, general mitigation measures 21, 22 and 23 will be applied to IPSG1. It is reasonable to expect that potential impacts will be fully mitigated by the identified mitigation measures.

Residual impacts of IPSG1

Residual impacts for IPSG1 operation are considered to be:

- Visual intrusion of the site
- Operational noise and consequent impact to fauna

Each of these is discussed below.

Visual intrusion.

The residual impact of visual intrusion, as a result of the presence of the IPS site, is recognised because the existing landscape is of high quality, and that permanent communities exist at Tsikisjvari. As visual intrusion will be minimised through the proposed mitigation presented above, the consequence is considered as medium.
Appling ESIA methodology, the significance of residual impact for visual intrusion (given by consequence x likelihood) is considered Medium (a score of 3 x 5 = 15).

It is proposed that no additional mitigation to visual intrusion is provided beyond that presented in this Section.

Operational noise

Operational noise will occur during normal operation of the site, however project standards will ensure no impact to humans arises. However, project standards cannot rule out possible impact to fauna.

Using the residual impact ranking methodology, the significance of impact (for operational noise (given by consequence x likelihood) is considered Medium (a score of 3 x 5=15). It is proposed that no additional mitigation to noise impacts is undertaken beyond that presented in this Section.

It is proposed that no additional mitigation to visual intrusion is provided beyond that presented in this Section.

10.3.8 Block valves

The operation of block valves present potential environmental impact to the following receptors or environmental resources:

- Water resources
- Ecology
- Landscape and visual intrusion
- Contamination of land

Power generation (approximately 7kW) at these sites will represent an insignificant contribution to project emissions and has not been considered in this assessment. Each of the above receptors is considered in terms of the potential impacts upon them caused by project activities, and appropriate mitigation measures required.

Water resources

Although this site will not generate sanitary or other wastewater, there may be fuel storage at remote actuated block valves, and therefore a minor risk of accidental spillage is presented. In order that this risk be minimised, general mitigation measures 4 (for fuel spills), 21 and 22.

Ecology

With the exception of the potential impacts to surface water quality mentioned above the operation of the block valves will not cause significant disturbance to the area’s ecology.

Landscape

Block valves along the route will result in localized landscape and visual impacts. General mitigation measure 12 will be implemented at all locations. Three block valves are located in areas of particularly high landscape quality.

Block Valve G-B12 is located on the north east side of Mount Tavkvetili. To the north west are the Narianis Veli wetlands. The Landscape Plan will screen the facility through the planting of rhodedendron and hawthorn species.

At Sakire, Block Valve G-B14 is surrounded by open meadows, cultivated fields and hedgerows. The setting is of high landscape value with the Trialeti range and associated meadow and forest areas rising up to the south of the site. The Landscape Plan will use hawthorn, pine and spruce to screen the facility from permanent receptors to the west of the site and from passers by on the road further to the west.

At Tiseli, Block Valve G-B15 is located on a west-facing slope and is surrounded by open meadows, fields, and hedgerows. As with Block Valve G-B14, the Landscape Plan will use hawthorn, pine and spruce to screen the facility from both permanent and temporary receptors.

Contamination of land

Activities associated with normal operation of block valves will not lead to the contamination of soils. However, the storage, distribution and application of generator fuels and lubricants, present a potential risk to soils through the possibility accidental spillage.

In order that the potential for contamination be mitigated during operation, general mitigation measures 24, 25 and 26 will be applied. It is reasonable to expect that potential impacts will be fully mitigated by the identified mitigation measures.

10.3.9 Other activities

Activities not associated with a particular facilities, which may result in environmental impact comprise the use of vehicles for:

- Pipeline route surveillance
- Transport of crude topped distillate and other vehicle activity
- Access road clearance to BTC facilities

As relatively few vehicles would be used during facility operation, it is not expected that noise will be significant, and in addition, those vehicles associated with greatest potential for noise impact will use public highways and access routes. Although vehicle operation would result in the generation of combustion emissions, the relatively minor numbers of vehicles represent an insignificant contribution to project emissions. Therefore, the following environmental receptors or resources may be impacted by road and off-road vehicles:

- Water resources
- Ecology (particularly for off-road movements)
- Landscape and visual intrusion
- Contamination of land

Water resources

Normal operation of vehicles during the operational phase, whether on public roads, or off-road (for example during ROW inspection) will not lead to contamination. General operation of vehicles may lead to accidental events and loss of oils or fuels, in turn leading to contamination of water resources. Although these accidental events are unlikely owing go regular vehicle maintenance, general mitigation measure 4 will be applied for vehicle activity.

Regular transport of CTD between PSG1 and PSG2 within Georgia presents an environmental risk to water sources should a road accident occur, particularly because transport routes will cross rivers, therefore is considered in Section 10.4. However, general mitigation measures 4 and 26 will be adopted.

Ecology

Off-road vehicle movement in areas of particular sensitivity may disturb fauna. As vehicles will, where practicable, utilise existing tracks and access routes, and because such disturbance to fauna will be transitory, it is not expected that vehicle movement will impact fauna significantly. However, in order to minimise potential impacts, general mitigation measure 2 will be adopted.

Landscape

Activities along the pipeline route include inspection of the ROW, which may result in visual intrusion. Traffic movements associated with operation of the pipeline will result in infrequent and transient visual intrusion, and are not therefore considered a significant impact.

Contamination of land

As noted above, normal operation of vehicles will not lead to the contamination of land. General operation of vehicles may lead to accidental events and loss of oils or fuels, in turn leading to contamination of land. General mitigation measure 4 will be applied for operational vehicle activity.

Regular transport of crude topped distillate between PSG1 and PSG2 within Georgia presents an environmental risk should a road accident occur, to land and therefore is considered in Section 10.4. However, general mitigation measures 4 and 23 will be adopted.

Using the residual impact ranking methodology, the significance of residual impact for of waste generation (given by consequence x likelihood) is considered Medium (a score of 2 x 5=10).

It is proposed that no additional mitigation to visual intrusion is provided beyond that presented in this Section.

10.3.10 Residual impact waste generation at all facility operation

Waste will be generated as a result of operation of all above ground facilities. Operational waste volumes for operation are anticipated to be low, and all wastes will be managed within constraints of project waste management plan (see Section 14, Management and Monitoring). Therefore, the consequence of waste generation is considered Low in terms of residual impact.

10.4 DECOMMISSIONING

At the end of the project life, the BTC and its ancillary equipment will have to be decommissioned. A number of technical options are currently available for decommissioning an oil pipeline in a safe and environmentally sound manner. The following list provides a number of engineering solutions of which one or more may be applied to the BTC.

- Removal of all surface facilities and appropriate reinstatement
- De-oiling of the BTC
- Filling the line with air or nitrogen to slightly over atmospheric pressure
- Maintaining a functional CP system to prevent corrosion, as corrosion could lead to subsidence
- Investigating any corrosion that does occur and excavating the BTC section if necessary
- In the event of a high risk of subsidence it may be necessary to fill sections of the BTC with concrete to prevent collapse

Environmental impacts are often associated with decommissioning activities of a pipeline and given the timeframe these activities will be the subject of an ESIA and appropriate BPEO studies towards the end of the project life.

10.5 ASSESSMENT OF UNPLANNED EVENTS

10.5.4 Introduction

As part of the early design process, the pipeline route was selected specifically to avoid populated areas, areas with known geohazards or other features that could have jeopardised the integrity of the pipeline during its operation. This process has arguably had the largest impact on minimizing the risk from unplanned events. Additionally, BTC has been designed to meet or exceed the relevant international codes and standards and a large effort has been directed towards ensuring that the design and integrity of the pipeline is maintained in order to ensure that there are no spill events. Rigorous application of best practice leak prevention and detection measures have been incorporated into the design and are outlined in Section 5, Project Description.

Nevertheless, despite high levels of design and operational standards, there is always a small residual risk of a loss of containment event.

An Environmental Risk Assessment (ERA) has been carried out with the following objectives:

- To demonstrate that the base case design is robust and verify that that residual risk of a spill is extremely small. It is important to note that the ERA was used both as an assurance tool and a tool to feed back into the design. The ERA was used as an iterative design tool to determine the effect of design changes on residual risk.
- To evaluate the potential consequences of a spill event in specific areas which have been selected on the basis of elevated environmental risk

This Section summarizes the environmental risk assessment and provides an overview of the results.

10.5.5 Environmental risk assessment

Environmental risk incorporates the risk to the environment as a whole, that is air, water, land, plants and animals, including direct or indirect impact on people. The environmental risk described in this report used in the assessment of the relative risk along the pipeline has been calculated as:

Environmental Risk = Frequency of failure x Volume of oil spillage x Environmental sensitivity factor

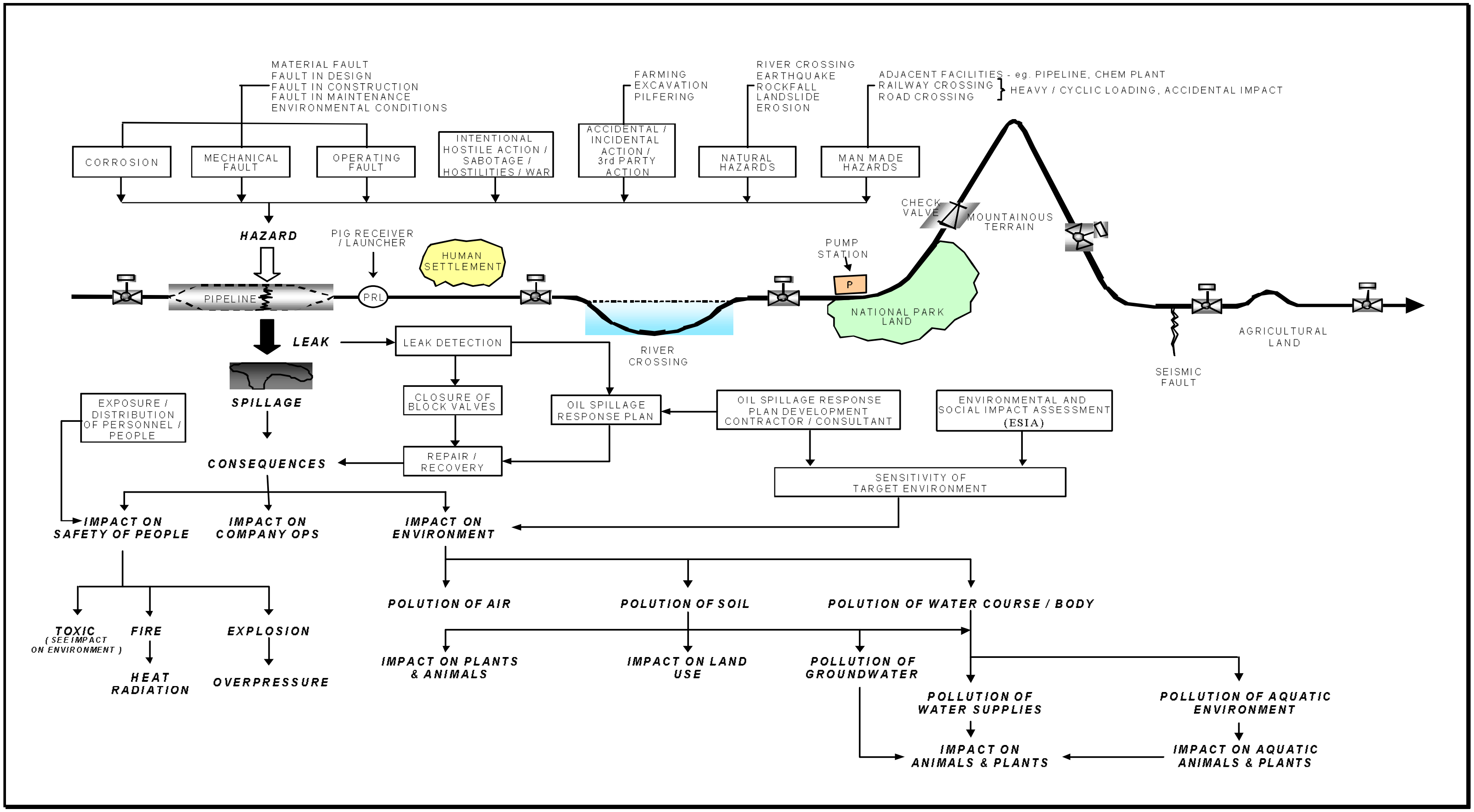
The major steps in the risk assessment process were:

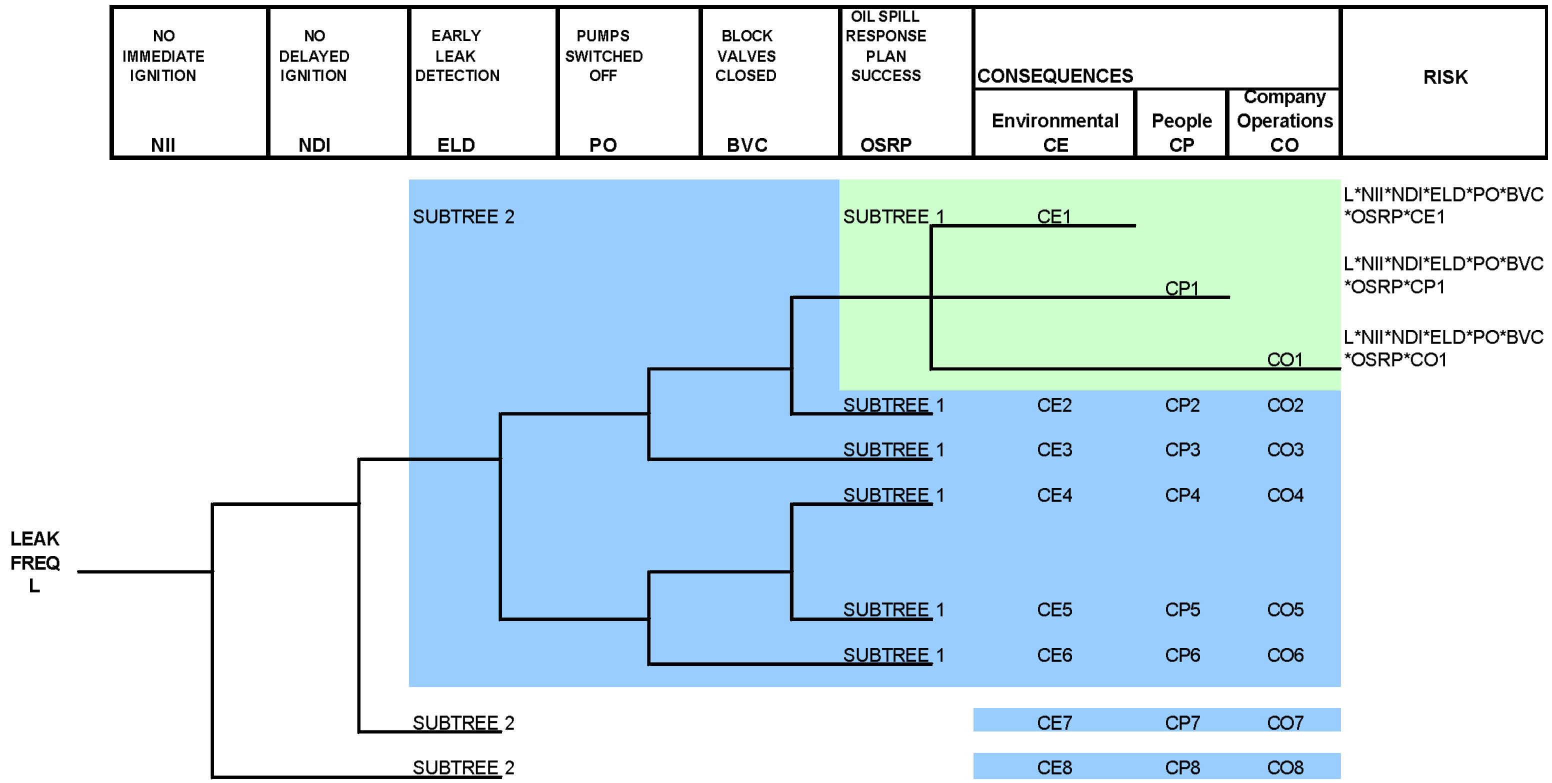
- Failure frequency analysis ie determination of spill frequency which involves both the identification of causes of failure and the likelihood of the failure
- Evaluation of potential spill volumes associated with the failure scenarios
- Determination of environmental sensitivity, ie susceptibility of the receiving environment to a spill of hydrocarbon. Note that this category includes sensitivity of human population as well as the environment.
- Quantification of risk by combining spill frequency, magnitude and sensitivity of affected environmental features

These steps are described in more detail below

Figure 10-12 below shows the schematic flow diagram of the QRA inputs and considerations

FigureError! No text of specified style in document.**-12 Schematic overview of pipeline risk assessment**




NO IMMEDIATE IGNITION NII
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CONSEQUENCES
Environmental CE
People CP
Company Operations CO
RISK
LEAK FREQ L
SUBTREE 2
SUBTREE 1
CE1
CP1
CO1
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SUBTREE 1 CE5 CP5 CO5
SUBTREE 1 CE6 CP6 CO6
SUBTREE 2 CE7 CP7 CO7
SUBTREE 2 CE8 CP8 CO8

10.5.5.1 Spill frequency estimation

Benchmark spill frequency estimates

The first task associated with this risk assessment is the identification of the possible causes of failure and the likelihood (or frequency) of these failures. This involves the consideration of historical data and site-specific conditions to estimate a predicted frequency of failure for spill events. This analysis shows where failures have been experienced in the past and hence where pipeline designers and operators must focus in order to decrease leak frequency. In this study, Western European pipeline failure and leakage data compiled by CONCAWE, an industry sponsored research organization, were used to develop an initial estimate that formed the spill frequency "benchmark". The historical record of pipeline spill events presents specific records of spill statistics associated with the following categories of failure:

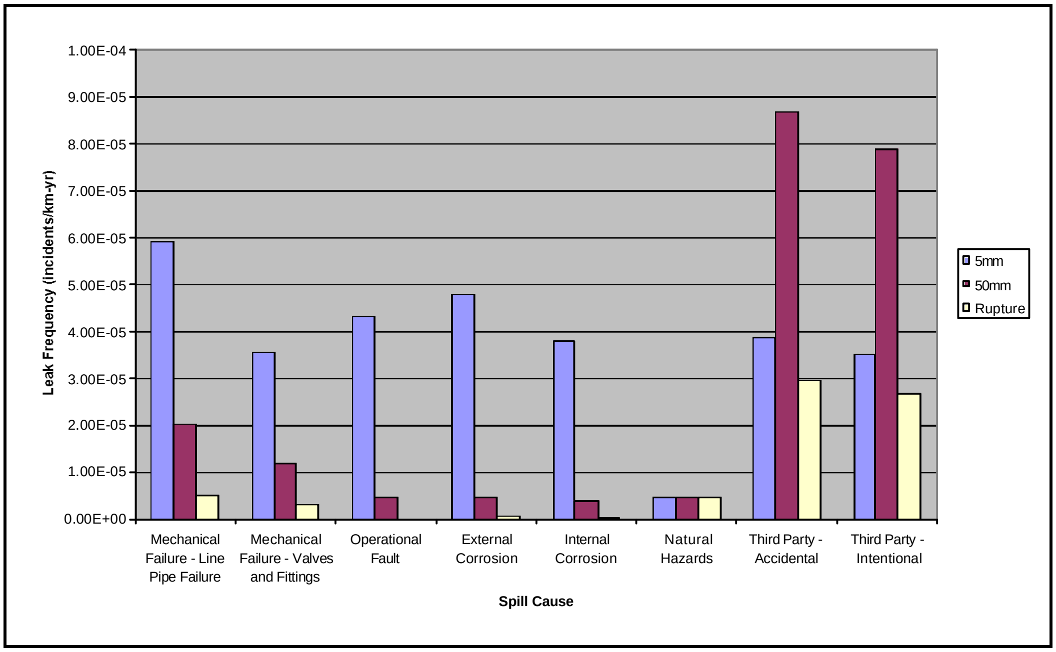
- Corrosion, both internal and external
- Mechanical faults, covering failure of the pipeline and fittings
- Operating faults, such as over-pressurisation
- Intentional hostile action against the pipeline, including sabotage and vandalism
- Accidental or intentional action against the pipeline, normally in the form of physical impact from mechanical tools
- Natural hazards, such as earthquakes, mud volcanoes, rockfalls, landslides, mudflows, ground subsidence or heave, erosion and river scour
- Man-made hazards, such as railways, roads, and adjacent pipelines or plant

Spill Cause	Frequency of Spillage [incidents/km y]
Mechanical Failure	
- Line Pipe Failure	8.44 E-5
- Valves & Fittings	5.06 E-5
(Subtotal)	(1.35 E-4)
Operational Fault (System malfunction / human error)	4.78 E-5
Corrosion Related	
- External Corrosion	5.35 E-5
- Internal Corrosion	4.22 E-5
(Subtotal)	(9.56 E-5)
Natural Hazards	1.41 E-5
Third Party Damage	
- Accidental / Incidental	1.55 E-4
- Intentional / Malicious	1.41 E-5
(Subtotal)	(1.72 E-4)
TOTAL	4.64 E-4

Table Error! No text of specified style in document.**-10 Statistical failure data for onshore pipeline systems (CONCAWE, 1998)**

By combining frequency figures with the types of leaks attributable to the various causes, an appreciation of both frequency and volume is apparent. Figure 10-13 below shows that while a high frequency of failure is associated with mechanical failure, these tend to be in the small leak volume category. Third party damage is associated with the highest frequency of both 50mm and full bore rupture.

Figure Error! No text of specified style in document.**-13 Leak frequency by hole size and fault category (Concawe, 1998)**



CONCAWE data is derived from Western European pipeline experience and represents the most comprehensive failure data set available to use for the purposes of risk assessment. It gives a very good general indication of historic trends with respect to failure mode and frequency. As stated previously, it is very helpful in determining where focus should be during pipeline design and operations. However, it should be recognized that CONCAWE has limitations and therefore it is useful for indicative purposes but might not necessarily accurately reflect the frequency likelihood for all pipelines.

The data set from CONCAWE is taken over a number of years and includes pipelines of many different diameters, coated and uncoated pipelines, and varying inspection and integrity regimes. This it represents data from the “best” and the “worst” pipelines in Western Europe.

Additionally, there are other issues which must be considered when using CONCAWE data. For example, whilst third party spills, which include activities like farming and trenching, accounted for the majority of the 48% of leaks, it could be argued that such activities can be expected to be significantly less frequent in Georgia. Population densities and the number of services being worked on are both significantly lower than in Western Europe and different farming practices apply where deep digging mechanical activities are infrequent. The use of CONCAWE data may, therefore, result in a conservative assessment of risk from this particular type of event. On the other hand there can be expected to be a potential increase in risk from intentional malicious damage from third party activities.

Another example of the limitation of the direct use of the CONCAWE analysis is the under-representation or absence of geographical factors relevant to this project. Earthquakes occur more frequently in the border region between Europe and Asia than in Western Europe and differences in weather and geographical features can result in flash flooding in a large number of seasonal rivers.

These considerations generally highlight that a realistic estimate of the likelihood and size of a leak in the BTC oil pipeline requires an adapted approach beyond the simple extrapolation of CONCAWE data. In particular, area-specific data using confirmed field survey information has been used wherever possible. Preliminary consultation with key stakeholders highlighted the need to include consideration of the additional hazards posed by rivers and landslide areas.

Project-specific conditions

The spill frequency estimates developed from CONCAWE historical data were modified to more specifically address project-specific conditions. These modifications address site-specific natural hazards, special concerns regarding intentional third-party damage, and several project design features that differ from the "average" European pipeline addressed by the CONCAWE data. These modifications generally resulted in an increase in the predicted spill frequency associated with the BTC pipeline. The refinement of spill frequency estimates is described below. This refinement was developed by review of each kilometre along the Georgian section of the BTC pipeline, and site-specific spill frequencies were calculated by the spill risk model.

It should be noted that this is an extremely conservative approach as the project has not taken "credit" for design features and mitigation measures, which put the pipeline into the "best" category in terms of design and operational integrity.

Site-specific natural hazards

Natural hazards represent a variable risk for pipelines depending on their location. Refinement of historical risk frequencies requires the use of information from a geohazard review specific to the BTC pipeline route. Specialist consultants were engaged to analyse the failure data from landslides, mud flows, fault crossings and river erosion hazards.

Seven known active faults were identified for specific consideration. Each of these faults were evaluated to define a recurrence interval for fault displacement exceeding pipeline design specifications. This was used to define an annual probability of a design-level fault displacement. This information was used to develop a conservative estimate of the annual spill frequency (spills per kilometre-year) associated with pipeline segments directly exposed to each fault displacement.

Landslides were also specifically addressed in this study. An analysis of slope stability and existing landslide features was conducted to identify potential hazards to the pipeline. This analysis included slopes with failure potential and identified landslide areas. Each segment of the pipeline route was characterised in terms of slope-related damage potential based on professional judgment, and this characterisation was used to define the landslide-related spill frequency estimate for each segment.

River crossings were identified as another natural feature with the potential to affect spill frequencies. Three river crossings were considered to justify special consideration in spill frequency calculations. These spill frequency estimates were combined with the fault crossing and landslide spill frequency estimates to develop the overall spill risk associated with natural hazards for each one kilometre pipeline segment

Third party intervention

Another topic of special concern for the BTC pipeline design is the potential for intentional third-party damage to the pipeline. The CONCAWE historical record of such events is not considered representative of the socio-political environment along the BTC pipeline route. Specific measures have been incorporated in the base case design to mitigate this risk and, therefore, CONCAWE frequency estimates are still considered appropriate. It could be argued that the third party risk from accidental events is less in Georgia owing go farming method and population and CONCAWE frequency estimates perhaps over estimate the frequency. The frequency estimates were not altered in this assessment and, therefore, may overestimate the risk slightly.

South Caucasus gas pipeline

Another design feature considered in the spill frequency analysis is the proximity of the South Caucasus Gas Pipeline through Georgia which, if it progresses, will be installed in the same corridor as the BTC line. The hazard from the gas pipeline was added as an increased spill frequency in the spill occurrence model.

Overall spill frequency results

The analysis of potential oil spill frequencies using historical CONCAWE data and specific refinements described above resulted in the determination of location-specific spill occurrence frequencies.

10.5.5.2 Potential spill volumes

The volume of potential oil spills is an important element in the assessment of overall risk. The volume of oil spilled is influenced by several factors, including:

- Size of the leak opening
- Pressure and flow rate at the leak site
- Time required to detect and respond to the leak
- Leak location and associated factors such as topography, static liquid head pressure, valve placement, and response access

This evaluation of spill sizes begins with the separation of spill events into three categories based on the size of the leak opening. These categories include pipe openings of 5mm or less, 6mm to 50mm, and full pipe rupture. Table 10-14 presents the proportion of leaks in each size group associated with each spill cause. This information was used to define the frequency of occurrence of leak openings of each size category for each one-kilometre long segment of pipe.

Table Error! No text of specified style in document.**-11 Leak size distribution by spill cause**

Cause	Proportion of Total Leaks (%)		
	Proportion of Leak (5mm or less)	Hole (6mm to 50mm)	Rupture (full bore)
Mechanical Failure			
Line Pipe Failure	70	24	6
Valves & Fittings Failure	70	24	6
Operational Fault (System Malfunction/Human Error)	90	10	0
Corrosion-related Spills			
External Corrosion	90	9	1
Internal Corrosion	90	9	1
Natural Hazards	34	33	33
Third Party Damage			
Accidental and Incidental	25	56	19

For each kilometre point, an estimated spill volume, associated with each spill size category, was calculated based on pipeline operating characteristics and location-specific data. This calculation addresses three distinct phases of oil release associated with each spill event:

- The first phase involves the calculation of leak volume, V_1, from the initial leak until to initiation of pump shutdown and valve-closure. Spillage during this first phase involves leakage at full operation of the pipeline system
- The second phase spill release volume, V_2, is a calculation of leak volume during the depressurisation of the pipeline section. This phase begins immediately following controlled closure of pipeline valves, and continues until free flow from the leak opening is halted
- The third phase (V_3) continues until response crews arrive at the leak site to contain the release or until the line empties itself of the fluid

Table 10-15 indicates the leak detection and response times and other details estimated to develop the spill volume calculations used in this study.

Table Error! No text of specified style in document.**-12 Assumed response times in calculation of spill volumes**

Activity	Hole Diameter 5mm (LEAK)	Hole Diameter 50mm (HOLE)	Hole Diameter Full Bore (RUPTURE)
Time to detect and confirm leak (T1)	48 hours	1 hour	1 minute
Time to shutdown pumps (T2)	10min	10min	10min
Time to close Block valves in affected section (T3)	10min	10min	10min

Activity	Hole Diameter 5mm (LEAK)	Hole Diameter 50mm (HOLE)	Hole Diameter Full Bore (RUPTURE)
Time to mobilise Spill Response Team and contain/control leak (T4)	24 hours	24 hours	24 – 72 hours to mobilise team and equipment sufficient to deal with catastrophic spill
Total spill/leak duration (T1 + T2 + T3 + T4)	72 hours	25 hr 20min	Time for affected section to drain down

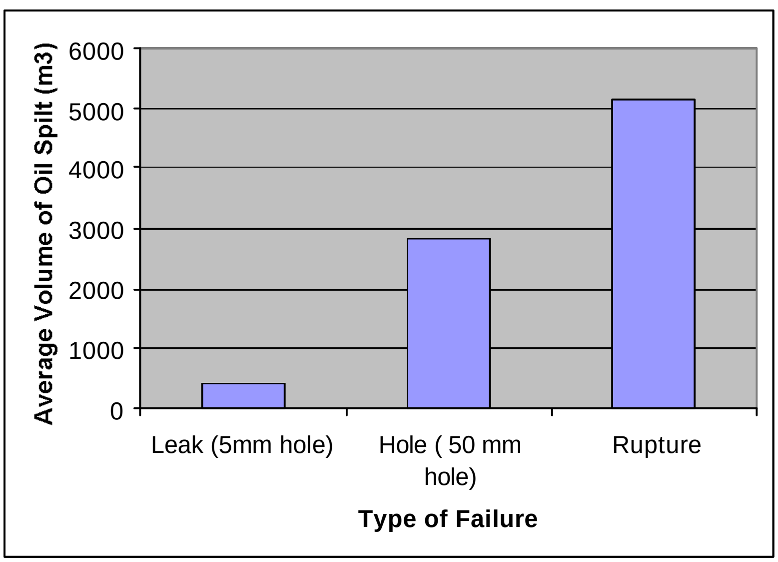
Spill volume inputs to the risk model

The total volume of oil spilled in any one kilometre section of the pipeline arising from each of the three leak categories considered has been calculated using the computer program AUMEX developed by ILF, the design contractor for the Turkish section of the BTC pipeline.

Overall spill volume results

With the completion of this element of the analysis, an understanding of the magnitude of potential oil spills is available to supplement the estimate of spill occurrence frequencies. Taken together, these two elements of the risk study provide an understanding of the most likely spill volumes at specific locations along the pipeline route.

Figure Error! No text of specified style in document.**-14 Average volume of spill**



10.5.5.3 Consideration of environmental sensitivity

Environmental sensitivity was determined based on the potential movement of spilled oil to sensitive resources and the degree of sensitivity of those resources. Simply put, for the environmental sensitivity to be rated as very high, the oil must easily reach the receptor and the receptor must be highly sensitive to impact from oil. This evaluation was accomplished for each one kilometre long segment of the pipeline, and focused on the following elements:

- Gradient to nearest downhill surface water
- Proximity to downhill surface water
- Sensitivity of downhill surface water
- Capacity of surface water to transport oil
- Soil permeability
- Groundwater sensitivity
- Terrestrial ecological resources
- Land use
- Proximity to downhill known archaeological resources

Each of these issues was reviewed for each pipeline segment and rated in terms of environmental sensitivity.

These kilometre-sections were first rated in terms of environmental sensitivity levels: 1 being "not sensitive", to 5 "very high sensitivity". The sensitivity rating was then multiplied by a weighting factor to reflect the assessment of the severity of spill impacts to the environmental receptor. This weighting factor took into account the nature of the effort required to respond and remediate the spill. It also accounted for the degree of recovery expected following the remediation for the receptor categories of Surface Water, Groundwater, Terrestrial Ecological Resources, Land Use and Archaeology. The environmental sensitivity matrix used for the kilometre by kilometre assessment is outlined in Table 10-15. The environmental sensitivity of the kilometre segment was characterized by the environmental receptor with the highest sensitivity. In the example highlighted in Table 10-16, "Terrestrial Ecological Resources" of that particular kilometre segment determines the overall sensitivity of that segment which is 3.

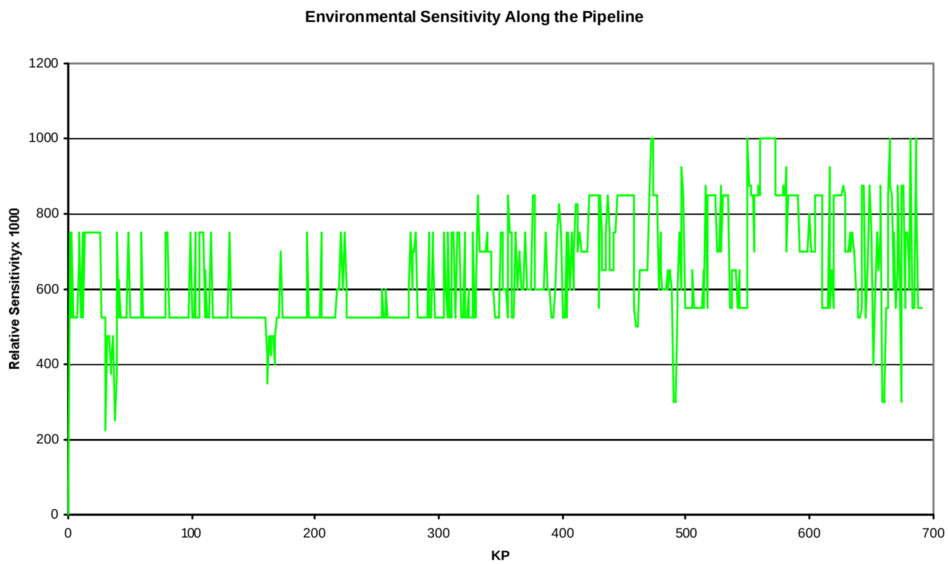
Table Error! No text of specified style in document.**-13 Environmental sensitivity assessment matrix**

Rating criteria	**Gradient to nearest downhill surface water**	**Proximity to downhill surface water**	**Sensitivity of surface water downstream**	**Capacity of surface water to transport oil**	**Soil (permeability)**	**Groundwater sensitivity**	**Terrestrial ecological resources**	**Land use**	**Proximity to downhill known archaeology**
Not Sensitive	less than 5 degrees	greater than 1.6km	No local surface water	No evidence of irrigation channels	Very low permeability	Non-aquifer	No ecological resources of value	Unused	greater than 1.6km
Low	5 - 10 degrees	0.4 - 1.6km	Artificial pond/dam for irrigation +/o livestock	Irrigation channels present	Low permeability	Confined aquifer - local importance	Disturbed habitat with minor ecological value	Extensive rough grazing	0.4 - 1.6km
Med	10 - 15 degrees	0.2 - 0.4km	Potential water supply	Natural streams not able to be diverted / controlled	Medium permeability	Confined aquifer - regional importance	Locally important habitat and/or flora/fauna	Intensive grazing, no local populations	0.2 - 0.4km
High	15 - 25 degrees	0.1 - 0.2km	Major source of local water +/o wetland of national importance*	Seasonal river	High permeability	Unconfined aquifer - local importance	Nationally important habitat and/or flora/fauna	Horticultural / Arable Agricultural Use +/o national reserves, local populations	0.1 - 0.2km
Very High	greater than 25 degrees	less than 0.1km	Major local and regional water supply +/o wetland of international importance*	Permanent river	Very high permeability (Fissure Flow)	Unconfined aquifer - regional importance	Internationally important habitat and/or flora/fauna	Horticultural / Arable Agricultural Use +/o reserve of international importance, local populations	less than 0.1km

Overall environmental sensitivity results

The results of this phase of study showed the relative environmental sensitivity rating on a kilometre by kilometre basis and provided for the environmental sensitivity input data to be input into the model.

FigureError! No text of specified style in document.**-15 Distribution of relative environmental sensitivity in Georgia**



10.5.5.4 Risk analysis results

The previous sections describe how frequency of spill, spill volumes and environmental sensitivity were determined. The risk analysis model combines these three elements and enables a computation of the relative environmental risk along the pipeline on a kilometre by kilometre basis.

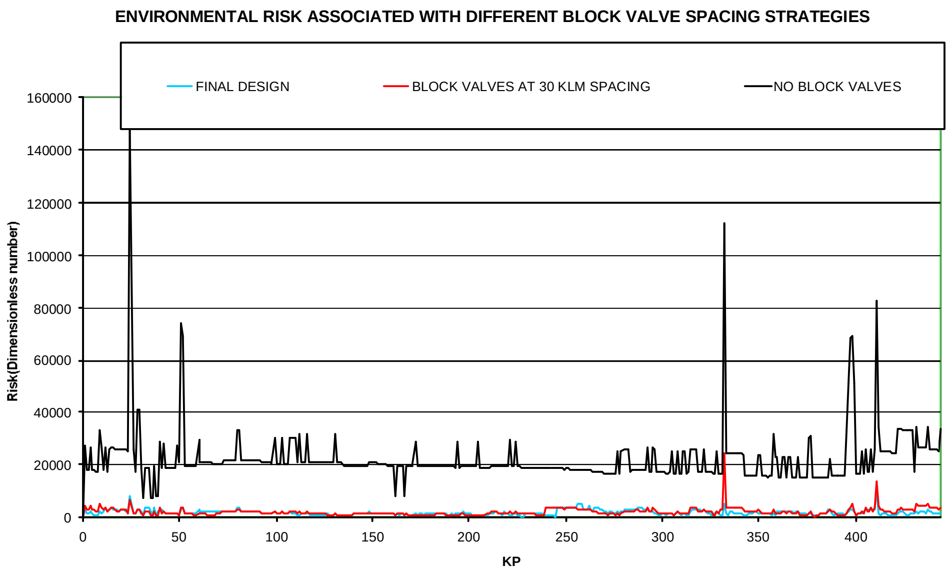
The relative environmental risk was not uniform and varied significantly dependant on location.

The results enable the project to evaluate where additional mitigation measures could be considered and the impact of additional mitigation measures on the risk profile. The application of the model is an iterative process and allows multiple runs of the model to evaluate the benefit of changing various design features on the relative environmental risk profile.

Changes to the base case design as a result of the risk assessment process

The project design engineers reviewed the model results and identified further opportunities reduce the frequency and size of oil spills. This enabled an evaluation of benefit of increasing the number of block valves and check valves to reduce the volume of potential oil spilt versus the slight increase in spill frequency associated with the additional valves. Figure 10-16 outlines the impact of changing the configuration of the block valves on the environmental risk profile.

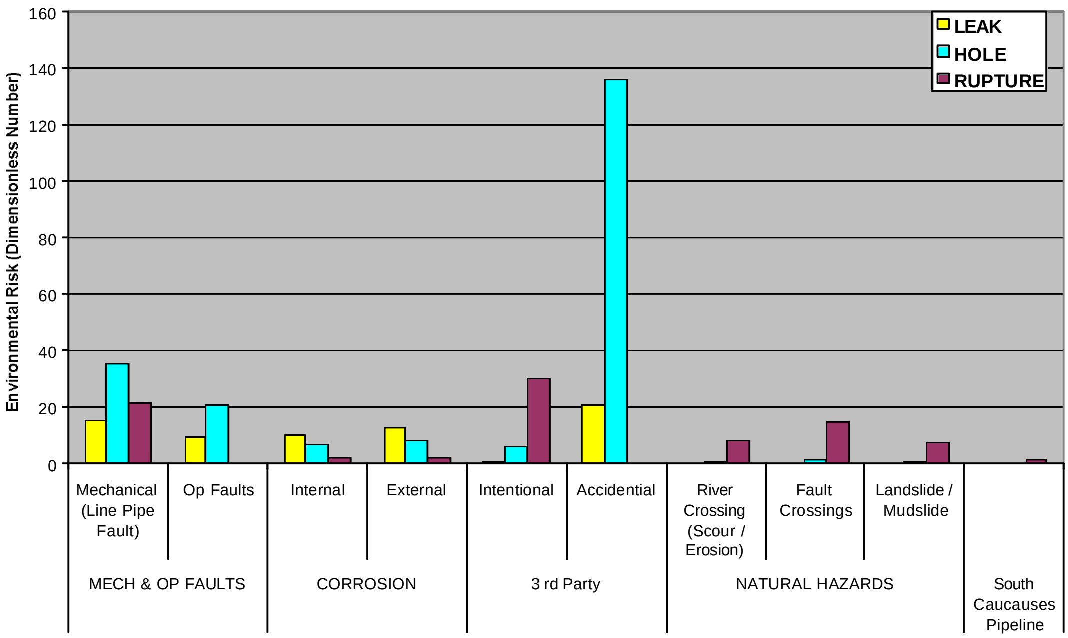
Figure Error! No text of specified style in document.**-16 Impact of block valve placement on environmental risk.**



The residual risk after changing the block valves is not a uniform profile and there are still areas which present relatively more environmental risk than others. These "peaks" are mainly due to natural hazard risks such as faults and river crossings. The design engineers are using this data to determine what additional design mitigations can be applied to lower the environmental risk. This iteration is taking place currently. The exception is that the additional mitigations will result in further risk reduction.

The outputs from the risk assessment have been assessed to better understand the types of activities that pose the largest risk to the pipeline, and are presented in Figure 10-17. This graph highlights the fact that whilst there are some locally high risk areas associated with fault crossings and other natural hazards, the largest overall risks are associated with potential failure causes that may occur at any point along the pipeline. Therefore, whilst some further reduction in risk at specific locations could possibly be achieved, the main environmental risks for the pipeline as a whole are associated with human activity. In particular the activities of the population (ie 3rd Party activity) and operations staff are the most significant risks to the pipeline.

Figure Error! No text of specified style in document.**-17 Summary of Environmental risk for different pipeline failure modes**



10.5.6 Analysis of consequences of potential oil spills

10.5.6.1 Introduction

The impact of a pipeline failure, in terms of damage to environmental resources (rather than risk of loss of life or serious injury to individuals or groups of people) is determined by a number of factors based on environmental resources, hydrology, soil characteristics and topography. The speed at which oil will travel is significant in terms of determining the environmental impact of a leak.

Once oil has been released to the environment it will spread. The extent to which it spreads is determined by the location of the pipeline (whether it is buried or above the surface), the topography of the land and the characteristics of the surrounding soils. Lighter fractions of the oil will evaporate and some will become attached to the soil particles. A proportion of the oil may penetrate to deeper layers of permeable soils.

Releases close to rivers will be distributed downstream and may extend even beyond the national boundaries if the release were to occur in the River Mtkvari when the river flow is at its peak. If an oil spill were to happen at a time of low, or even no flow, then the spreading potential is much reduced. However, this would depend on the cleanup of oil before new periods of rainfall or snow melt, in which case oil may be released from the river bed. It must be noted that an oil spill into a dry riverbed will almost certainly lead to some level of groundwater contamination. The hydraulic conductivity of the bed materials is generally high and provides a "chimney" to the aquifer. In all cases the spreading will occur at the spill location and downstream in the watercourse or canal. For oil spills on land, the spreading potential is generally low.

Acute crude oil pollution of water may degrade the environment in several ways.

- Contamination of water resources may directly affect water used for drinking or irrigation because of the dissolved toxic components of oil in the water. Small concentrations of oil in water may result in tainting of the water or, if the spill is on land, of agricultural produce

- Dissolved oil components in river water may have acute toxic effects on fish and invertebrates, and the adsorption of oil onto sediments may cause chronic effects over a longer period of time due to slow but continuous release

- Oiling of water surfaces (of rivers, canals, lakes, ponds and ditches) can also affect birds, not only in terms of toxic ingestion, but also in terms of oiling of their feathers, particularly of diving species

Oil spill on land may also cause adverse effects: The oil could penetrate porous sub-soils through which it will move downwards under the influence of gravity and capillary action. The amount of oil retained in soil at saturation is normally between 5 and 40 litres per cubic metre (l/m3), dependent upon soil porosity.

The rate of penetration depends on the type of oil (its viscosity), the type of soil (its porosity) and the soil's saturation with water. Low viscosity (thin) oil and coarse gravel provide the combination with the fastest penetration rate. In practice highly viscous oils, such as some crude oils, do not penetrate to a significant extent.

In the event of an oil spill onto land, several migration pathways exist.

On impermeable soils, oil will flow downslope over the surface and may form a pool or enter a ditch, drain or other watercourse.

On permeable soils, migration of oil into the subsurface can be divided into three stages:

- seepage through the unsaturated zone
- spreading over the water table
- stability within the water capillary zone

Once a significant volume of oil is released, it migrates downward, generally under the influence of gravity and subordinate capillary forces, until it reaches the capillary fringe above the water table. In homogenous materials, seepage occurs with minimal amounts of lateral spreading.

While the extent of surface spreading is less on porous soils than on those that are impermeable, the depth of penetration is greater and lateral subsurface spreading can be significant.

Primary factors affecting the amount of lateral spreading include the rate of release, the volume of release, and the presence of significant permeability contrasts, as would be anticipated in heterogeneous materials. For example, a large instantaneous release into the unsaturated zone will have a higher degree of spreading in comparison to a continuous small release. Furthermore, slow releases may also develop fingers of product migrating vertically downward.

Where soil or rock heterogeneity exists, as is most often the case, flow paths can be substantially different from those anticipated. This phenomenon is common when zones of significant permeability contrasts are encountered, as for example with clay perched zones. To complicate matters, lateral seepage within the unsaturated zone may in some cases occur in directions contrary to the overall direction of groundwater flow owing go geologic conditions such as stratification, channelling and bedrock orientation.

However, in areas where soils have a low permeability, the viscous nature of crude oil typically results in the oil from a leak forming a pool on the soil surface.

The Caspian crudes to be transported in the BTC are light, with a high proportion of volatile organic fractions. Virtually all losses will be initiated 1m below ground surface (though a major pipe failure may be expected to affect the ground surface).

In order to gain an appreciation of how the different morphological conditions along the BTC route may influence the fate of spilled oil a number of simulations have been undertaken at 16 sites.

The 16 locations for the consequence analysis were determined on the basis of the distribution of environmental sensitivity in Georgia (Figure 10-15 in previous section) with the exception of two locations in Western Georgia that were selected solely on the basis of the environmental sensitivity.

Depending on the location, the simulation consisted of an assessment of the overland flow of the oil, dispersion in surface watercourses and migration in groundwater. Obviously, groundwater and surface water simulations were only undertaken where these resources were in the vicinity of the spill location. The 16 locations and the simulation that were carried out at each location are listed below and shown in Figure: Map 10-1.

It should be stressed that the likelihood of a major oil spill event is extremely unlikely. Nonetheless the detailed modelling that follows was undertaken as a result of consultations with the regulator where oil spill was considered a key issue to be addressed in the ESIA. The oil spill modelling study undertaken for this ESIA is based on technique approved by Environmental Protection Agencies in the U.S. and Europe and has not been undertaken previously as part of ESIAs for equivalent large pipeline projects around the world.

Table Error! No text of specified style in document.**-14 Oil spill modelling locations**

Risk Site Number	Kp	Overland Flow Assess-ment	Surface Water Risk Assessment	Ground-water Risk Assess-ment	Summary Site Selection Rational
1	9	×	✓	✓	Block valve station, major area of irrigated land
1a	11	×	✓	×	Major supply channel to large area of irrigated land, feeds Jandari Lake
2	29	×	✓	×	River crossing, located close to power station using river water as coolant and head works for irrigation system
3	44	✓	✓	×	In the proximity of Kumisi Lake
4	73	✓	✓	×	In close proximity to River Geti and floral community of low to medium importance
5	85	✓	× Spill does not reach surface water	✓	Up gradient of River Chiv Chav, shallow groundwater feeding local springs, important wildlife habitats, and cultural heritage sites
6	95	✓	✓	×	Within close proximity of cultural heritage sites, cultural heritage sites and floral and faunal habitats
7	120	×	✓	✓	Up gradient of Tsalka Reservoir, with associated fisheries and hydropower station. Also sited of groundwater system supplying potable water supply to local populations
8	138	×	✓	✓	Up gradient of Tsalka Reservoir, with associated fisheries and hydropower station
9	156	✓	✓	×	Located adjacent to Narianis Veli wetlands an important breeding ground for migratory birds
10	173	×	✓	×	Upstream of Narianis Veli wetlands
11	182	×	✓	✓	Located upstream of Borjomi, within a protected area of high conservation value and close to a seismic fault. Also potentially a recharge area for groundwater of commercial and local value

Risk Site Number	Kp	Overland Flow Assess-ment	Surface Water Risk Assessment	Ground-water Risk Assess-ment	Summary Site Selection Rational
12	199	✓	✓	×	Up gradient of populated area with associated cultural heritage sites. Also areas of faunal significance in the vicinity of the site
13	213	×	✓	×	Up gradient of River Mtkvari and within the Borjomi Protected area
14	222	×	✓	×	River Mtkvari crossing, ideal biotype for spawning and feeding fish, also local area of floral significance
15	239	✓	✓	×	River Potskhovi River Crossing 1 also important fish spawning and feeding grounds
16	243	✓	✓	×	River Potskhovi River Crossing 2, also important fish spawning and feeding grounds

The objective of this assessment was to evaluate the adequacy of the mitigation measures built into the pipeline design such as the leak detection system and the valve actuation times and to estimate what provisions may be required at sensitive sites with regard to oil spill containment resources and equipment.

The assumptions with regard to duration of the spill and time to supply crews and equipment were based on the information provided by BP. Oil spill calculations were also provided by BP and are based on the oil pressure at each location, the distance from the nearest block valve or natural flow divider. Figure: Map 10.1 attached shows the locations of the spill modelling sites along the pipeline route.

The methodology used to simulate the dispersion of oil over land, in surface water and groundwater is summarised below. Full details of the models used and models output are included in Appendix E, Annex IV.

10.5.6.2 Modelling techniques

The modelling techniques employed during this assessment have been select to provide as accurate an assessment as practicable, however, as with any modelling process, assumptions have been required. Those assumptions made during the modelling process have aimed to be over conservative, such that the overall results predicted are uniformly worst-case and over estimate the risks.

Overland flow

The overland flow model simulates the movement of spilled oil based on a digital terrain model and on the released volume of oil at the spill site. The variables used for the model are the leakage time, soil permeability and topographic gradient.

In order to create a three-dimensional terrain model, the elevation data extracted from the aerial photographs of the route corridor (3km wide on average) was interpolated using a GIS based digital terrain model. The movement of spilt oil is then simulated through the analysis of the terrain elevations in the vicinity of the release point (in $25m^2$ squares). The model identifies the lowest point towards which the oil will be directed and subtracts a volume likely to be absorbed in each square area based on soil permeability. If the model detects that elevations in all directions are higher, oil pooling is simulated until it reaches the level when it can overflow out of the depression and the pooled volume is subtracted from the flow. The model stops when it reaches a surface water receptor and indicates the remaining volume unless all the oil has been lost to surface infiltration.

The software does not take into account evaporation while losses along the direction of flow are limited to infiltration in the soil at a given area and pooling. This however, provides an in-built level of conservatism in the model. Another limitation is that only likely spill migration direction is simulated without estimating a time period required for oil to cover the distance to the identified receptor.

Surface water flow

Oil flows in surface waters are complex and minor changes in flow characteristics can have a significant effect on the characteristics and velocity of oil flows. A model was developed to define the surface water migration characteristics within the watercourse. Refinements included an estimation of the velocities and distances migrated by oil once it has reached the watercourse.

The model focused on three main processes:

- Transport of oil via water flows
- Entrainment and reintroduction of oil on channel banks
- Evaporation of volatile fractions of oil

Data relating to the hydrology and channel properties for each of the spill sites were obtained from literature. Where data were not available conservative assumptions were adopted.

It was assumed that oil travels at 125% of the mean velocity of the underlying water. This assumption has been made to take into account the velocity profile present within channels due to frictional forces of the channel bed.

The volume of oil entrained on banks was calculated as a proportion of oil present over the banks of the river. Once the main body of the spill has passed the oil stored on riverbanks is released back into the water via a first order decay curve. This feature also provides conservatism in the model.

Evaporation losses were also calculated via a first order decay curve, where by 35% of the initial volume of oil release is assumed to be evaporable, this evaporable volume was assume to decay at a rate of 31.8% per day.

A modelling threshold of 0.1% volume-to-volume ratio of oil to water was applied, whereby it was assumed that where oil was present at volumes less than 0.1% of water, modelling was stopped for this location at this time.

The model was used to predict the variation of oil volumes over time at sites identified as sensitive; where the watercourse was the only identified sensitive receptor the distribution of oil along the channel length was predicted.

Groundwater flow and transport

The contamination of groundwater, in terms of magnitude and areal extent, has been estimated by developing an analytical model. This model has two components: the simulation of the fate and transport of the crude oil as an immiscible liquid floating on the groundwater table (termed the light non-aqueous phase liquid or LNAPL model); and, the simulation of the dissolution and migration of dissolved phase hydrocarbons within the impacted aquifer system. These models have been applied to five sites, as defined previously, as these were the most representative locations where groundwater is a sensitive resource.

In the LNAPL model, leakage from the pipeline is assumed to be instantaneous and results in a deep mound of LNAPL directly below the leakage point. Since the distance from the invert level of the pipe and the water table is generally less than 3m, it is assumed that in most cases the leak fills the unsaturated zone beneath the leakage point, with the dimensions of the initial LNAPL volume calculated form the leakage volume and unsaturated zone porosity. Based on the properties of the contaminant and aquifer, either known values or conservative assumptions, the extent of the LNAPL floating product is evaluated in all directions from the leakage point including up-gradient.

In the dissolved phase model, contaminant concentrations are modelled down-gradient of the LNAPL, based on a one-dimensional advection and three dimensional dispersion equations. The model uses hydrogeological data including porosity, hydraulic conductivity and gradient, and retardation potential of the aquifer/contaminant. Hydrogeology data was sourced from literature, including data on boreholes in the vicinity of the modelling points. The worst-case data was always used in the model (for example the highest porosity and hydraulic conductivity of the data set), such that the model results are inherently very conservative. This is standard practice for groundwater modelling. Should additional hydrogeology data become available, it will have the effect of increasing the travel times of the contaminant concentrations modelled ie improve the results.

Consequently the impacts to groundwater comprise two additive components: LNAPL migration floating on the water table; and dissolved plume migration sourced from the LNAPL pool floating on the water table.

The impacts on the groundwater have been assessed at five different time horizons: after 30 days, 90 days, 6 months, 1 year and 2 years.

10.5.6.3 Summary of results of oil spill modelling

The full set of results of the modelling work that was carried out is enclosed in Appendix E, Annex IV. The sections below summarise the key issues emerged from the modelling.

Overland flow

The overland flow simulations indicated that, with the light crude oil that will be transported through the BTC pipeline, limited infiltration should take place and therefore the pathway of the spilled crude oil is generally controlled by the topography. The speed of migration of the oil is clearly dependant on the gradient of the terrain where the spill occurs and the initial amount of spilled oil. With small leaks is it unlikely that the spilled oil would surface and therefore no overland flow has been simulated. With medium leaks it can be assumed that a proportion of the oil would surface as a consequence of the rupture and that gravity driven overland flow would occur subsequently. With a full rupture overland flow would be initially driven by the spill pressure and subsequently by gravity. In the last case it is possible that the erosive forces of the oil flow could create preferential channels in the land and thus accelerate the oil migration even further.

Surface water flow

The main findings from the simulations of spills on surface waters are as follows:

- A minor leak into a surface watercourse would have negligible effects in most cases due to the rate of dilution that the oil would be subject to. The only appreciable effects to surface water quality or freshwater ecology would result from a small leak into a semidry stream of limited size and flow;
- The extent of oil migration from the point of entrance into the watercourse varies significantly with the flow conditions of the river that in turns depend on meteorological factors. A spill on a dry river results in great accumulation of oil on the banks and significant impacts on the riparian habitats. The same spill in the same river at full flow may result in no accumulation on the banks and mass transport of the oil to downstream receptors;
- The speed of migration of a medium or large spill from the point of entrance of the oil into the watercourse would be far greater than any realistic oil spill response time. The implication of this is that most of the spilled oil would leave the spill site, if this were close to a surface watercourse, before any recovery action could be taken.

Groundwater transport

The simulation of an oil spill in groundwater was carried out at five locations selected on the basis of the sensitivity of the aquifers (potable use) and the lithological characteristics of the aquifers, which represented the worst-case scenario of contaminants transport (high permeability and shallow water table).

The findings of the modelling are summarised as follows:

a) A spill would result in the formation of a crude oil lens floating over the water table and of a plume of hydrocarbon dissolved in the groundwater. The aerial extent of the oil lens would depend on the size of the spill and could reach 1 km^2 in case of full rupture. The extent of the plume of dissolved hydrocarbon would depend on the gradient of the water table at any given location (see point “c” below)
b) The crude oil lens would have a negligible horizontal migration velocity thus making any clean up operation effective, regardless of the response time for intervention
c) The migration velocity of the dissolved product would be far lower than the velocity of groundwater flow, due to the dilution that would occur and the tendency of the oil to be

adsorbed to organic particles in the soil. All simulations showed the dissolved contamination plume to extend no more than 10km from the spill site if no oil recovery were to be carried out and under worst-case permeability assumptions. On this basis it can be assumed that oil recovery and clean operations would minimise any risk of significant offsite migration through groundwater transport.

10.5.6.4 Assessment of impacts associated to oil spill and proposed mitigation measures

The quantitative environmental risk assessment and the analysis of consequence have highlighted that the likelihood of a spill from the BTC pipeline is very small and even smaller if a full rupture spill is considered. However, the assessment has also indicated that in case of oil spill some significant impacts could occur and therefore mitigation measures are warranted to minimise the effects of a spill.

The severity and significance of the impacts is clearly dependent on the location where the spill occurs and a comprehensive listing of the sensitive locations along the pipeline route is enclosed as part of Section 8, Environmental Baseline. In addition to sensitive sites that are located along the route a large scale spill could also result in off route impacts such as to the River Khrami riparian system and the Jandara Lake. A large spill could also have transboundary effects if oil reached the eastern section of the River Mtkvari prior to its entrance into Azerbaijan.

The mitigation measures proposed to minimise the effects of an oil spill belong to two categories: 1) design measures aimed at reducing the risk of spill and 2) operational measures aimed at ensuring that appropriate action is taken to prevent a spill or to deal effectively with its consequence. The design and operational mitigation measures are discussed below.

Design mitigation measures

The pipeline is designed to ensure that it can be safely operated and that the environmental risk is minimized. As such, the pipeline is designed as a minimum to conform with the internationally recognised design code for onshore oil transportation pipelines - ANSI B31.4, which includes mitigating features such as: a design factor of safety on wall thickness for pressure containment (Figure 8), an over pressure protection system, an external corrosion control & coating system, full QA/QC during line-pipe manufacture and field welding, buried design, post installation strength test (hydrotest), welded buried pipeline connections, and a leak detection system.

In addition, the BTC pipeline block valves have been spaced according to a quantified risk assessment, not on a regular spacing basis as is more normally the case. Accordingly, a risk assessment model was developed and employed, utilising input data such as spill volumes, environmental sensitivity and failure data. The outputs from this model were considered, and (where appropriate) modifications to the design were made in areas identified as having high environmental risk. In particular, additional block valves were added in Georgia, particularly in the Borjomi / Bakuriani area as a result of this risk assessment process. The environmental risk in this area and the reductions in spill volumes resulted in the addition of the additional valves.

Operational mitigation measures.

Operational mitigation measures include the development and implementation of an oil spill response plan and site specific measures to ensure its effective implementation. The oil spill response plan will be developed as a result of a detailed assessment of the potential migration pathways of any spilled oil and will be appropriately structured to deal with any type of accidental event that were to occur. A framework of the oil spill response plan is attached in Appendix E, Annex V.

The site specific mitigation measures have been developed particularly for the section of pipeline from KP 175.5 to KP 192, where an oil spill could result in contamination of the River Borjomula and of the gorge where the Borjomi mineral water park is located. The mitigation measures specific for this section include the following:

- Spill response team and equipment to be based locally (Tsikisjvari or nearby villages)
- Daily patrols of the ROW to inspect for leaks and to discourage sabotage or attempts to tapping
- Additional markers above ground, and tape markers above the pipeline in the trench to prevent accidental excavations in the proximity of the pipeline
- Public awareness programmes.

SOCIAL IMPACTS AND MITIGATION

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11 SOCIAL IMPACTS AND MITIGATION

11.1 INTRODUCTION

This Section describes both the direct potential socio-economic impacts [1] of the project, and the indirect issues [2] that are related to the project. In addition, this section outlines management and mitigation measures for these issues and impacts. It specifically addresses the impacts of the project on pipeline-affected communities[3] at each stage of the project.[4] Residual impacts on these communities, after implementation of the measures, are considered in detail in Section 12.

11.1.1 Direct issues

Five categories of direct issues related to project activities have been identified as a result of the field survey work and wider consultation. These are as follows:

- Local employment/recruitment and procurement opportunities (Section 11.3)
- Land acquisition and land-based livelihoods (Section 11.4)
- Local infrastructure, services and natural resources (Section 11.5)
- Community relations, management of construction workers and construction camps (Section 11.6)
- Safety and nuisance (11.7 and also covered within 11.5)

11.1.2 Indirect issues

An additional indirect issue (ie not a result of the project itself, but nonetheless a concern related to the project), access to energy is also identified and discussed separately in Section 11.2 below.

11.1.3 Assessing impacts

The evaluation of socio-economic impacts is not an exact science and always requires a considerable degree of subjective judgement, based on in-country and previous project experience. This is primarily because data on potential socio-economic impacts consists not only of fact but also of individual and community perceptions and attitudes, thus allowing the

(1) Impacts are the consequences of an action that affect a specific household, community or sector of a community. Refer to Section 2, Glossary for a formal definition of social impacts

(2) Issues are broadly defined as elements requiring consideration and assessment for which a policy or a specific mitigation strategy may need to be defined.

(3) Pipeline affected communities are defined as those that are located within (or partly encroach into) a 2km corridor either side of the route, or are within 5km of a potential construction camp or pipe yard. These communities are likely to experience and be affected by the activities of construction, operation and decommissioning of the pipeline.

(4) There are a number of other social and socio-economic issues that are regional in nature as opposed to route specific. These are being examined within the scope of another study entitled 'Environmental, Social and Economic review of the ACG Full Field development and Export in the Regional Context'. This addresses broader issues of interest, including revenue management, access to energy, economic linkages, conflict and human rights. One issue covered in this review that may be of particular interest to readers of the ESIA is the project's approach to pipeline security. The BTC security arrangements are described in Section 5, Project Description.

impact to vary according to the individuals and communities involved. The data collected provides evidence and support for this evaluation, but do not always allow impacts to be fully quantified, or their importance to be assessed or ranked numerically. The assessment in the following sections should therefore be read with this in mind. A more general categorisation of the significance of the residual impact is however provided (see Section 7, ESIA methodology).

11.2 ACCESS TO ENERGY

Access to energy was identified as a major concern among villagers living along the routes during consultation. This is due to the limited availability of energy to communities on the pipeline route, caused by inadequate supply, lack of infrastructure and poverty (see Section 9: Socio-economic baseline).

The nature of this issue varies from others discussed in Section 11, since the project has been designed to have little direct negative impact in this regard, and the provision of national energy supply and infrastructure remains entirely within the remit of the national government. Given the limited impact of the project in this domain, the broader indirect issue of improving access to energy for pipeline-affected communities has not been dealt with in detail in this ESIA. However, community expectations are such that it must be considered in the approach to managing community relations.

Access to energy is reviewed in more detail in The "Economic and Social Implications of ACG/BTC (and Shah Deniz) in the Regional and National Context". The potential impacts arising from the energy requirements of the project, possibly affecting the amount available for local consumption, is discussed in Section 11.5.

The perception of communities in this instance is that the project should have a positive impact as well as that there might be a negative impact from the project's own power needs. As a result, this issue has been dealt with in more detail in Section 12, Residual Impacts. Communities concerns, that the construction and operation of the pipeline and AGIs will impact on their access to energy is dealt with in Table 11.4, item I6 & I7.

11.3 LOCAL EMPLOYMENT AND PROCUREMENT OPPORTUNITIES

Community level consultation revealed that unemployment, and the poverty that accompanies it, is the key concern amongst communities along the proposed pipeline route. BTC Co is committed to maximising employment opportunities for local communities.

Local employment and procurement opportunities should be available to both project affected communities and to workers and companies at the national level. Management measures seek to optimise opportunities for each of these two groups, but provide opportunities to candidates from pipeline-affected communities in the first instance, before vacancies are opened up to other Georgian nationals.

11.3.1 Aspects of project giving rise to employment and procurement–related Issues

11.3.1.1 Local labour requirements during construction

The detailed labour requirements for the project will not be known until the appointment of the construction contractor. This section, therefore, includes a preliminary assessment of the number of workers that will be required. These figures should be regarded as indicative and will change prior to commencement of the project.

It is currently estimated that 2,500 people will be employed during peak construction periods (approximately 12 months) for project construction, including the pipeline, AGIs and in management of the pipe yards and construction camps. This includes a combination of skilled, semi-skilled and unskilled workers. Skilled workers will include experienced professional staff in categories such as welding, and machinery operators. Semi-skilled workers will include experienced drivers, mechanics, night watchmen and cooks. Unskilled workers may be employed with no prior construction experience, though preference will be given to applicants with experience. Approximately 1700 of these workers will be employed in pipeline construction.

Skilled and semi-skilled workers will normally be expected to move with the construction activities along the length of the pipeline to avoid safety issues associated with constant re-hiring. Unskilled workers will probably be hired for shorter periods (eg 1-3 months) as construction passes through their area.

- At peak of the project, the number of pipeline jobs created will be approximately 1,700. It is currently estimated that Georgian nationals should be able to fill 50-80% of these jobs. This is dependent upon whether Georgian nationals are found to possess the necessary skills for certain jobs, although most of the positions will require unskilled labour

- Approximately 500 workers will be required for the construction of the AGIs. It is estimated that 30-65% of these workers will be Georgian nationals

- Approximately 300 workers will be employed by the construction camps (footnote) and pipe yards (foot note) at peak periods in the pipeline construction process. Each camp is likely to require around 100 support staff and each pipe yard is likely to require around 30 support staff. The majority of these will be Georgian nationals. The total of 300 workers is based on the assumption that two construction camps will be operating at any one time, and 3-4 of the 11 pipe yards.

The construction phase is expected to last about 18 months. However the peak construction period will be approximately 12 months, and many of the jobs will only be available for a varying proportion of the overall period.

11.3.1.2 Local labour requirements during operations

BTC Co anticipates that approximately 50 staff will be directly employed during the operational phase. In the first year of operation (2004), approximately 80% of these staff will be Georgian operations staff or technicians and the remainder expatriate workers. Additional staff are expected to be employed as security staff, cleaners, kitchen staff and drivers working at the AGIs, plus further horse patrol staff, employed in patrolling the WREP and BTC pipelines. There will also be oil spill response teams located along the route. Precise details of those teams will be developed prior to commencement of operations.

11.3.1.3 Procurement of goods and services during construction and operation

The proposed project will provide service opportunities for companies at the national or regional level, and for communities along the route. It is considered important that local sourcing of goods and services is maximised as this will deliver cost benefits to the project and sub-contractors, provided local suppliers can offer sufficient quality and reliability and can meet the stringent standards, particularly on health and safety set by BTC Co, for all parties involved in the project (including sub-contractors). The types of local contracts that are anticipated during construction and operation are shown on Table 11-1 below. A large proportion of these services are most appropriate for the construction camps.

Table 11-1 Goods and services with potential to be procured locally

CONSTRUCTION PHASE	OPERATIONAL PHASE
Catering services to camps and construction sites	Catering services to manned AGIs
Laundry services to camps	Laundry services to manned AGIs
Security staff at camps and construction sites	Security patrols along the proposed pipeline route and at AGIs
Supply of vehicles (eg imported tractors, trucks)	
Provision of food supplies (indirectly through catering services)	
Supply of bottled water	
Supply of some construction equipment and materials, including timber, stone, land re-instatement materials (jute matting, seeds, plants and fertilisers)	
Aggregate for road repairs	
Setting up of nurseries, management of compensation planting, and other environmental-related activities	

11.3.2 Identification of employment and procurement impacts

Table 11-2 outlines potential impacts and management and mitigation measures that have been developed in relation to employment, based on the aspects of the project described above and on community concerns. These include both positive and negative impacts. These measures aim to maximise the proportion of Georgian staff employed and in particular for the pipeline-affected communities.

Except for measures which will be directly implemented by BTC Co, these measures have been integrated into the Invitation To Tender (ITT) document for both pipeline construction and AGIs (pump station and pigging stations), so that each construction contractor will be required to implement these measures as part of their contract. Each contractor's strategy for implementing the measures will be judged during the bid evaluation process. Details will be finalised in the Environmental and Social Management Plan prepared by the construction contractor. Additional or alternative measures may be identified in discussion with the selected construction contractor. Further mechanisms will be agreed to monitor implementation of these measures.

The management and mitigation measures in this Section focus on BTC. Measures related to training and skills development will be developed in association with BTC Co, in recognition of the common interests of the two projects. This section is based on the assumption that construction of the SCP pipeline will follow the BTC project.

The issues and impacts addressed in Table 11-2 are as follows:

Construction Phase:

- E1 Direct Employment
- E2 Wide Distribution of Employment Opportunities
- E3 Recruitment Process
- E4 Employment Expectations
- E5 Working Conditions
- E6 Differential Wages among Project Workforce
- E7 Enhanced Local Skills
- E8 Indirect Employment Opportunities
- E9 Local Produce Supply / Neglect of Farmland

Operational Phase

- E10 Direct Employment
- E11 Enhanced Local Skills

Table 11-2 Impacts and mitigation measures: employment issues

Issue No.	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS [1] (see Section 12 for a discussion of each residual impact)
	CONSTRUCTION PHASE		
E1	**Direct employment** There will be a positive short-term impact on workers employed during the construction phase and on their families and communities, particularly given the high level of unemployment in the Districts crossed by the pipeline.	**Recruitment targets** BTC Co will establish local and national employment targets with the construction contractor during contract negotiations, to maximise local employment. This will include a breakdown of targets for skilled and unskilled labour, from pipeline-affected communities and from Georgia as a whole. Performance against these targets will be monitored during construction.	Additional cash injected into communities from wages: Beneficial
E2	**Wide distribution of employment opportunities** The scale and distribution of this impact will depend on the geographical spread of employment; the length of employment; and the extent to which new workers can be hired from the different Districts. The recruitment process will therefore largely determine this impact.	**Managing local recruitment** BTC Co will ensure that there is a "preferential" approach to recruitment. Priority will be given to workers from pipeline affected communities, ie those within 2km, either side of the proposed route, or near temporary or permanent project facilities. The construction contractor is required to outline a recruitment strategy that recruits workers from the affected communities through recruitment centres along the route first. This strategy will include procedures to identify and verify the areas in which applicants live, as well as provide information on experience, skills and potential training needs. BTC Co and the contractor will seek to ensure that the number and locations of recruitment	Wide Distribution of Economic Benefit: Beneficial Un-met employment expectations: High

(1) Residual impacts are defined as either beneficial, or if negative, low, medium or high. For a description of how these ratings are assessed, please refer to Section 7 ESIA Methodology'

Issue No.	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS [1] (see Section 12 for a discussion of each residual impact)
		centres allow equitable access. Where feasible these centres will be close to the pipeline route. It is anticipated that these centres will be located close to construction camps, in Akhaltsikhe, Atskuri, Bakurianis Andeziti, Tsalka, Marneuli and Gardabani. In the event that additional workers are required, the contractor will then recruit at the regional then national level. The contractor will be required to set out the rationale for any employment of third country nationals.	
E3	**Recruitment process** Consultation has repeatedly suggested that there is the potential for corruption and / or bias in the recruitment process, which could lead to an unfair distribution of employment opportunities and resentment among local communities.	The Construction contractor will be required to work with the BTC Co to establish an employment strategy that is transparent, public and open to all regardless of ethnicity, religion or gender. 'Preferred individuals' lists will not be supplied to or accepted by the contractor or BTC Co – applications will be accepted from all people within the appropriate geographic area. Recruitment will be visibly overseen by BTC Co to allay community concern about the transparency and openness of the process and specifically the ability of members of their communities to obtain work. It is suggested that recruitment should also be overseen by a respected local community member. This might be the Gamgebeli, Head of Sakrebulo or an informal community leader, such as a teacher or doctor. In addition, the contractor will be required to ensure that a clear and sufficiently specific description of available jobs is available to interested parties.	Un-met employment expectations: High

Issue No.	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS [1] (see Section 12 for a discussion of each residual impact)
		The employment strategy will be distributed to all pipeline affected communities, at least one month prior to the date of recruitment in that area. This will probably be done via distribution of leaflets and posters placed in public locations. The project will regularly monitor and periodically audit the contractors' recruitment process. Should corruption be found by the monitoring team where a staff member from either BTC Co or construction contractor is at fault, disciplinary action will be taken.	
E4	**Employment expectations** Given the high levels of local unemployment, the number of people applying for jobs is certain to be far more that the jobs available. There will therefore be a negative impact of frustration and potential resentment among unsuccessful applicants and communities where none or very few workers are employed by the project. The levels of frustration and resentment will depend on the transparency of the recruitment process and final distribution of employment and how well expectations of applicants and communities are managed.	The project will seek to manage expectations of employment at both local and national levels. The limited number of jobs available during construction and operation and the estimated duration of jobs available have already been outlined to communities during the ESIA consultation process (December 2001 and January 2002). This will be carried out in greater depth during the ESIA disclosure process. During the recruitment process, information will be provided to communities and potential applicants. Information will include detailed job descriptions including specific skills levels required. By doing this, unsuitable candidates are unlikely to apply for jobs and be rejected. BTC Co will also provide details of the estimated number and	Un-met employment expectations: High

Issue No.	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS [1] (see Section 12 for a discussion of each residual impact)
		duration of employment opportunities to government, media, communities and other interested stakeholders prior to, and during, the construction process. Information on the employment strategy and the location of recruitment centres will also be provided.	
E5	**Working conditions** The terms and conditions of work (eg hours of work, overtime, wages etc.) that are specified in workers' contracts will have an important effect on the quality of life of local and foreign workers, (eg health and safety effects of long working hours).	Construction contractors have been required (via the ITT) to apply the BTC Co's corporate policies on employees, relationships and ethics as well as the 8 core International Labour Organisation (ILO) Conventions on employees working conditions. Contractors will also be required to abide by the BTC Co Statement of Social Objectives (see Section 5).	There should be no residual impact if mitigation measures are effectively implemented.
E6	**Differential wages among project workforce** There is a potential impact, in terms of frustration and resentment, if local workers perceive that foreign workers are receiving better pay or conditions for exactly the same job. This was highlighted as an issue during consultation. In reality it is unlikely that a foreign worker will be employed in a job for which there is a local labour pool and therefore this impact is more one of perception rather than fact.	The contractor will be required to pay at least minimum wage for local works and expatriates. This will be monitored by BTC Co. Community Liaison Teams will be made aware of differential wages as a possible issue since there is frequently a perception of inequity, which can persist, and needs to be diffused.	Differential wages among project workforce: Low

Issue No.	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS [1] (see Section 12 for a discussion of each residual impact)
E7	**Enhanced local skills** There will be a positive impact on local skills through the experience gained by workers, and any training that they receive. The scale of the impact will depend upon the quality of the training programme and work experience, and on the individuals themselves. It is likely that all the local workforce will need at least some training prior to employment, to perform tasks to the international standards that have been set by the project on issues such as Health, Safety and Environment (HSE). Given the short duration of their employment period, unskilled workers will gain primarily through gaining experience rather than developing new skills. Skilled workers will be better placed to enhance their skills during their period of employment.	**Training** The contractor will be required to develop a comprehensive training programme to enhance the numbers and skills level of national employees (including through subcontractors). This will be designed to maximise the opportunities for country nationals to gain through employment in skilled and semi-skilled roles during the construction of the pipelines. The training programme will be part of the contractor's employment strategy and will be reviewed and approved by BTC Co. Training must be provided in Georgian and Russian and, where requested by local workers, in other languages. It is envisioned that the construction contractor shall undertake training of workers in the following disciplines as appropriate: road vehicle safety; welder training; construction plant operation; environmental and social awareness and procedures; safety and awareness and procedures. The training programme will include induction training to ensure that all recruits have the necessary understanding and knowledge levels for each job, in particular with regard to HSE issues. On the job informal training sessions and discussions will also be provided, as necessary, during the construction and operation of the pipeline.	Enhanced local experience and employability: Beneficial
E8	**Indirect employment opportunities** There will be a positive economic impact through the provision of goods and services. During construction these will be at national and local levels, close to construction activities and at camps	The construction contractor shall source construction materials from local facilities wherever possible. For procurement activities the construction contractor shall give preference to goods and services from local companies insofar as they are competitive in	Economic benefit from in-direct employment opportunities: Beneficial

Issue No.	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS [1] (see Section 12 for a discussion of each residual impact)
	and pipe yards. During operation these will be near AGIs and maintenance facilities. There will therefore be revenues flowing into the local economy as a result of sourcing goods and services through local suppliers.	terms of price, delivery and quality of product, and show a clear basis for acceptance or rejection. The construction contractor is required to prepare a Procurement and Supply Management Plan describing how they will achieve these objectives, and the Plan will require review and approval by BTC Co. In addition, BTC Co will hold a seminar with potential suppliers and sub-contractors before the commencement of the project to inform local businesses of opportunities to supply both construction related services as well as services to other parts of the project such as construction camps. This seminar will: • explain what sub-contracts and business opportunities might arise from the project • explain what sub-contractors need to do in order to be better placed for this work • provide information on the process by which contractors will be identified and invited to tender; • provide information on the HSE, ethical and business conduct and technical standards requirements of BTC Co policies	Enhanced capacity to tender for international contracts: Beneficial
E9	**Local produce supply / neglect of farmland** There is a potential `boom-bust' impact on communities affected by construction activities over a short period. This could include the sale of stockpiles leading to shortages or inflation. The probability of this occurring is considered reasonably low. The most likely areas of impact are in communities	Communities will be provided with information about the duration of construction activities in their vicinity during the consultation and community liaison process. The construction contractor is required to submit procedures for local sourcing to BTC Co, which will include the anticipated volume of goods that they intend to buy from Georgian companies, and the approximate time/season of procurement.	Economic benefit from in-direct employment opportunities: Beneficial

Issue No.	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS [1] (see Section 12 for a discussion of each residual impact)
	located nearest to large construction camps, where the potential to be drawn to other economic opportunities is greatest. There is also a small risk of the neglect of farmland given the likelihood of better wages associated with the project. However, there is considerable excess labour available at community level to maintain agricultural activities. Hence the risk of this occurring and the potential impact is low.	Information on the volume of goods that the contract would like to purchase locally will be shared with the local communities, via the CLO, so that communities can plan for supplying such goods without compromising their own needs. The Project is also developing a Community Investment Programme (see Section 13, Cumulative Impacts) that will provide communities with sustainable skills that will help them in the longer term.	
	OPERATIONAL PHASE		
E10	**Direct employment** There will be a positive impact on the people employed permanently during the operational phase, both for those involved directly on the pipeline and AGIs, and those employed in associated activities eg management of compensation planting.	BTC Co is committed to maximising the potential of employing local staff in the operating company and to raise skills levels during the operational phase. Local staff will be supplemented in the short to medium term by experienced expatriate staff who will provide necessary supervision and coaching during the initial period of pipeline operation. These expatriate staff will be selected for their training and coaching skills, as well as their proven HSE and technical expertise.	Additional cash injected into communities (specifically those close to AGIs) from wages: Beneficial Reduction in spending by foreign workers as number of foreign workers declines: Low
E11	**Enhanced local skills** Individuals employed during the operational phase will benefit from personal development opportunities.	A comprehensive training programme will be developed for all national staff employed by BTC Co during operations. Expatriate staff will be phased out as national staff acquire and demonstrate the required competence and skills. The training will be carried out early enough to enable local staff to participate in pre-commissioning and commissioning activities. The training programme will be conducted within the framework of BTC Co's	Enhanced local experience and employability: Beneficial Reduction in spending by foreign workers as number of foreign workers declines: Low

Issue No.	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS [1] (see Section 12 for a discussion of each residual impact)
		Competence Management Assurance system, which will involve the identification of required and actual skills profiles for all operational staff, and the development of associated training and assessment modules.	

11.4 LAND ACQUISITION AND LAND-BASED LIVELIHOODS

11.4.1 Introduction

This section outlines policies and principles to be applied in all cases where the project construction activities and operations involve impacts on land, houses and structures, non-moveable assets, land-based livelihood and related employment. Detailed land acquisition and compensation procedures are still being formulated and will be documented in a Land Acquisition and Resettlement Action Plan based on World Bank Group requirements (available in 3Q 2002). No households will be physically re-located.

Project land acquisition and associated livelihood impacts will be addressed in accordance with international good practice as embodied in the policies and guidelines of the IFC/World Bank Group. The requirements contained in the project HGA and Georgia legislation will also be complied with. New laws or amendments to existing laws will also be considered to enable rights contained in the HGA to be practically applied in the land acquisition program.

The principal World Bank instrument governing project impacts resulting from land expropriation is World Bank OD 4:30 *Involuntary Resettlement*[1]. World Bank OD 4:30 *Involuntary Resettlement* is invoked where the involuntary taking of land results in people experiencing economic or physical displacement through one or more of the following circumstances: (i) relocation or loss of shelter; (ii) loss of assets or access to assets; (iii) loss of income sources or means of livelihood, whether or not the persons must move to another location; and, (iv) loss of access or restriction of access to communal resources and services. Projects entailing any of the foregoing impacts are required to prepare a Resettlement Action Plan.

11.4.2 Project land requirements

The BTC project in Georgia will temporarily acquire the following land areas during a three to four year construction period:

- A construction corridor approximately 32m wide[2] and 246 kilometres long
- Land for 2 to 4 construction camps (approximately 500 x 500m– preliminary estimate). Sites near Akhaltsikhe, Atskuri, Bakurianis Andeziti, Tsalka, Marneuli and Gardabani are considered in this ESIA as potential locations for camps
- Pipe yard sites, ranging in size from 15,000-120,000 square metres. Possible sites have been investigated at the following locations along the route; Vale, Tsikhisjvari, Tetritskaro and Gachiani [3], and at the six construction camp locations listed above

1 There are presently two involuntary resettlement policies in force within the World Bank Group. IFC, the World Bank's private sector lending arm, uses OD 4:30 Involuntary Resettlement (June, 1990). World Bank public sector operations use OP 4:12 and BP 4:12 Involuntary Resettlement (January, 2002). On the advice of the World Bank Group, the project has adopted OD 4:30.

2 Acquisition of an additional 12 metres required for the SCP project will take place at the same time, creating a total of 44m by 246 kilometres long. It has been assumed that the construction of SCP will follow directly after BTC and that the land acquisition process for SCP will take place concurrently with BTC.

3 Akhtagla and Karatagla

- Land for temporary access roads of 2.8km (preliminary estimate)(these may become permanent and revert to local authority control in environmentally non-sensitive areas where communities make a case to maintain them)

The BTC project will permanently acquire, lease or otherwise secure rights to construct and operate a pipeline over the following:

- An 8 metre by 246km corridor of land where the pipeline will lie (former owners will be able to re-use the land, subject to certain restrictions)
- Land for construction of four permanent AGIs. These include pump stations and pigging stations. The pump stations are located in the districts of Gardabani and Tetritskaro, and the pigging stations are located in the Borjomi district and in Akhaltsikhe district, near the Turkish border. The pump stations will require approximately 90,000 square metres (preliminary estimate) of land and the pigging stations will require approximately 30,000 square metres (preliminary estimate) of land (plus a temporary flare area of 110 m^2 (preliminary estimate). Figure 9.2 (Baseline) shows the location of all the AGI sites in relation to communities along the proposed pipeline route
- Land for an estimate of up to 5.7km of 4m (preliminary estimate) wide road that will be maintained in the operational phase
- Approximately 15 remotely actuated ball valves and 10 check valve stations, which are likely to be relatively small (10m by 10m), though they may affect one or more landowner(s). The significance of this impact on any one individual will be assessed during the land documentation process

The total land area required for permanent use is about 230 to 280 hectares (preliminary estimate).

A variety of mechanisms for acquiring rights to construct and operate the pipeline are presently under consideration. These range from full ownership, acquiring of “construction rights”, or use of “servitudes” (a form of easement). In selecting the most appropriate approach, key considerations will include:

- The overriding objective of allowing landowners, lessees and other users to resume their pre-project activities on the land around the pipeline upon completion of construction, subject to certain restrictions
- The need to establish a good long-term relationship with adjacent landowners whereby there is an ongoing commitment to maintaining the pipeline corridor
- Sufficient flexibility for BTC Co to safely construct and operate the pipeline and ancillary works

Any mechanism used will involve compensation payments for any loss of land (temporary or permanent), assets or income caused by the project.

11.4.3 Potential land and livelihood impacts

Through careful pipeline alignment and facilities siting, the BTC project will minimize impacts on housing and has eliminated the need to physically relocate households. The project will also involve impacts on land, productive assets, and livelihood through (i) temporary use of land for construction purposes; (ii) permanent acquisition of land (or imposition of rights to construct and operate a pipeline) for the pipeline alignment and the permanent AGI sites; and, (iii) imposition of restrictions on land use adjoining the pipeline. The project will impact privately owned land and state owned land, some of which is leased to private entities and individuals. Some forestland, used informally by adjoining communities for subsistence activities, will also be affected.

Land and related livelihood impacts of the BTC project will include some or all of the following.

Permanent Impacts

- Permanent loss of land (and any related income) for the large AGI sites, block and check valve locations, permanent access roads and other permanent ancillary works
- Loss of trees / perennial crops in the 32 metre construction corridor

Temporary Impacts

- Temporary loss of use of cultivated land, with resultant loss of income for owners/lessees/other users for the one-two year construction period
- Impairment of livelihood in areas in the 32m pipeline corridor and ancillary facilities that are affected by restrictions on use (particularly affecting vineyards, orchards and other tree crops)
- Temporary loss of use, or physical constraints on movement, on grazing land and pasture during the construction phase and at other times during the operational phases
- Loss of structures and land attachments (eg. wells, fences, drying yards, animal pens, water tanks etc) in the 32 metre corridor
- Possible impacts on irrigation and drainage systems
- Loss of annual / seasonal crops in-ground at the time land is occupied for construction
- Loss of other productive assets (such as fish ponds)
- Loss or restriction of access to communally used resources such as forests
- Impacts on enterprises (including loss of productivity, downtime)
- Loss or damage to community property and resources
- Loss or damage to community services and infrastructure
- Severance of lots with loss of productivity and income

11.4.4 Objectives for land acquisition and resettlement

The overarching goal of the project in relation to land acquisition is:

To restore or enhance project affected peoples' living standards, income earning capacity and production to at least without-project levels

Other project objectives for land acquisition and livelihood restoration are as follows:

- To align the pipeline to avoid houses and settlements so that physical relocation of people and their dwellings is minimized
- To carefully consider the pipeline alignment and siting of ancillary facilities to minimize impacts on productive land and livelihood
- To develop fair and transparent procedures for determining compensation for (i) temporary use of land for construction purposes; (ii) permanent acquisition or otherwise obtaining of rights to construct and operate a pipeline on privately owned and state

owned land; and, (iii) any restrictions on use that may be applied to areas adjoining the corridor and other facilities

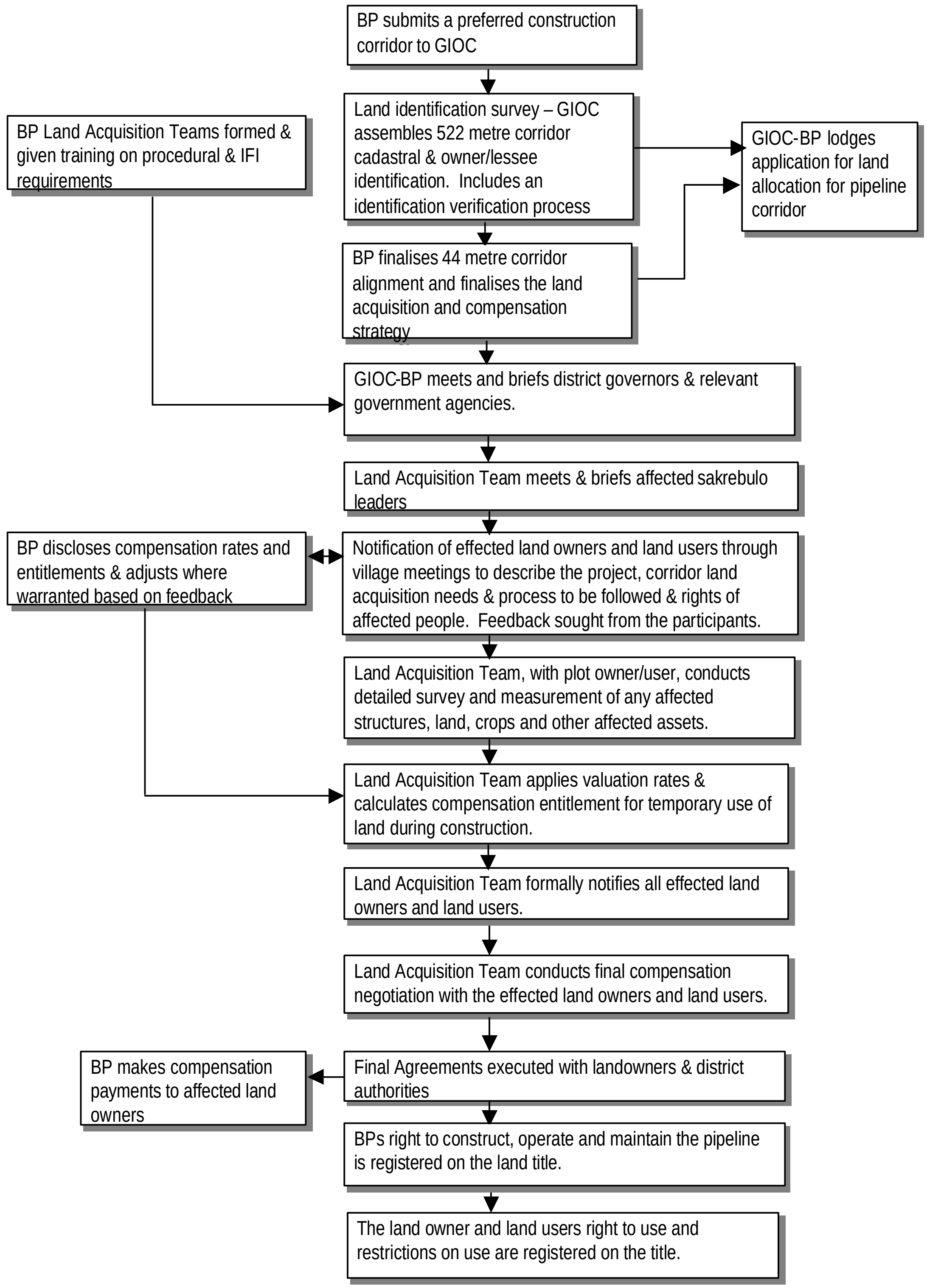
- To acquire land (or right to use land) through negotiated agreement, with use of powers of eminent domain only as a last resort. A grievance procedure will be set up to initially try and resolve disputes
- Upon completion of construction, to reinstate the pipeline corridor to a condition whereby landowners/users/lessees are able to resume their pre-project agricultural activities
- To adopt design standards that minimize the need to impose restrictions of use on adjoining areas
- To compensate for permanent use of land at full market value, inclusive of all transaction costs
- To keep affected people and communities fully informed about the project, the process that will be followed to acquire and compensate for land, and their related rights and avenues for redress

To monitor the effectiveness of mitigation measures described in the Resettlement Action Plan and, if necessary, to take corrective action to ensure affected peoples' living standards and incomes are fully restored.

11.4.5 Land acquisition and resettlement procedure

BTC Co's land acquisition process is shown diagrammatically in the figure below.

Figure 11-1 BTC Co's land acquisition process



11.4.6 Implementing roles and responsibilities

Table 11-3 Land acquisition roles and responsibilities

Activity	Purpose	Period	Responsible Party	Implementation
Community preparation & education	To explain nature of the project and its impacts to project affected communities & gather feedback	Pre-construction	BTC Co	Land owners' rights advocacy NGO, BTC Co land acquisition team
Land parcel & ownership identification survey	Legal identification of project affected landowners & lessees	Pre-construction	GIOC	GIOC/specialist consultant
Notification & preliminary consultation with project affected people	Meetings to advise landowners, users, & / or occupiers of the need to acquire their land, the procedures that will be followed & their rights & obligations	Pre-construction	BTC Co	Land owners' rights advocacy NGO, BTC Co land acquisition team, together with respective village officials
Socio-economic survey of affected people	To assess a sample of affected household characteristics, living standards & livelihood sources as basis for identifying resettlement impacts & establishing monitoring baseline.	Pre-construction	BTC Co	BTC Co with local consultant
Inventory of land, structures, crops & assets to be lost to the project	To inventory all land, crops, structures and other assets and as basis for valuation.	Pre-construction	BTC Co	BTC Co land acquisition team with affected owners/users/occupiers and government officials
Valuation of land, assets & livelihood to be lost	To define type & quantum of compensation for temporary & permanent use of land as well as use restrictions.	Pre-construction	BTC Co	BTC Co with third party specialist assistance, and in consultation with specialist NGOs.
Final negotiation of compensation	To reach agreement between BTC Co & the land owner for BTC Co to acquire/use the necessary land	Pre-construction	BTC Co	Land acquisition team, owner & user (as applicable), with land owners' rights advocacy NGO and the government as witnesses to ensure a fair process
Execution of Final Land Acquisition Agreements	To summarise the basis and compensation to be received by each affected landowner/user/occupiers & define land to be acquired/used	Pre-construction	BTC Co	BTC Co, land owner, notary with land owners' rights advocacy NGO and the government as witnesses to ensure a fair process

Activity	Purpose	Period	Responsible Party	Implementation
Payment of compensation	Payment of compensation	Pre-construction	BTC Co	BTC Co makes compensation payment direct to affected parties.
Issue of new ownership agreements and rights to land use	To formalise and register all transfers of land ownership	Pre or Post-construction	Land Registrar	BTC Co assists in assembling all necessary documents for registration & pays associated fees.
Monitoring	To verify receipt of entitlements, assets replacement & monitor effectiveness of livelihood restoration	All phases	BTC Co	Land owners' rights advocacy NGO, BTC Co

11.4.7 Consultation and disclosure

Measures for consultation and disclosure related to the overall project are outlined in the BTC/SCP project PCDP. Measures specific to the land acquisition process will include:

- Appointment of a national-level land owners' rights advocacy NGO to undertake community information dissemination, education, as well as to monitor gather feedback from affected people and communities throughout the land acquisition process
- Disclosure of land parcel boundaries in affected villages for affected land owners/occupier verification ahead of negotiations
- Disclosure of compensation methodologies and principles in affected villages with opportunity for affected people to give feedback
- Survey and inventory of affected assets to be conducted with full participation of the affected land owner, user or occupiers
- Focus group discussions with affected people and vulnerable groups to elicit preferences on preferred form and methods for compensation disbursement, and particular concerns
- Local and international disclosure of the Resettlement Action Plan
- Distribution of local language pamphlets summarizing compensation rates and entitlements

The IFC/World Bank Group requirement for 120-day in-country and international disclosure of the Resettlement Action Plan will be complied with.

11.4.8 Grievance procedures

As far as possible, the project will seek to resolve grievances outside of the judicial system. Avenues for project-affected individuals to express grievances, including through independent third parties, will be publicised in each village as part of the land acquisition notification process and in project information pamphlets. The project will engage a suitably experienced national NGO to collect grievances, facilitate entry into the grievance system, and monitor outcomes. A register of all grievances, corrective actions and outcomes will be maintained from the commencement of the land acquisition process.

In the event of failure of non-judicial approaches to grievance resolution, Georgian legislation provides for aggrieved parties to take action through civil courts, with avenues for appeal.

11.4.9 Liaison with communities

BTC Co will engage a national landowners' rights advocacy NGO to disseminate information and educate affected people about the project, the processes that will be adopted for land acquisition and compensation, and their rights with respect to landownership and leasing. BTC Co and the NGO will be responsible for community preparation ahead of land acquisition, and for notifying and briefing owners and users directly affected by land acquisition. The NGO will also undertake ongoing monitoring of communities affected by the project.

In addition, BTC Co has a land team, who will represent the project in terms of negotiating with affected people and carrying out inventories of affected crops and assets. The land team members have received training on the World Bank's land acquisition and resettlement principles, policies and techniques for consultation and interaction with affected communities. Following the documentation process, this team will also conduct the negotiations with landowners and users for compensation and/or acquisition.

The land team will remain the main point of contact for communities on property and land issues during construction. They will monitor and assist the construction contractor's pre-entry agreement procedure and final re-instatement sign-off with owners and users and resolve outstanding issues. They report to the BTC project management team.

11.4.10 Valuation methods and compensation

There have been a limited number of private land transactions since the land privatisation process commenced in the project area, with many affected land owners only receiving their land allocation in the last 1-3 years. This makes it difficult to ascertain a meaningful "market value" for land to be acquired by the project. Furthermore, in spite of the introduction of the Law on Land Registration in 1996, many land transactions are based on informal agreements and are not registered, so there is no public record of what financial consideration was involved.

BTC Co will develop fair and transparent procedures for valuation and compensation for temporary use and permanent expropriation of land. Where appropriate, the project will make use of independent third party land appraisers to assist with determining fair compensation rates. All compensation rates and entitlements will be publicly disclosed.

11.4.11 Documentation of land ownership and use

The Government of Georgia has completed land parcel identification surveys. These surveys identify all registered landowners and all registered land users. Land parcels that do not identify the landowner or registered land user are noted and the government is required to register these parties before BTC Co are given the land identification documentation. Land parcels are plotted on maps, which will be disclosed well ahead of land acquisition negotiations. The maps are a convenient communication tool, as they enable people to orient their property boundaries against familiar landscape features such as houses, roads and trees.

11.4.12 Eligibility for compensation

In determining eligibility for compensation, the project will follow the guidelines of the World Bank. World Bank OD 4:30 Involuntary Resettlement notes that lack of legal title does not disqualify people from receiving resettlement assistance. A census of all project-affected people, including informal dwellers, will be undertaken as part of project resettlement planning. Based on the findings of the census and of an associated socio-economic survey, resettlement assistance measures will be formulated to address the needs of informal dwellers.

11.4.13 Negotiations

BTC Co will negotiate directly with the owner, lessee, or user of any other asset (land or otherwise). BTC Co will support representatives of a national landowners' rights advocacy NGO to be present during negotiations to advise landowners on their rights and obligations. Government representatives will also be present during the negotiation and signing processes. All documentation will be agreed with the entity or family involved and will be subject to notarisation in accordance with Georgian Law. All transaction costs including fees for notarisation, registration and transfer taxes will be borne by the project.

Table 11.4 outlines the potential impacts, mitigation measures and residual impacts for property damage and land acquisition issues as follows.

- L1: Permanent acquisition of land (and any related income) for AGI sites, block and check valve locations, access roads and other ancillary works
- L2: Temporary Use of land on the ROW and for construction sites
- L3: Severance of lots with associated temporary loss of productivity and income
- L4: Soil fertility investments/ Future degradation to land
- L5: Infrastructure: Houses and other buildings, fencing, irrigation channels etc
- L6: Damage to property outside ROW and approved construction areas
- L7: Loss/ damage to other productive assets
- L8: Temporary Impacts on enterprises (including loss of productivity, downtime)
- L9: Forest areas impacted by construction
- L10: Restrictions on land use

Table 11-4 Impacts and management and mitigation measures: property damage and land acquisition issues

Issue No	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
	Construction	(In-principle measures – to be developed in detail during Land Acquisition and Resettlement Plan preparation)	
L1	**Permanent acquisition of land (and any related income) for AGIs, block and check valve locations, access roads and other ancillary works.**	Cash compensation based on market value of land or, where this is not readily assessable, on an expert appraisal of land value based on an explicit procedure. This will take into account land quality, extent of improvements, access to irrigation, historical productivity, etc. The loss of productive land has been minimized through careful attention to siting AGIs and permanent facilities. Where project land acquisition results in a household permanently losing use of land to the extent that the balance of land is no longer economically viable, the project will provide cash compensation.	Loss of productive land: Low Changes in livelihood source as a result of land loss: Low
L2	**Temporary Use of land on the ROW and for construction sites** 1,200 to 1,300 hectares of land will be required for the 3-year construction period (assuming SCP construction follows on from BTC), which will interrupt both agricultural and pastoral land use. This will have an impact on household livelihoods, given the high dependence on agriculture for subsistence. The impact will vary according to the crops produced. For instance, the impact of disturbance to a mature orchard will be different to	BTC Co will be responsible for compensation for property damage and loss of production during the construction period. This will vary accordingly between annual crops and perennial crops. Where impacts on trees and perennial crops are unavoidable, consideration will be given to clearing a reduced ROW to minimize impact. Cash compensation will be provided based on the	Additional damage to land and/or property: Low Possible small increases in demand for staple foods in local markets as land affected households replace consumption of crops grown for subsistence with purchased foodstuffs: Low

Issue No	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
	the impact of disturbance to annual crops. The land acquisition process will determine exactly how many individual households will be impacted by land rights acquisition. Construction will have a major impact for those who own orchards that cross the ROW, given that all trees on the route will be removed and time will be required to re-grow trees to harvesting maturity. Although routed to avoid orchards, vineyard and other long-term crops, the ROW does cross several orchards, specifically in Borjomi district and Akhaltiskhe district. The replanting of trees will be restricted near the corridor, with the extent of the restrictions depending on the type of trees being planted.	cost of planting, labour and fertiliser inputs required to bring crops/agricultural assets to maturity plus the cost of the lost production for the period it will take a sapling to reach the production level of the tree/vine at the time it is lost to the project. Adequate notice of the pipeline construction schedule will be provided to affected farmers so that they don't un-necessarily lose crops. Cases of hardship (eg. problems with access to water, shortage of fodder, blockage of movement routes to seasonal pastures, lambing/calving losses) will be monitored by the community liaison team (the teams of both the contractor and BTC Co) so that the project can provide support in cash or in kind, where a need is established. Grievance mechanisms will be put in place for use by households who may experience economic hardship as a result of the project. For mitigation measures to minimise damage to houses close to construction activities see issue L5 below Land used during the construction process will be re-instated. Appendix E Annex I outlines the reinstatement procedures. This will be the responsibility of the construction contractor and will be monitored by BTC Co In summary, any agricultural and pasture- land, except that which is	Some resultant increase in cash movement in local economies: Beneficial. Reduced labour requirement in some affected households due to reduced area for cultivation and harvest: Low Residual impacts resulting from the valuation and compensation procedures are dealt with in the RAP.

Issue No	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
		needed permanently for AGIs and new permanent access roads, will be restored to at least the condition it was in prior to construction. Agricultural land will be left graded and tilled ready for the farmer to re-plant. Where land must be re-planted in order to prevent erosion, the regime will be agreed with the landowner.	
L3	**Severance of lots with associated temporary loss of productivity and income.** Construction activity or the building of permanent infrastructure (including access roads) may in some instances separate or isolate a land plot leaving a portion inaccessible or of a size that is not economically viable or feasible to work.	The project will consider; (i) compensation for lost production on that portion for the construction period; or (ii) outright purchase where the separation is long term and has a negative economic impact if acquisition is permanent. In the case of (ii) livelihood restoration measures (such as agricultural intensification on the affected households' remaining land) will also be required.	Grievances over land compensation: Medium
L4	**Soil fertility investments/ Future degradation to land** There is potential for a long-term negative impact to farmers along the route if the soil fertility, and therefore agricultural yield, is reduced as a result of construction. While it is unlikely that there will be a long-term decline in soil fertility along the ROW, WREP experience shows it is possible that there will be pockets of such cases. Without additional mitigation to address reduced soil fertility, the duration will be long-term.	A Reinstatement Plan has been developed to ensure that agricultural fertility is maintained as far as practical. If necessary, BTC Co will provide compensation to bring land back to previous fertility levels as outlined in the compensations procedures of the RAP.	Grievances over land compensation: Medium

Issue No	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
L5	**Infrastructure: Housesand other buildings, fencing, irrigation channels etc** Many communities are heavily reliant on irrigation water for their agricultural activities. Some channels feed several hundred cultivators and even short duration disruptions in supply could have serious impacts. Houses or other buildings located close to the construction corridor and to access roads may be impacted by vibration damage due to construction activities. The most likely damage would be cracking to walls. The areas of impact will not be determined until the contractor has finalised the Transport Management Plan.	BTC Co and the construction contractor will always seek to avoid causing damage to infrastructure where possible. General measures to protect infrastructure impacted through the construction process are outlined in Section 11.5. Where damage cannot be avoided cash compensation based on full replacement cost (as required by the World Bank), or replacement structures/facilities will be provided. The full re-instatement option will involve direct replacement of the structure with no cash transaction taking place. In addition the construction contractor will assess and document the likely impact on buildings at particular risk and considered sensitive close to project traffic routes. This documentation will be agreed with the house owners/ occupants and a copy provided to them.	Damage to infrastructure or housing not repaired or not compensated: Low Grievances over land compensation: Medium
L6	**Damage to property outside ROW and approved construction areas** There is potential for damage to land, property and infrastructure outside of the ROW. This could involve:	All construction activities will be undertaken within approved boundaries. The construction contractor will be liable for any accidental damage caused outside of these designated areas and this will be compensated accordingly.	Additional damage to land/and or property: Low Grievances over land compensation: Medium – low depending on the

Issue No	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
	• clearing land beyond the designated project working areas; • vehicles or people straying outside working areas and causing damage to land and crops • adverse effects of dust on crops	The construction contractor will also be responsible for negotiating compensation for any additional construction sites required and BTC Co will monitor this. The requirement to keep within the working area will be strictly enforced and emphasised to the work-force during inductions and tool-box talks. Working areas will be determined prior to construction. Sites will be demarcated as necessary using fencing, marker posts or signs. Permanent facilities will be fenced. For the pipeline ROW, stakes will be placed to identify the working width. BTC Co will monitor the impact on land and property outside the ROW and approved construction areas.	number of incidents within a community
L7	**Loss/ damage to other productive assets** In addition to land, crops and trees, the construction process may damage other productive assets such as livestock, bees, etc **Livestock** During construction, the ROW and open trenches will be a physical constraint on livestock movement, and potential hazard to grazing animals. There is a potential impact arising from loss of	**Livestock** BTC Co and the construction contractor will identify principal livestock movement corridors and will incorporate appropriate crossings at key locations. Further measures are identified in Section 11.5, I15 and I16. **Bees** The Community Liaison Team will seek to identify any beekeepers whose hives are within 300m of the route before the start of the honey production season (ie before spring). These beekeepers will be	No residual impact if mitigation implemented. However if beekeepers fail to move any hives from within 300m of the ROW before the start of the honey production season, these will need to be moved 5km to ensure that bees are not lost.

Issue No	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
	livestock due to accidents related to construction (animals being struck by machinery, animals falling into the open trench, etc.). **Bees** Bee keeping is not a major commercial activity along the route. However some households do keep bees for personal use and occasional sale, particularly in the Gardabani and Marneuli Districts and in Bashkoi and Santa villages in the summer. The project could physically disturb bees where hives are located within about 250- 300 metres of the pipeline. This is primarily due to dust (bees are sensitive to intensive dust on themselves and surrounding flora), noise of the machinery and vibration at very short distances. There will also be a very small loss of vegetation due to construction, but this impact is not considered significant. Once the production season begins, bees, if moved, will attempt to return to their original home within a 5km radius even if the hive has been moved.	requested to move their hives (both mobile hives and stationary hives) to a distance of at least 300m from the route for the season. If the hives are not moved before the honey production season, they will have to be moved to a distance of at least 5km from the route. **Compensation if necessary** If a temporary loss of use to a productive asset occurs, cash compensation based on an estimate of average annual revenue lost over the construction period will be provided. The asset will be restored to its original condition upon completion of construction. For permanent loss to an asset, cash compensation based on a multiplier of fixed market rates will be provided.	
	bees, if moved, will attempt to return to their original home within a 5km radius even if the hive has been moved.		
L8	**Temporary Impacts on enterprises (including loss of productivity, downtime)**	Cash compensation will be provided equivalent to lost productivity to enable employer to pay salaries and wages for duration of any downtime. Assistance will also be to find alternative premises and relocate plant and equipment if required.	No residual impact if mitigation implemented.

Issue No	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
		Measures to develop replacement employment will be implemented where the project results in any loss of employment.	
L9	**Forest areas impacted by construction.** Approximately 10-12km of trees will be cleared from the ROW in Georgia. The longest single stretch is approximately 2km. Most are short sections. Some communities in Borjomi and Tetritskaro gather wood from these forests and others trade in wood products from them. Some communities in the forested areas have hopes of developing tourism opportunities. The construction ROW will leave a long-term path through the forest that is free of trees. Over time this impact will be reduced as replacement trees grow and other areas of the forest are improved through the eco-compensation program (see Section 10, Environmental Mitigation). Tourism development may, however, be impacted in the short-term, especially during the construction phase.	In the forested areas of Tetritskaro and Borjomi, the ROW is reduced. Where impacts on long-term crops (ie vineyards and orchards) are unavoidable, BTC will negotiate with the construction contractor during contract negotiations to ensure that consideration will be given to clearing a reduced right of way to minimize impact The high value timber that is felled to clear the ROW will be sold, where possible, and the cash invested into the community investment programme. Small trees and branches will be made available for communities to use as firewood or otherwise.	Loss of wood available for harvesting for wood products for both personal use and commercial gain: Medium. Loss of tourism livelihoods from visual impact of de-forestation: Low but long-term Income generated from sale of valuable timber and invested in community investment program: Beneficial
	Use of wood cleared from ROW Access to wood for heating and other purposes eg cooking, is a positive benefit for communities, since this is already an important source of energy for communities on the pipeline route.	All small trees and branches will be given to local communities to use as firewood and building materials. Community Liaison Officers will identify appropriate pick up points for the wood off the ROW, through discussions with the community.	Use of wood cleared from ROW: Beneficial

Issue No	ISSUES/IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
	OPERATIONAL PHASE		
L10	**Restrictions on land use** Following the construction period, land-use will revert to normal, except on the designated 8m ROW where restrictions will apply in relation to planting trees, building, drilling and deep ploughing. Ploughing depths will be limited to ensure cables buried along the route are not damaged. This will have a significant impact on vineyards and orchards, which cannot be replanted. The replanting of trees will be restricted near the corridor, with the extent of the restrictions depending on the type of trees being planted. Regular surveys of the pipeline will be conducted on horseback to ensure that the 8m corridor remains tree-free. Additional safety restrictions may apply to new developments. New irrigation channels will not be allowed on the 8m ROW during operation of pipeline. However existing channels will remain and shallow channels will also be acceptable. Hence, it is not considered likely that farmers will suffer from water shortages as a result of the pipeline.	BTC Co will provide compensation to landowners for restrictions on land use as set out in the RAP. Decisions on specific restrictions will be made prior to commencement of the land acquisition program. There will also be the potential to establish new replacement areas in some locations. The project will replace irrigation canals as appropriate.	Grievances over land compensation: Low

11.5 LOCAL INFRASTRUCTURE, SERVICES AND NATURAL RESOURCES

Section 9 (Socio-Economic Baseline) outlines the lack of infrastructure among communities on the pipeline route, and the impact of this on their quality of life. This Section uses this baseline information to assess the potential impacts of the project on infrastructure, while Section 14 (Management and Monitoring Plan) considers opportunities for enhancement of local infrastructure to improve the overall quality of life.

11.5.1 Aspects of project giving rise to infrastructure, services and natural resource impacts

11.5.1.1 Roads and rail transportation

It is expected that the construction contractor will use the ROW itself as an access road, as far as possible, to minimise the need to build additional roads for access purposes. As far as possible, transportation routes will not go through local communities, AGIs have been located as close as possible to existing tracks; and potential camp and pipe yard sites have been selected, with easy access to the ROW. However, there will still be a requirement for the use of existing and new roads and the rail network, particularly for:

- The transportation of an estimated 10,800 loads of pipe by rail through the country: 3000 of which will be for the pipeline in Georgia and 7,800 will be transported to Azerbaijan. This equates to approximately three 750m long trains per day, assuming that there are 45 wagons per train, and that a rail car load is 4-5 lengths of pipe. Other materials for the project in Georgia and Azerbaijan will also be transported by rail. This will include construction material, the check and block valves themselves etc
- The pipes and other construction materials for Georgia will then have to be transported from the rail network to the pipe yards and then from the yards onto the route itself. This will involve approximately 5000 loads in Georgia – a truckload is a single trailer truck with 3 sections of pipe (12 metres long). Most yards are directly adjacent to the railhead, but two (Bakurianis Andeziti and Tsikhisjvari) are approximately 40km away from the railhead and will therefore require additional truck transportation, given that at least one of the two will likely be selected for use by the contractor. Transportation to these yards will be on the outskirts of some communities. Overall, the distances between the yards and the ROW ranges between 0.2 and 8km, with an average distance of 2.1km. Transportation vehicles carrying pipe will pass through three communities (Gardabani, Bakurianis Andeziti and Tsikhisjvari) on route to the ROW
- Transportation of numerous heavy vehicles to the ROW
- Transportation of local workers from designated pick-up points, to the construction site and back again, on a daily basis using approximately 40-50 buses daily during peak construction times
- Access to the AGIs
- On-going pipeline maintenance during operation

Potential access roads have been identified by the Engineering Design Team. These have been classified as either in good condition, with no upgrading requirements, in poor condition with upgrades required or to be newly built for the project. Approximately 8.5km of new road have been identified as a preliminary estimate, but exactly which of these potential access roads will be used will not be known until the construction contractor has drawn up the Transport Management Plan.

11.5.1.2 Power use by construction facilities and AGIs during construction and operation

The project will require electrical power prior to and during the construction phase to move both rail trucks loaded with pipe and other construction materials, and for construction camps and pipe yard sites.

The power for rail transportation will be partly drawn partly from the Georgian rail grid. Some trains will be diesel powered. An average round trip from Poti to the Azerbaijan border (fully loaded in one direction) would require approximately 9000 litres of diesel. Data on the amount of electrical power required per round trip is currently unavailable.

With regard to both temporary construction sites (camps and pipe yards) and permanent facilities (valves, pump stations, etc.), the ITT suggests that main power can be drawn from local supplies as long as it does not adversely affect supplies to local communities.

The estimated peak electricity requirement for the pipeline itself during operation is around 80 kilowatts of power, which will be needed for the operation of the block and check valves. Because of unreliable power supplies in Georgia, all power needs will be self-generated by stand-alone diesel generators in each location. In the unlikely event that the contractor wishes to draw power from local supplies, this will be approved by local authorities and BTC Co in advance.

11.5.1.3 Water needs for construction and operations

The project will require water for construction purposes, eg dust minimisation, hydro-testing of the pipeline and for operations, specifically at manned AGIs.

Construction camps will require water for civil uses for up to 750 people. Water for drinking purposes must meet World Health Organisation standards. This water will be bottled, trucked in or treated on site. The camps, constructions sites and AGIs will take either surface or groundwater for domestic and process use, which will require obtaining a permit from the appropriate authorities. The following volumes are estimated to be required for each activity:

- Construction camps will each require approximately 173 cubic metres per day (per 750 workers in a camp) including water used by the associated construction teams in the field
- Operations phase – total water use of approximately 5 cubic metres per day at pigging stations and 24 cubic metres at pump stations (with a capacity for 240 cubic metres per day in an emergency)

Prior to the start-up of the pipeline, it will be hydro-tested, that is - filled with water and pressurised to check its integrity. The testing will be carried out in sections. The quantities of water required are considerable and chemicals may have to be added to protect the pipeline from corrosion. Sourcing and disposal arrangements for hydro-test water are therefore very important. The quantities will depend on the selected construction contractor's detailed construction testing programme. Sites for water extraction which have been identified along the route, include but are not limited to:

- Mtkvari in the east
- Tsalka Lake
- Tabatskuri Lake
- Mtkvari in the West
- Potskhovi River

11.5.1.4 Construction and operational wastes

Construction camps will need to dispose of solid waste, human waste and domestic wastewater. There will also be waste arising from the construction process along the ROW, and limited waste arising in the operational phase. For reasons of security and safety, the waste sites will be available to the project only, and not for use by the surrounding communities. Information on the volume and types of waste that will be generated by the BTC project is included in Section 5 (Project Description), Table 5.8, entitled "Indicative Construction Waste Breakdown".

11.5.1.5 Telecommunications for construction and operation

The existing fixed telephone and mobile phone networks will be used for telecommunications, in both the construction and operational phase. In addition, a new fibre-optic system dedicated to pipeline operation will be installed for data transfer and telecommunications, when the pipeline becomes operational.

11.5.1.6 Blasting

Blasting for the pipeline will be necessary for trench extraction in some locations along the route in Georgia. Villages near areas that may require blasting include:

- Jandari
- Kosalari
- Daget-Hachin
- Ivanovka
- Bashkoi
- Shapar-Haraba and Santa
- Avranlo and Kizil-Kilisa
- Tabatskuri
- Tsikhisjvari
- Kodiani (summer village)
- Sakire

Alternatively, rock may be excavated using hydraulic hammer mounted on backhoes, which would eliminate the need for blasting near these communities.

Blasting may also occur at aggregate extraction sites depending on the geology of the area and the aggregate requirements along the spread.

11.5.1.7 Medical and health and safety infrastructure

Construction contractors will provide their own self-contained health and fire protection services.

During operations private medical and fire protection services will be used.

11.5.1.8 Open trench

The following aspects of the projects are relevant to an assessment of safety and nuisance issues and impacts:

- Trenches and pipes - the trenches will be on average between 2.2 and 2.4 metres deep, approximately one metre of which will then be taken up with pipe. See Plate 5.8 in the Project Description Section 4 for an illustration of an open trench. This is likely to be deeper in places such as river and gully crossings or landslide areas, where the depth could reach 15m in extreme cases. However in some of these cases, there is unlikely to be an open trench but rather a hole opening through which crossing fabrications can be installed. The maximum trench length open at any one time will be 10 kilometres continuous or 15 kilometres non-continuous, including tie-ins, crossings and special sections
- The pipeline will cross access roads, canals, and other transportation networks along the route. The average length of time the trench will remain open at a crossing is 2 days.

11.5.2 Identification of infrastructure, services and natural resources impacts

Table 11-5 and the General Measures below describe specific impacts and mitigation measures developed in relation to local infrastructure. Except for measures, which will be directly implemented by BTC Co (eg measures for the operational phase) these mitigation measures have been integrated into the ITT documents for pipeline and AGI construction, which the construction contractors will be required to implement. Each contractor's proposed implementation measures will be considered during the bid evaluation process. Details will be finalised in the Environmental and Social Management Plan (1) and other relevant management plans prepared by the selected construction contractor. Additional or alternative measures may be identified in discussion with the selected construction contractor.

The project will pursue the objective of 'No Net Loss' in relation to infrastructure, wherever feasible. This means that the project will aim to result in 'No Net Loss' in the quality, quantity or availability of existing local infrastructure, where this will impact adversely on ability of communities to undertake subsistence or economic activities, or reduce access to education, health or other emergency services.

11.5.2.1 General construction mitigation measures

The overall approach to management of potential impacts on infrastructure and resources is as follows:

(1) This takes into account the measures developed in the ESIA Management and Monitoring Plan'

- All construction activities will take place within agreed areas
- Construction techniques will be used to minimise disruption to infrastructure and services. Examples of these measures have been identified in the project description (eg trench-less crossing of busy roads by auger bore or pipe jack.) Others are identified in the following sections. The contractors will have the freedom to suggest alternative or additional measures, but will be required to demonstrate that these measures will achieve the mitigation objectives as effectively as those specified in the ESIA
- A crossing schedule including all known roads, telephone and electricity facilities and oil, gas and water pipes has been prepared and will be given to the selected construction contractor. The contractor is expected to cross these facilities and pipes in full agreement with their owners and without causing damage. During construction the contractor will be aware of the potential for un-identified services and structures and will take care to avoid any damage. There will be no planned disruption to services. The Contractor will be required to repair any damage caused
- Where there will be planned diversion to infrastructure or services, this will be identified by the contractors with as much advance warning as possible. All planned diversions will be communicated to local authorities at least 3 days in advance and to communities through pre-construction meetings (see Section 11.6, Community Relations). The timing and duration of the diversion will be agreed between the contractor and the affected party. Where infrastructure is to be damaged, the timetable for repair of the infrastructure will be agreed with the authorities and the communities. Should the diversion result in loss of livelihood in the affected party's judgement the validity of the claim, and necessary compensation, will be determined as described in Section 11.4 (Impacts on land and land-based livelihoods)
- Should infrastructure or services be disrupted accidentally, the authorities of the affected communities will be informed of the reason for the disruption and the contractor will work with the service owner to complete repairs in the shortest time possible. Within one day, written information will be provided to the village executive (or the district centres) providing details of the disruption, information on alternative measures (if appropriate) and any measures that will be taken to assess any damage caused as a result of the disruption. The Community Liaison Officer will ensure that there is an announcement in public places and that notices are posted on the community notice board such that the local residents are fully informed of the disruption
- The contractor is responsible for maintenance for 2 years following the completion of the pipeline

The measures outlined in Table 11-5 below relate to the following specific issues:

- I1 New Roads/ Improvements to Roads
- I2 Damage to Existing Roads
- I3 Roads: Increased Traffic and Traffic-Related Accidents
- I4 Road Access
- I5 Increased Rail Traffic
- I6 Electricity and Power: Potential depletion of local electricity supply due to electricity use during construction
- I7 Electricity and Power: Depletion of Local Electricity Supply due to Electricity Use During Operation
- I8 Water: Increased pressure on Water Resources for Construction Activities, Camps and AGIs
- I9 Water: Damage to Community Water Supplies

- I10 Sewage and Waste Disposal: Increased Waste
- I11 Telecomm: Congestion of Network
- I12 Use of Telecomm during Blasting
- I13 Extraction of Aggregates
- I14 Educational Infrastructure
- I15 Access Restrictions
- I16 Open trench

Table 11-5 Impacts and mitigation measures: local infrastructure, services and natural resources issues

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of each residual impact)
I1	**New roads / Improvements to roads** The project will require the use of roads, both new and existing, to transport pipe, equipment and staff to the ROW. Many communities anticipate that this will result in a positive impact due to the need to upgrade existing roads and build new roads that will remain in use by the community following the completion of construction. Some communities are concerned that new roads will facilitate illegal logging of the forests, although most areas where the ROW crosses forests are already accessible.	The construction contractor will be required to consult with communities and landowners before building any new roads. The construction contractor will inform communities of the proposed location for new roads. The building of new roads in ecologically sensitive areas will be limited by maximising the use of the ROW as an access road, and ensuring that construction of AGIs requiring regular access are close to existing roads. Where roads are built in ecologically sensitive areas, communities will be informed as to why the roads are needed and when they will be removed, as well as the rationale for their removal. Following construction, communities will be able to put forward a case to keep new roads, which are not located in ecologically sensitive areas. BTC Co will consider requests on a case-by-case basis, in consultation with authorities and the specific landowners impacted, taking into account land acquisition impacts.	New roads / Improvements to roads: Beneficial Illegal de-forestation: Low Discontent regarding removal of new roads in ecologically sensitive areas: Low
I2	**Upgrades/ Damage to existing roads**		

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of each residual impact)
	While the majority of roads are already in a very poor condition, there is concern in the communities that these roads and bridges will be further damaged by construction activities, leaving them in worse condition than they were in before construction began. This would be of major concern, given the poor state of roads and bridges at present and the importance placed on the transport network by communities. The level of use on these roads and bridges will not be known until the contractor has drawn up their transport management plan.	The sites of potential pipe yards have been selected to minimize the distance between both rail and pipeyard and pipeyard and ROW,, thus minimising the level of road traffic. The construction contractor will be required to document the initial condition of all roads and bridges that will be used during construction. This documentation will include photographic evidence and will be agreed in close co-operation with the community and authorities in advance. The construction contractor will be required to maintain roads and bridges to a reasonable standard, throughout the period they are used for construction. The contractor will also be required to ensure that all roads and bridges used are in a reasonable condition on completion of the work or at least in the condition they were before construction activities began. Maintenance of roads and bridges will be monitored by BTC Co The community liaison officers, using the procedure described in Section 11.6, will deal with any complaints about the construction company and its operations.	Improvement to roads and bridges: Beneficial
I3	**Roads: Increased traffic and traffic-related accidents** There will be a substantial increase in traffic on	Traffic safety is a high priority for the BTC project	Increase in traffic and

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of each residual impact)
	all the roads used for construction. (Traffic counts and assessments are detailed in Appendix C Annex 1) The duration of this impact will be short to medium term in any one place, given the pace at which the spreads will move. This will result in increased nuisance (particularly noise, emissions, vibration, dust) and general disturbance for communities as well as higher safety risks for both people and animals. However some community members are likely to see an increase in traffic in their areas as a positive impact, providing more economic opportunities, such as roadside stalls.	and the project has sought to minimise the amount of traffic through communities. The construction contractor will be required to develop a Transport Management Plan. The plan will take into account routes, speeds, times of travel, key roads in terms of local services, delivery of goods to market and measures to be taken to limit impacts on these key roads. Likely impacts on schools and major pedestrian crossing areas will also be assessed and necessary measures identified. The plan will be reviewed during the selection of the construction contractor and finalised in negotiation with BTC Co The plan must also be aligned with the BTC safe driving rules outline in the HSE policy. These include no night driving and a maximum speed limit of 80km/hour on open road and 40-60km/hour in residential areas. Construction contractors will also be required to provide defensive driving training to all drivers working on the project to ensure a high standard of project driving. The Transport Management Plan will include a programme of traffic safety awareness-raising and information provision in communities	traffic related incidences: High Economic Benefit (road-side stalls): Beneficial

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of each residual impact)
		affected by traffic. This activity will be carried out by the Community Liaison team (See Section 11.6).	
I4	**Road access** There may be some temporary road closures required during crossings. Only secondary roads and tracks will be open cut and therefore require diversions. Access to main roads will not be disturbed. The average time a road is cut for a crossing is 2 days, but will frequently be shorter.	The Community liaison team will inform communities in advance if/when road closures are required, and diversions will be properly signposted. Alternative access routes will always be available. This would include existing alternative roads as well as any routes specifically constructed by the contractor.	Road access: Low.
I5	**Increased rail traffic** There will be a substantial increase in rail traffic, which will result in increased noise and general disturbance to communities nearby the railway, as well as increased safety risks.	Communities located within close proximity of the railway lines to be used by the project will be identified and the Community Liaison teams will include them in their community management plans (as set out in Section 11.6) The contractor will provide information on this increase in rail traffic and the implementation of the traffic safety awareness-raising programmes outlined in the Transport Management Plan in rail affected villages.	None if mitigation carried out in full.
I6	**Electricity and power: potential depletion of local electricity supply due to electricity use during construction**	**Transparency**	

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of each residual impact)
	It is understood that power drawn from the rail grid is likely to have an impact on the availability of power for public consumption, however the distribution of power during shortages is not known. It is therefore not possible to identify precise impacts or specific communities that might be impacted. However, in many cases the trains will be powered by diesel instead. In the highly unlikely event that power is also drawn from the grid for construction activities and at camps there may be an additional impact on communities, however the likelihood of this is considered very low. Additional perceived negative impacts could be encountered where communities with no/minimal access to power are located close to facilities where access to power will be continual, through the use of generators. ie: • potential construction camps at Akhaltsikhe, Atskuri, Bakurianis Andeziti, Tsalka, Gardabani and Marneuli • Pump station 1 in Gardabani District, which is approx one kilometre from Kesalo and Jandari communities • Pump station 2 in Tetritskaro District, which is approximately three	If complaints are raised that the project's energy draw is having a negative impact on community access to power, BTC Co will provide information on monthly power to individuals or organisations requesting it. The community liaison team will advise local communities that installations supplied with power by self-sufficient generators will not support local electricity supply on any occasion. CLOs will be required to liaise with communities to address concerns that may arise over the absence of any positive benefits in relation to access to energy. Weekly reports will ensure that BTC Co is kept informed of any concerns or questions and responses.	Electricity and power use depleting supply to communities: Low Economic benefits from local purchase of diesel to use in power generation: Beneficial

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of each residual impact)
	kilometres from Jigrasheni (although separated by forested land and not readily visible from the village).		
I7	**Electricity and power: depletion of local electricity supply due to electricity use during operation** There will be self-generation (using diesel) of power at pump and pigging stations and therefore no negative impact will occur in relation to the availability of power to communities. Additional perceived negative impacts are likely to be encountered where communities with no/minimal access to power are close to the large AGIs where power supply is continual.	No mitigation measures have been identified to compensate for additional power use at AGIS, as this is expected to be negligible or non-existent and will therefore not have an effect on the electrical supply in each area. CLOs will be required to liaise with communities to address concerns that may arise over the absence of any positive benefits in relation to access to energy and to further report this to the CRM.	No residual impacts.
I8	**Water: increased pressure on water resources for construction activities, camps and AGIs** Most communities experience difficulties in getting sufficient clean water for either domestic or agricultural use. The primary constraint is the absence / poor quality of water pipes and pumps but water scarcity is also an issue. Hence, water used by the project could result in shortages in local communities, who	This impact will be eliminated by identification of water sources for project use that do not affect the amount of water required for local use. Communities who use the same water source as the project will be routinely consulted to understand whether there has been any negative impact on their access to water and project water	Increased demand for water (if mitigation measures not implemented): High Perception of inequity in water resources: Medium

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of each residual impact)
	use these sources for irrigation, domestic uses and livestock watering. In such locations, there is additional risk of a perceived impact if construction camps and sites are seen to have access to fresh water while villages do not. Extraction of large volumes of water for hydro-testing may also impact fish stocks, creating a negative impact on the livelihoods of those relying on fishing for income. However, given the low dependence on fishing as a livelihood in the area, the impact is not expected to be very large. See Section 4, Project Description for measures to manage fisheries stock during construction.	draws adjusted as appropriate. Large volumes of water will be required for hydro-testing and therefore only very substantial sources may be used – sources will be carefully selected. Appropriate approvals will be sought from the regulators for hydrotest water abstraction. It is likely that drinking water at the camps and on the construction sites will be bottled, so there will be no use of local sources for drinking.	Economic benefit from supply of bottled water if locally supplied: Beneficial
I9	**Water: damage to community water supplies** Between 30% and 66% of households (excluding Borjomi) do not receive running water in their homes. If environmental management is not implemented correctly, construction activities around waterways and river crossings could result in high levels of sediment in water sources, used by communities for drinking purposes, and render them even less suitable for human	Sediment control measures will be used on all river crossings and where water used for drinking is affected by construction activities. Where access to drinking water sources is halted by construction, alternative sources of supply will be provided to communities during the period of disruption.	

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of each residual impact)
	consumption. The presence of sediment would also reduce the quality of water used for other agricultural and other domestic purposes. There is also a very small risk of oil pollution to surface and ground water supplies, which would cause a variety of negative social impacts. The pipeline has been designed to the highest international standards in order to avoid potential leaks Water pollution issues are addressed in Section 10.3	The pipeline design has specifically incorporated features to address the main causes of a pipeline leak, including third party interference, geohazards, corrosion etc See section 10.4 for a description of the risk assessment procedures. Should an emergency occur, a comprehensive oil spill response plan will also be developed to control, minimise and clean-up any pollution including rivers and other water sources in the unlikely event of pipe leakage during operation. This plan will include measures for community liaison, including grievance procedures and compensation for loss/damage to land or livelihoods in the event that a spill does occur.	Damage to water supplies from an oil leak in pipeline: high (See Section 12, environmental residual impacts assessment for discussion) Pollution of community water sources during operation: Medium
I10	**Sewage and waste disposal: increased waste** A preliminary assessment of potential waste sites has been completed. Only one of the sites identified (in Nagebi) has significant social impacts, as it is 30-50 metres from the nearest house.	The contractor is responsible for waste management and is required to meet European standards for the management of waste. They will prepare detailed Waste Management Plans for the construction activities. Any site chosen close to residential areas will have consultation	

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of each residual impact)
	Waste management and disposal is a concern in many communities, as there is already an existing problem with waste management. The areas of impact will be concentrated in communities close to construction camps and around waste disposal sites.	programs with neighbouring properties to understand their concerns. The contractor will develop mitigation measures to address concerns raised, which will be approved by BTC Co All sites proposed for waste management must also meet any requirements needed for local regulatory approval. The volume sent to waste management sites will be minimised by re-use, recycling and incineration where possible. Incineration will occur at one or more of the construction camps.	Smoke from incineration of waste: Low
I11	**Telecomm: congestion of network** It is expected that the mobile network will receive high usage during the construction process by project personnel. Fixed networks will also be used wherever they are available. Fixed and mobile infrastructures are antiquated and degraded and have low capacity and marginal service levels. Any significant rise in usage, as a result of the construction process, will tend to overload the existing network. However the impact of such usage on local communities will be negligible given the current low telephone usage. For the operational phase, the use of the fibre	An upgrade may need to be considered for either fixed line or mobile networks if capacity is insufficient in order to meet both project and community demands, combined.	Congestion of networks (if upgrade not implemented): Low Improved telecoms network (if upgrade implemented): Beneficial

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of each residual impact)
	optic cable will result in minimum impact on the existing landline network. There will be some use of mobile phones during operation. However, this is expected to have a limited impact given the small number of staff required for this phase.		
I12	**Use of telecoms during blasting** Unobtrusive methods are used to minimise sound and vibration impacts during the blasting and therefore general disturbance impacts are not expected. However, the use of mobile phones, and hand held or vehicle VHF radios may not be possible during blasting activities if they interfere with detonation systems. This will depend on the blasting techniques used.	The construction contractor will be required to inform communities if and when there will be a ban on use of mobile phones, hand held and vehicle VHF radios	Inability to use telecoms equipment during blasting: Low
I13	**Extraction of aggregates** The extraction of aggregates from local quarries will have positive social benefits in terms of economic impact for local aggregate businesses, as long as aggregate demand from the construction contractor does not restrict local access for other purposes. If aggregate is extracted, there will be increased noise, dust and visual impacts from the extraction process, however because the project is not expected to require large quantities of aggregate, this is therefore unlikely to be a significant impact.	Some surplus rock and subsoil from the ROW will remain after excavated areas have been refilled and may be used as a construction material for other project needs. Where additional aggregate is needed, the ITT has specified that construction contractors will aim to use local aggregate extraction sources. It also specifies that the contractor will need to complete full environmental and social permitting procedures prior to extraction.	Economic benefit from local supply of aggregate: Beneficial Limited availability of supplies: Low

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of each residual impact)
I14	**Educational infrastructure** There will be no direct impacts on educational infrastructure, as all construction workers will be employed on a single status basis. Nevertheless, there are a number of potential secondary impacts in this respect: • In-migration to the project area resulting in increased pressure on schools. This is not anticipated to occur to a significant extent, as in-migration will be strongly discouraged by the project. (See section 11.6, C1) • Children of school age may replace parents with temporary construction jobs by taking on unpaid "family work" such as farming, animal husbandry or looking after family members. Children of school age already undertake some unpaid family work in busy agricultural seasons, particularly at harvest time. Given the existing high levels of adult unemployment, and that most jobs are likely to be short term, it is not expected to be a common occurrence.	None required.	None
I15	**Access restrictions** During the construction phase, open trenches and other construction work will limit access	The ROW will be clearly demarcated. The contractor, with assistance from the community	Access restrictions and safety implications of

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of each residual impact)
	along or across the ROW. This will hinder access to grazing land or fields under cultivation. It may also hinder access to schools, markets etc. The scale of impact will depend on an ability to identify convenient alternative crossing points and the length of time the trench is open in each specific place. At crossing points, trenches are expected to be open for a maximum of 2 days.	liaison team, will be responsible for identifying the need for crossing points and reaching agreement with landowners, land users (including shepherds) and communities on the most appropriate quantities and locations to ensure that disruption is minimised. Shepherds in Kodiani village and those close to Sakire and Tabatskuri in particular, will be consulted to agree crossing points. These will be safe, clearly visible and illuminated. Where roads or other access routes cross the pipeline the contractor will be responsible for providing and maintaining safe diversions, temporary bridges, traffic controls, barricades, signs and warning lights as may be required. All crossings of tracks and roads will be re-instated on completion of activities.	open trench (if measures not implemented correctly): High
I16	**ROW and open trench** Although only construction personnel will be permitted to enter the working corridor of 32 metres there is the possibility that community members and animals will nonetheless gain access to the ROW and trench. It is very unlikely that people will fall into the trenches based on previous pipeline construction experience, but such an incident	The amount of trench open at any one time is expected to be limited to 15km (only 10km in continuous stretches). Stockproof fencing will be erected in areas of danger for livestock. The Community Liaison Team will agree areas for fencing with relevant communities and livestock owners, in advance of construction activities.	Accidents involving community members: High Accidents on open trench involving livestock: Medium

Issue No	ISSUES / IMPACTS	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACT (see Section 12 for a discussion of each residual impact)
	could cause serious injury or even loss of life. Danger will be increased at night and after heavy rains when there may be a risk of drowning associated with unprotected water-filled trenches. It is reasonably common for livestock to fall into open trench.	Stored top soil and excavated subsoil will prevent accidental wandering onto the ROW. Community Liaison teams will provide safety briefings during their meetings in every community along the route prior to construction. This will include information on road safety and also an explanation of the hazards posed by the construction activities. Briefings will also be provided to groups outside formal settlements, but within two kilometres of the construction ROW, including shepherd communities. Fences will be used close to occupied properties or sensitive areas where this is deemed the most appropriate mechanism to assure safety of people, livestock and property. All crossing points over open trench will be fenced on either side to prevent people or animals falling into the trench.	
I16 cont.	**Open trench (continued)**	In addition to this, watchmen will be employed to survey the trench and the night time vehicle storage areas. They will also discourage public infringement onto the ROW.	

11.6 COMMUNITY RELATIONS, MANAGEMENT OF CONSTRUCTION WORKERS AND CAMPS

Despite maximizing local employment throughout the construction phase of the pipeline, approximately 750 foreign workers and workers who are not local to the pipeline affected communities may be required. Influxes of foreign and non-local workers based in construction camps can have a major impact on local communities, as well as attracting additional migration of people seeking economic opportunities into an area. In Georgia, consultation revealed that some communities are particularly sensitive to the presence of foreign workers. Hence, the siting and management of the camps themselves and the management of community relations in connection with the camp and other construction activities is of critical importance to minimising potential impacts of the project. Further, blockading of projects has occurred previously in Georgia, and could therefore be a potential risk to the project. Hence, there is awareness that some issues will need to be managed carefully to avoid negative impacts that could give rise to conflicts between workers and local people.

This section sets out specific measures related to the management of the influx of foreign workers and of the construction camps, as well as addressing community relations management plans relevant to the pipeline project as a whole. The majority of the measures outlined here relate to the construction phase and will be implemented by the contractor. Most of these measures have been included in the ITTs for construction of the pipeline and AGIs. They will be developed in more detail in management plans for community relations and construction camps that will be reviewed and finalised with the BTC Co community relations team during contractor negotiations, and prior to the start of construction activity. BTC Co will be responsible for implementing measures in the operational phase.

11.6.1 Aspects of the project giving rise to community relations impacts

The various impacts relating to relationships between the construction workers and local communities are centred on the construction camps and the construction sites and spreads themselves, to and from which workers will be transported on a daily basis. Two to four construction camps are anticipated in Georgia, with potential sites identified close to Akhaltsikhe, Atskuri, Bakurianis Andeziti [1] and Tsikhisjvari, Tsalka, Gardabani and Marneuli

Each permanent camp will measure approximately 500m x 500m and will have the capacity to accommodate up to 1400 construction personnel, although it is most likely that only about 750 people will be housed there at any one time. The camps will be open, in the sense that workers will generally be free to come and go and to interact with the local communities in their leisure time. However, there are likely to be some restrictions on these freedoms such as after hours limits on movement outside the camps. In addition, full recreational facilities will be provided within the camps to minimise the need for finding recreation in the local community. The camps will generally house skilled and some semi-skilled workers, who will be employed for significant periods of the construction phase.

There will also be interaction between communities and construction work teams along the pipeline route and at the location of AGIs and pipe yards.

1 Also known as "Andezit"

Section 9.9.3 sets out the results of community consultation at each of the proposed locations for construction camps and pipe yards. Any other sites proposed for construction camps will be subject to further environmental and social assessment, in line with regulatory requirements.

11.6.2 Identification of impacts

Table 11-6 below lists the impacts, measures and residual impacts associated with these issues, and with the overall community relations process. The residual impacts are then discussed further in Section 12. The community relations programme process is designed to assist in the management of issues affecting communities that have been described earlier in this section, in Section 11.4 (impact on land and property), and Section 11.5 (impact on infrastructure).

The issues and impacts addressed are as follows:

Construction Phase

- C1: In-migration
- C2: Siting of Construction Camps and Pipe yards
- C3: Tension between Communities and Workers
- C4: Damage to Local Land and Property
- C5: Crime and Violence arising from Drugs and Alcohol
- C6: Spread of HIV/AIDS and other Communicable Diseases to Communities along the Pipeline Route
- C7: Health Provision
- C8: Positive Social Interaction
- C9: Community relations – General Measures
- C10: Unresolved Concerns

Operational Phase

- C11: Community Relations – General Measures

Table 11-6 Impacts and mitigation measures: construction personnel and community relations

ISSUE NO	COMMENTS ON IMPACT	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
	CONSTRUCTION		
C1	**In-migration** Previous pipeline construction experience shows that it is highly likely that people will be attracted to areas around construction activities seeking to sell goods and services ranging from food to prostitution. This could result in: • tension with local communities and • limited opportunities for local businesses • the establishment of informal settlements in the vicinity of the project area • increased competition for public services and resources • increased potential for the spread of diseases and illegal activities including drugs use. Areas of Impact: This may occur in the vicinity of construction camps, ie Akhaltsikhe, Atskuri, Bakurianis Andeziti and Tsikhisjvari, Tsalka, Gardabani and Marneuli.	In migration in search of employment opportunities will be actively discouraged by the construction contractor and BTC Co as early as possible, through implementation of the employment strategy outlined in section 11.3. The employment strategy gives preference to candidates from pipeline affected communities and will provide specific job descriptions for semi-skilled and skilled work Recruitment will only take place at designated recruitment centres and not via informal requests or approaches from community members, either at construction camps or on the route. The construction contractor will publicise the fact that goods needed for the project will not be purchased informally at camp locations or work sites, but instead through formal contracts with suppliers. Informal settlements close to camp boundaries will be reported to the relevant authorities.	In migration: Medium
C2	**Siting of construction camps and pipe yards** Consultation surrounding potential construction camp sites revealed the need for careful planning and attention to final selection of sites from among the identified potential sites.	In order to minimise social disturbances as a result of construction workers, • Existing camps from previous projects	Tension between communities, workers and the project: Medium

ISSUE NO	COMMENTS ON IMPACT	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
		were identified as a first preference. • State land was a second preference followed by land where there is a willing lessee. Community concerns regarding construction camps will be considered and discussed with the construction contractor during contract negotiations and the project will seek to avoid siting camps where their presence might contribute to any conflicts between villages.	
C3	**Tension between communities and workers** Cultural differences, behaviour of construction workers, potential disregard for local cultural norms, potential for prostitution and the attraction of 'hangers on' at camp sites could lead to increased tension between local communities and the workers and camps. The scale of this impact will depend on successful implementation of mitigation measures and in part on the origin of the workforce staying in construction camps[1]. Some communities have expressed particular concerns in this regard.	**Overall management of construction workers** The employment policies defined in Section 11.3 above which aim to maximise job opportunities for local people will help to minimise tensions caused by different socio-cultural values. Training will be provided to all staff, both national and expatriate, on camp management rules and overall discipline and cultural awareness. This will include, in appropriate languages: • a briefing on Camp Rules • a community relations orientation. The objective of this orientation will be to increase awareness about the local area, cultural	Tension between communities, workers and the project: Medium.

(1) Semi-skilled and skilled workers will be housed in the construction camps. Unskilled workers will generally be sourced from the local communities and may therefore not require housing.

ISSUE NO	COMMENTS ON IMPACT	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
		sensitivities and the project Code of Conduct • awareness-raising on health considerations, including STDs. The construction contractor is required in the pipeline ITT to develop a Construction Camp Management Plan to address: • Discipline • Community liaison • Ethnic tensions • Market distortion *(see employment and local sourcing mitigation)* and • Communicable diseases A Code of Conduct and Camp Rules will be required within the Construction Camp Management Plan that provides a disciplinary framework. These will include the following: • limits on hours of movement outside of camps • no access to camps by unauthorised personnel and use of security passes for workers • zero tolerance of illegal activities including use of illegal drugs by construction personnel • no hunting, fishing or unauthorised gathering • zero tolerance of bribery or requesting gifts from communities. Any “gifts” to be immediately reported. This policy must be in line with the BTC Co’s policy on Ethical Conduct • no use of camp vehicles for non-work	

ISSUE NO	COMMENTS ON IMPACT	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
		business • no use of personal vehicles for work business (safety and liability issues) • a strict policy with respect to alcohol • description of disciplinary measures for infringement of the code and camp rules • rules on access to, and use of camp entertainment facilities if these are to be opened up to neighbouring communities	
C4	**Damage to local land and property** Lack of control over the movements of construction staff (during and after working hours) could result in trespassing and damage to local land and property. This lack of control could also result in residents feeling vulnerable to the behaviour of construction personnel as well as create a sense of invasion of privacy. However, such reactions will depend on the on-going behaviour of construction staff and the extent to which local residents feel comfortable about their presence.	The general mitigation measures outlined above for C3 will help to manage the behaviour of workers and minimise the likelihood of this impact.	Tension between communities, workers and the project: Medium.
C5	**Crime & violence arising from drugs and alcohol** There may be some incidents of construction workers obtaining and consuming illegal substances and/or excessive amounts of alcohol in communities along the route. Previous construction projects show that this can have a negative impact on communities by increasing incidents of crime and/or violence and threats (real or perceived) to the safety of community	Limited types of alcohol will be available to workers within the camps. This will not include high alcohol spirits and is designed to discourage them from seeking alcohol outside the camps. The contractor will have a programme for drug and alcohol abuse prevention and random testing that is equivalent in scope and objectives to the BTC Co Drug and	Tension between communities, workers and the project: Medium.

ISSUE NO	COMMENTS ON IMPACT	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
	members. This is most likely to be an issue in communities located nearest to potential construction camps, ie Akhaltsikhe, Atskuri, Bakurianis Andeziti and Tsikhisjvari, Tsalka, Gardabani and Marneuli	Alcohol Abuse Policy. There will be a zero tolerance policy of drunkenness on the ROW or during on-duty hours.. Disciplinary procedures will be standardised for all contractors and sub-contractors so that subcontractors will be required to ensure similar standards of behaviour within their own workforce. As part of the community relations plan, the Code of Conduct will be publicised in settlements potentially affected by the construction camps. This will help ensure that the local residents are aware of the expected behaviour of construction staff. Posters with the Camp Rules will also be posted in neighbouring settlements. Construction camps will provide entertainment facilities for workers to encourage workers to remain within the camp boundaries during leisure time.	
C6	**Spread of HIV/AIDS and other communicable diseases to communities along pipeline route** There is a strong likelihood that there will be prostitution associated with camps, as is common for all large construction projects. This carries a risk of the spread of HIV / AIDS and other sexually transmitted diseases, either to local communities or to commercial sex workers that move in to these areas.	The Construction Contractor will operate a personal health programme in order to prevent illness or disease occurring or spreading, including immunisations if required. BTC Co will provide a community outreach programme on communicable diseases eg	Increase in diseases: High and Medium Improved health awareness: Beneficial

ISSUE NO	COMMENTS ON IMPACT	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
	(See Section 9 for information on HIV / AIDS in Georgia) There is also a risk that interaction between foreign workers and local communities might either introduce new diseases to the country or the region, or might significantly increase the rate of transfer from one community to another. Communities nearest to potential construction camps will be most affected, ie close to Akhaltsikhe, Atskuri, Bakurianis Andeziti and Tsikhisjvari, Tsalka, Gardabani and Marneuli.	HIV/AIDS. This is likely to be in partnership with a local expert NGO. The construction contractor is required to provide: • Health awareness training for workers including sexually transmitted diseases at induction and then periodically throughout construction. • Awareness-raising on HIV/STDs for communities close to camps (via posters, leaflets, through health clinics, community meetings). • Liaison with local medical authorities THGGG	
C7	**Health provision** There is a risk of resentment towards the project and project team where communities see that construction workers are provided with superior health facilities to which the community has no access.	Medical facilities within camps will not be made available to local communities in general. However, workers, including local workers, will be able to use the project's medical facilities and this will reduce demand on the existing community health services for the duration of construction in each community's area.	Perceived inequity in health provision: Medium
C8	**Positive social interaction** Interaction between workers and communities can be a positive benefit, bringing information and ideas to relatively isolated communities. However, the mitigation measures defined above are required to counteract the negative impacts of construction workers in the area which will limit the	None, beyond the community relations induction listed above.	Access to new cultures and international attitudes: Beneficial

ISSUE NO	COMMENTS ON IMPACT	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
	scale of this positive impact.		
C9	**Community Relations – general measures** Negative perceptions and unresolved concerns from the local communities could result in a poor relationship between the community and BTC Co / Construction Contractor and the Construction workers. Good community relations are essential to the project and community concerns must be dealt with accordingly	The construction contractor will be required to submit a Community Relations Plan for review and approval by BTC Co This is described in further detail in the PCDP, Appendix F. The construction ITTs require the contractor to provide community liaison personnel who will be integrated into a joint BTC Co /Contractor team led by a BTC Co Community Relations Manager. This person will be in place early enough to oversee the development of management plans and carry out community liaison in relation to preparatory construction activities. Community members have expressed a preference that CLOs represent a mix of both local and international people to ensure that the community liaison team understands the context of both local and BTC Co's perspective on any issues that arise. The Community Liaison team will also need to reflect the ethnic make-up of each of the districts and be competent in the various local languages used. Community Liaison Officers, employed by the construction contractor, will work alongside the construction activities (ie camps, pipeline and AGI construction). The leader of this team will be in place at least 6 months before construction commences, and the full team will be in place at least two months prior to the start of pipeline or	Tension between communities, workers and the project: Medium.

ISSUE NO	COMMENTS ON IMPACT	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
		camp construction. For further details of the structure and roles of members of the community relations team refer to Section 5 in the PCDP annexed in Appendix F. In addition to a community relations plan, BTC CO will implement a community investment programme for pipeline-affected communities in order to provide tangible benefits to affected communities. This is discussed in further detail in Section 14	
C10	**Unresolved concerns** Despite mitigation measures outlined in this section, and in earlier management and mitigation sections. There are likely to be incidences where community members will still want to make formal complaints. For example - to record an incident of poor worker behaviour in a community or to apply for compensation as a result of damage to property etc.	**Complaints procedure general measure** The Contractor will aim to minimise formal complaints through the use of community liaison mechanisms outlined above. However, a formal complaints procedure will be set up to record and address any complaints. A nominated individual (normally the Community Liaison Officer) will be provided for community members to address complaints directly. Details of the telephone numbers and complaints procedures will be distributed at community meetings and via posters to all communities in the vicinity of the working area, construction camps and close to roads that will experience significant increases in traffic movements. However, given the limited availability of working telephones, the location of the community liaison team will also be widely publicised so that complaints can be made in person.	Complaints procedure: Beneficial The aim of these mitigation measures is to establish a legacy of trust and good relations with communities.

ISSUE NO	COMMENTS ON IMPACT	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
		The telephone will be answered in person whenever possible during working hours and recorded at all other times. Details of the complaint, source, location and date/time of offending event must be recorded. The Contractor's Community Liaison Officer and/or the Community Relations officer will investigate the complaint. The communities will also be provided with contact numbers for the BTC Co Community Relations Manager in the event that the Contractor does not satisfactorily handle a complaint. BTC Co will respond to all complaints that are received from local community members or local authorities within 2 weeks. Full details of the complaints procedure are contained in the PCDP in Appendix F.	
	OPERATIONAL PHASE		
C11	**Community relations – general measures** A community liaison team will be required to manage community relations during the operational phase. It is not expected that day-to-day operations will create any negative community relations impacts. However, communities will expect to be kept informed of activities surrounding the pipeline and failure to do may create some discontent with the project.	A community relations team will be in place during operation of the pipeline. This team will • hold regular meetings with communities • maintain awareness of safety issues • monitor the pipeline route to ensure compliance with land use constraints • provide monthly reports to the Operations Management on issues arising from community liaison • report breaches of safety or land use constraints, or serious disputes.	No direct residual impact anticipated

ISSUE NO	COMMENTS ON IMPACT	MANAGEMENT AND MITIGATION MEASURES	RESIDUAL IMPACTS (see Section 12 for a discussion of each residual impact)
	In the event of a safety incident, community information needs will be even more important to minimise any safety related impacts (for both persons and livelihoods) and to minimise negative feelings towards BTC Co	Selected land officers will also remain the main point of contact for communities on property and land issues to monitor and assist the construction contractor's pre-entry agreement procedure and final re-instatement sign-off with owners and users and for resolving outstanding issues. They will report to the BTC Co management team. Full details of the general community relations measures are contained in the PCDP in Appendix F.	

11.7 SAFETY AND NUISANCE IMPACTS

The community consultation process has indicated that there is much concern about safety and nuisance issues along the whole of the proposed route, particularly in the communities consulted regarding the AGIs. However, communities were often not able to specify exactly what safety and nuisance impacts issues were of concern to them. This can be attributed in part to the fact that communities are not fully aware of the nature and extent of this disturbance and also that their hope of employment on the project leads them to downplay these potential negative impacts. It is anticipated that the level of concern regarding safety and nuisance will increase once construction has commenced.

Most of these issues are covered in more depth in Section 10, Potential Environmental Impacts and Mitigations:

- 10.3.3: Air Quality (including dust)
- 10.3.4 Noise
- 10.3.10 Landscape and Land-use (including visual impacts)

The remaining safety and nuisance mitigation measures without an environmental facet have been integrated into other areas of Section 11 as follows:

- I15 Access Restrictions
- I16 Open Trench

RESIDUAL IMPACTS

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12.1 INTRODUCTION

Sections 10 and 11 described the potential environmental and social impacts that would occur along the route as a result of different phases of the project and how the proposed mitigation measures would contribute to minimizing or eliminating the impacts. As discussed, not all impacts can be fully mitigated and residual effects will be experienced by the environmental and social receptors. This Section summarizes the residual environmental and social impacts at project level throughout Georgia. The impacts are analysed according to their ranking as determined through the assessment process detailed in Section 7.

12.2 RESIDUAL ENVIRONMENTAL IMPACTS

12.2.1 High ranking residual impacts

This Section describes the residual impacts that have been ranked as High, based on the methodology presented in Section 7. High ranking residual impacts have been predicted only for ecology and landscape. These receptors and the ranking of the residual impacts are discussed below.

12.2.1.1 Ecology

Two areas have been identified where high ranking residual impacts to flora will occur owing to clearing of the ROW: Tetritskaro (KP 84-92) and Tsikhisjvari /Sakire (KP 182 to 204). It must be noted that not all the ROW in these areas is covered by forest. The overall area of continuous forest encroached by the ROW at the two locations mentioned above is approximately 55 hectares.

The clearance of forest along the ROW will necessarily mean that a large number of trees of high conservation value will be lost. Mitigation of the impacts is only partially achievable through conservation. The residual impacts have been scored as High at both locations as a result of the certainty that the clearance will occur, and the national significance of the species that will be affected (high mountain oak). It must be noted, however, that, no significant impacts are expected to occur with regard to the forestry practice in Georgia, or to forestry management in general, as the forests affected by the proposed pipeline project are a small fraction of the overall forest heritage of the country.

An additional area where High ranking impacts to fauna will occur is Mt Tavkvetili (KP 151-157). The removal of the rhododendron scrub from the ROW in this area will result in loss of black grouse habitat. Mitigation measures in this area will include the removal of the habitat prior to the breeding/nesting season so that minimum loss of individuals of black grouse will result from the construction activities. The habitat will then be restored as part of the reinstatement activities.

Additional mitigation measures to offset these residual impacts are included in the Environmental Investment Plan, discussed in Section 13.

12.2.1.2 Landscape

High ranking landscape impacts are predicted to occur at the following locations:

- Tetritskaro (KP 84-92): Permanent modification of forest landscape as a result of ROW and PSG2 construction
- Mt Tavkvetili (KP 151-157): Permanent modification of volcanic landscape identified as a "landscape monument" in the Georgian Red Data Book
- Tskhratskaro pass to Sakire (KP175.5-204): Permanent modification of forest landscapes, steep slopes and unstable land
- River Mtkvari West crossing (KP 221): Permanent modification of riparian landscape as a result of ROW construction
- River Potshkovi North crossing (KP 238): Permanent modification of riparian landscape as a result of ROW construction

In all cases the High ranking is given by the certainty that the impact would take place, and by the permanent modifications that will ensue as a result of the construction activities in high value landscapes.

The implementation of mitigation measures over the long term, as described in the Landscape Management Plan (Appendix E, Annex 1), will however reduce the significance of the impacts over time as the reinstated vegetation features will blend with the surrounding landscape.

12.2.2 Medium ranking residual impacts

Residual impacts of Medium ranking are predicted for the following issues:

- Ecology
- Landscape
- Noise

These receptors and the significance of the residual impacts are discussed below.

12.2.2.1 Ecology

Ecological impacts of Medium ranking include events with a medium to low likelihood of occurrence (such as the disturbance of a certain floral population), or events with certain likelihood but concerning species of regional or local importance.

Both locations identified in the previous section (KP84-92 and KP 182-204) as high significance impact areas, will also experience Medium level impacts, associated with the removal of locally important habitats such as park like forests and alpine and sub-alpine meadows. Mitigation measures such as transplanting protected herbaceous species and habitat restoration after construction of the pipeline will ensure that the disturbance will have a finite duration and that pre-existing conditions will be achieved after restoration of the ROW. The potential disturbance of faunal habitats, such as bears and other mammals in these two areas, is also ranked as a medium impact although the significance of this residual impact is not fully understood as there is no conclusive evidence that the ROW clearance and construction operations could significantly affect the migratory behaviour of such mammals. Additional surveys and monitoring will be undertaken to assess this issue further and develop suitable mitigation measures if required.

Other locations are considered to have residual environmental impacts of Medium ranking as detailed below.

- Kumisi plain (KP 29.4-53.2): potential impacts to rare populations of snake eyed lizard during construction
- Algeti River crossing (KP 53.2-53.8) and River Geti Crossing (KP 72.8): loss of regionally important riparian habitat
- Bedeni ridge (KP 92-108): Potential loss of part of extensive marsh orchid habitat
- Kizil Kilisa (KP 140): Fragmentation of local wildlife habitat (pine plantation)
- Mt Tavkvetili (KP 151-157): Potential loss of alpine wetland

The implementation of the project mitigation measures described in Section 10 will ensure that the likelihood of these impacts is reduced as much as possible. The final definition of the ROW on Mt Tavkvetili will also provide an opportunity to avoid the high mountain wetlands known to be present in this area.

12.2.2.2 Landscape

Residual impacts of Medium ranking to the landscape will occur throughout the ROW as a result of the short-term visual intrusion, caused by the construction equipment in areas of high landscape value, or by permanent modifications of the landscape in areas of medium landscape value. The locations where these impacts will occur are detailed in Section 10.2. With the exception of degraded landscapes that occur in the westernmost and eastern part of the route for an overall length of approximately 80km, the majority of the proposed pipeline route will be affected by such impacts.

The residual impact of visual intrusion, as a result of the presence of PSG1 (KP 3.6) PSG2 (KP 84) and IPSG1 (KP 18), is also predicted because the existing landscape is of high quality. As few permanent receptors exist near to the site, and because visual intrusion will be minimized through the appropriate mitigations, the residual impact ranking is considered as Medium.

12.2.2.3 Noise

Noise associated with pipeline construction will be difficult to mitigate and it will cause disturbance to human receptors. Areas where human receptors have been identified to be present within 1km of the ROW are detailed in Section 10.2.

The degree of disturbance will depend on the distance of the receptor from the construction site and the meteorological conditions at any given time. Noise generation will, however, be of a temporary nature at any one stationary receptor. On this basis it has been estimated that none of the impacts generated will be of High ranking.

Prolonged noise impacts will occur as a result of the operation of the ancillary construction facilities such as the port, the storage yards, the worker camps, the borrow pits and the waste disposal sites. As per the construction related impacts, the significance of any disturbance will depend on the distance of any receptors from the site and as most of these facilities had not been selected at the time of writing the ESIA, it is not possible to accurately estimate the degree of disturbance and its significance. However, the final location of these sites will require approval by BTC Co such that social and environmental factors will be taken into account.

Operational noise will occur during normal operation of the AGIs and project standards will ensure that no impact to humans arises. However, project standards cannot rule out possible impact to fauna if the source of noise is within a habitat used by wildlife. On this basis at PSG2 the ranking of operational noise impacts is considered Medium.

12.2.2.4 Unplanned events

Unplanned accidental events would affect different environmental receptors depending on the location of the accident and its extent. The likelihood of the occurrence of such accidental events also varies along the route, depending on physical factors (soil chemistry, presence of faults, river crossings, etc) but it is however extremely low as discussed in Section 10.4.2. On this basis, for a worst case scenario considering the most environmentally sensitive location and highest possible volume of oil spill, the consequences would be very high, but the likelihood of this occurring extremely low. Hence, the overall residual impact ranking is Medium. Section 10.4.2 includes a detailed analysis of the potential frequency and therefore likelihood of accidental events.

12.3 RESIDUAL SOCIAL IMPACTS

12.3.1 Introduction

This Section outlines in more detail the likely residual social impacts of the BTC project.

12.3.2 High significance residual impacts

12.3.2.1 Access to energy

(Related impact: Section 11.2)

As outlined in Section 9 (Socio-Economic Baseline), access to energy is perceived at the national level and among pipeline-affected communities to be of high importance. There will, therefore, be a residual high significance negative impact of un-met community expectations as the project will not provide communities with additional power directly.

Although it is a legitimate expectation of people to have access to energy, the obligation to provide energy rests with the Government of Georgia. However, BP is collaborating with and supporting the Government departments tasked with this obligation and responsibility. BP has undertaken a broad review of the access to energy problems in Georgia, identifying the key organizations involved in addressing the problems of energy access. BP seeks to provide expertise and experience to those involved in the country's energy planning, and supports the government and other authorities in rebuilding the energy networks particularly along the pipeline route. In addition, the Shah Deniz Georgia HGA provides for gas supply from the SCP project to Georgia which will help to mitigate community expectations to some extent, depending on how this additional gas is distributed by the government within the existing gas infrastructure.

During 2001, BP implemented a major initiative to provide winter heating to vulnerable Georgian communities. The BP Foundation contributed $1 million to the US AID Georgia

Winter Heat Assistance Programme. The same mechanism was used by BP to contribute during the winter of 2000 (US$500,000).

12.3.2.2 Un-met employment expectations

(Related impacts: E2, E3, E4)

As discussed in previous sections, expectations regarding the number of available jobs are unrealistically high. Given the limited number of jobs available, many will be disappointed when they are not able to gain employment, including those in affected villages, in major towns and in villages just outside the area defined as directly affected. The inability of the project to meet the high expectations for employment may create resentment that could lead to hostility toward the project and towards those who win jobs.

Measures to manage expectations regarding employment opportunities (set out in Section 12.3, E4) will help to reduce any potential impact. However, it is likely to remain a key concern of communities and the public in general given the high interest in employment found during the consultation process. It is therefore considered that remaining unmet expectations will have a High impact.

It is also possible that there will be a short-term residual impact of discontent and perhaps resentment towards the project arising from occasional instances of corruption/bias in the recruitment process. It will be extremely difficult to eliminate all bias and corruption from the recruitment process. Whether real or a perception, this will be a high significance residual impact.

12.3.3 Medium significance residual impacts

12.3.3.1 Grievances over land compensation

(Related impacts: L3, L4, L5, L6, L10)

WREP experience suggests that there will be disputes and disaffection between the project and some landowners and users on the pipeline route. These will be caused by perceived or actual instances of disagreement with regard to the compensation process and/or methodology, and associated impact on livelihoods. This could cause resentment and possibly hostility towards the project and BTC Co.

The nature and scale of these negative residual impacts will depend on the quality of implementation of the land acquisition and compensation process, community relations and the grievance procedures. However it is expected that these will be of medium significance.

12.3.3.2 Accidents involving community members

(Related impacts: I3, I16)

It is possible that accidents involving local community members will occur at some stage in the project activities. The most likely accidents would be traffic related, however, other potential risks include accidents involving the open trench or fire. Any accident that harms a person will have a medium significance residual impact in terms of diminishing quality of life for that person, negatively impacting them or their household livelihood, and potentially creating hostility towards the project and project team.

The risk of accidents happening will depend on the quality of implementation of the safety training and traffic strategy, particularly in relation to driving and traffic management. However, the focus placed by BTC Co on traffic safety suggests that serious accidents can be avoided and are very unlikely.

Mitigation measures have been developed to ensure safety close to residential areas, thereby avoiding the possibility of residual impacts occurring. But, as fencing will not be used on all open lengths of trench, there is still a risk to the safety of people who move beyond any marker fences and on to dangerous areas of the ROW.

Should an accident with a community member occur on the ROW, the contractor will be responsible and will be liable for any compensation due. The community liaison team will also work with communities to manage issues or anxiety surrounding accidents, and to inform them about potential risks.

12.3.3.3 Increase in diseases

(Related impact: C6)

There is a potential negative residual impact if the existence of worker camps and the interaction of the workforce with local residents might either introduce new diseases to the country or the region, or might significantly increase the rate of disease transfer from one settlement to another. The likelihood and severity of this will depend upon the health of the workforce and the level of interaction with local settlements. This will also depend on the effectiveness of community awareness programs to provide education on the issue, and training of construction workers. This may include more serious diseases with a long term effect on community mortality levels, eg HIV/AIDs, other STDs, etc. This may also include short-term outbreaks of diseases with an impact on mortality rates. Short term outbreaks in diseases with no impact on mortality are considered of low significance.

A rise in sexually transmitted diseases is more likely to occur in the large towns rather than the smaller communities along the route where prostitution is strongly discouraged because of more strict social norms.

If it is not carefully managed, the residual impact of an increase in diseases within communities could be highly significant in terms of human health, and on the health care infrastructure. However it is more likely that this will have a medium significance, whereby there is a shorter-term impact on the quality of life and potentially the ability of households to maintain their livelihoods (either through formal work or from subsistence activities).

12.3.3.4 Perceived inequity in health provision

(Related impact: C7)

If there is any resentment over lack of access to the project's health services, this would remain as a residual impact. The residual impact would be concentrated in communities close to worker camps as that is where the project will have health facilities. This has been assessed as likely to occur and be of medium significance given the poor quality of the existing health infrastructure.

12.3.3.5 Illegal de-forestation

(Related impact: I1)

Improved roads within forested areas may facilitate illegal logging, and this has been identified as a concern of several communities in the mountainous areas. Illegal de-forestation will impact households and communities where harvesting wood products is an important livelihood source or who harvest wood for personal uses. The restriction on new roads, and reinstatement/removal of new roads in ecologically sensitive areas will help to minimize this impact to some extent.

12.3.3.6 Infrastructure and services

The mitigation measures identified for infrastructure and services will, if implemented correctly and in full, prevent any planned significant impacts. However, in a project of this size it is likely that there will be instances when infrastructure or services are accidentally disrupted without notice and prior planning. Such disruptions could affect large numbers of people living over extensive areas and, although temporary, there is a possibility that an unplanned disruption could hinder income generation (including subsistence activities) of those affected, for example by impeding irrigation to crops by accidental damage to an irrigation channel. This will also result in residual resentment towards the project. Such instances can be dealt with through the compensation and complaints procedure.

12.3.3.7 Resentment over condition of roads

(Related impact: I3)

While roads will be maintained in at least as good a condition as prior to the commencement of construction, this may not be sufficient to meet community expectations and there may be residual discontent and resentment toward the project and project team. Evidence gathered in some communities through the qualitative survey suggests that this would be significant. The extent of discontent will depend on the extent of the temperament of individual communities. The benefits of road upgrades in real terms is outlined in Section 12.3.4.7.

12.3.3.8 Access to water resources

(Related impact: I8)

There is the potential for the project to have a negative impact on the short-term availability of water for communities, particularly during the construction phase, but to some extent during operation for communities near the large AGIs. Mitigation measures developed in Section 11 require the construction contractor to consult with local communities on whether the project's water consumption is impacting household and agricultural supplies so that project water consumption can be adjusted accordingly. Similarly BTC Co will consult during operation to ensure that the project's water consumption has no negative impact. However, in cases where a negative impact is identified, there might be a time delay before consultation takes place and the project's water consumption is adjusted during which household and agricultural water access will be hampered, impacting both quality of life and livelihoods (particularly agriculturally based livelihoods). The extent of the impact will depend on a number of factors: the season (ie in summer, irrigation is required and the impact will be more severe), the speed at which the water source can be replenished, the number of users relying on the source, and the amount the project is drawing).

There is also a potential for a residual perception of inequity from the communities with poor potable water close to worker camps that are aware that workers have constant access to potable water. This is likely to be a problem in Akhaltsikhe, Atskuri, Bakuriani, Andeziti (Andezit), Tsalka, Gardabani, and Marnueli.

12.3.3.9 In-migration

(Related impact: C1)

In-migration is likely to occur to a very limited extent, for short periods around worker camps, despite mitigation measures. This could result in a residual impact of increased competition for public services and resources, and potentially the spread of diseases and illegal activities including prostitution.

12.3.3.10 Tension between communities, workers and the project

(Related impacts: C2, C3, C4, C5, C9)

It is likely that there will be incidents and tensions between workers and communities at particular times and locations during the construction phase given the number and range of impacts that will affect communities.

Mitigation measures outlined in Section 11 will minimize project impacts but where any incidents are not completely resolved there could be a localized residual impact in loss of trust and increased discontent with the project and project team. The community liaison management plan and activities are designed to address these situations and to ensure any residual discontent or resentment among communities is minimized.

The level of trust/resentment will also be affected by the scale, quality and impact of the project community investment programme which is designed to deliver benefits to communities who are impacted by construction (see Section 14.4.2).

12.3.3.11 Access restrictions and safety implications of open trench

(Related impacts: I15, I16)

It is likely that there will be minor accidents involving livestock on the ROW. Basic health and safety management measures are in place to minimize this but as stock proof fencing will not be used on all open lengths of trench there is still a risk that animals could move beyond any marker fences and on to the ROW, which could result in accidents. Compensation measures via a grievance process have been established which will mitigate any losses incurred, however any accidents that occur may increase discontent with the project in general.

12.3.3.12 Pollution of community water sources during operation

(Related impact: I9)

In the very unlikely event of an oil spill, there would be a short term residual effect on the quality of life and livelihoods of households within the affected area. The oil spill response plan will include measures to clean up compensate households affected, making the long term residual impact of an oil spill on communities of medium significance but manageable.

12.3.3.13 Loss of potential tourism development opportunities

(Related impact: L9)

Communities in Borjomi district in particular have hopes that tourism will develop in the area, bringing an associated positive economic impact. There will be a residual impact of a permanently changed landscape in the forested areas, given the 8 metre corridor which will not have large trees growing on it. The residual impact has been minimized by landscape planning and reinstatement measures, and therefore the residual impact is primarily one of perception among communities who worry about the connection to tourism development. (See Section 14 for landscape plan and re-instatement measures).

12.3.4 Beneficial residual impacts

12.3.4.1 Additional cash injected into communities from wages

(Related impact: E1, E10)

Employment is the most significant positive social impact associated with the BTC project in the short-to-medium term. There will be a positive residual impact of the income obtained and spent by local workers in the community. This will be limited in each individual community by the short-term nature of the employment of unskilled workers (see Section 11.3 E2), but more prolonged in the case of semi-skilled or skilled labour. The result will be short term economic benefit for individual households and additional indirect employment for local businesses as a knock on effect. The key issue in determining the scale of this impact will be the total number of Georgians employed in construction, and the duration of their employment. The target for this has not yet been fixed, and will be negotiated during the construction contractor selection process.

There will also be a positive residual impact from the money spent locally on goods and services by construction workers in the local communities, which could also help to create temporary indirect employment.

12.3.4.2 Distribution of economic benefits

(Related impact: E2)

Management measures for the recruitment process should ensure that distribution of jobs, and therefore the distribution of economic benefits, are spread out over the route. However, individual jobs at the unskilled level will be for a shorter time (ie - 2-3 months rather than for the full construction period) thus creating a smaller positive economic benefit for each individual.

12.3.4.3 Enhanced local experience and employability

(Related impact E7: E11)

There will be benefits in terms of the additional experience and skills gained by construction and operational workers.. However it will be more significant for those participating in skills development programmes, and also for skilled workers who will be employed for longer periods. The future employment prospects of these workers will be enhanced, especially as regards SCP. Hence, the indirect benefit to the families and communities could be significant.

The potential to realise this positive impact will depend on the training programmes developed by the construction contractor, to future business development demands, and to some extent on the individuals' willingness to learn. Professional (office-based) workers are more likely to have enhanced employment prospects, since they will be eligible for positions in other industries.

There will be a positive residual impact for companies (and their employees) benefiting from supply contracts through increased skill levels and experience. The scale and distribution of this impact will depend on the number of contracts let.

12.3.4.4 Economic benefit of indirect employment opportunities

(Related impacts: E8, E9 I3, I6, I8, I13)

If local people remain within the local communities much of the cash injected is likely to remain within the local economy beyond the construction period, creating a positive residual impact.

Roadside stalls and local businesses

Many communities perceive that there will be an economic benefit to local businesses from additional traffic purchasing products from roadside stalls, local markets and restaurants.

Bottled water

If bottled water is sourced locally, rather than from an international water company, there would be a positive economic impact in terms of money earned from the sale of water. This will not directly impact pipeline affected communities who do not have local sources for bottled water, with the exception of Borjomi region. However, it will provide an economic benefit to those regions of Georgia which do produce bottled water.

Local purchase of aggregate

Positive economic impact, though short-term in nature. The scale of this impact will depend on the quantity the selected contractors propose to purchase, and on the sites selected.

Diesel

The local purchase of diesel will have a positive economic impact for Georgia, primarily in Tblisi as this is likely to be purchased through Tbilisi-based companies (the quality of diesel available at the local level is not considered of sufficient quality for use by the project). In addition, diesel will probably be used for power generation at the worker camps and major facilities along the route. This will have a further positive economic impact.

12.3.4.5 Enhanced capacity to tender for international contracts

(Related impacts: E8)

Skills developed by local businesses during contracting arrangements for this project will enhance the ability of these Georgian companies to respond to other international tenders. This will include overall business management skills such as health and safety, quality assurance and project management.

12.3.4.6 Use of wood cleared from ROW

(Related impact: L9)

Because small trees and branches cleared from the ROW will be given to local communities to use for firewood, there is a positive short term residual impact arising from provision of additional fire wood at no cost and minimal effort to the individual.

12.3.4.7 New roads/improvements to roads

(Related impacts: I1, I2)

There will be a positive residual impact arising from upgrades to roads, despite the potential for a perceived negative impact described in 12.3.3.6 above. Consultation with affected communities in Georgia shows that communities list improvements to roads as a priority. This will, therefore, be an important benefit of the project.

There will be a positive residual impact arising from construction of reasonable quality new roads where they can be used by the local population for access to markets, education, etc. This is dependent on community support for not removing the roads once construction is complete and local government ability and willingness to maintain the new roads. If communities want the roads removed, there is neither a positive or negative residual impact.

12.3.4.8 Improved health awareness

(Related impact: C7)

Health awareness raising programmes (both conducted by the contractor and by the community investment programme) in local communities should result in a positive residual impact for the quality of life of local communities.

12.3.4.9 Access to new cultures and international attitudes

(Related impact: C8)

There are some opportunities for the internationalisation of local communities / greater tolerance and awareness of other cultures which can be seen as a positive residual impact if communities welcome this.

12.3.4.10 Complaints procedure

(Related impact: C10)

A fair and effective complaints procedure will help to establish a legacy of trust and good relations with communities. The level of trust will be determined by the quality of implementation of all measures, not simply those related to community relations.

CUMULATIVE IMPACTS

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13.1 INTRODUCTION

The Georgian section of BTC is part of an overall scheme to extract crude oil from the ACG oil field in Azerbaijan and export such oil to end users in the Mediterranean region. The oil production project and the pipeline construction projects in Azerbaijan and Turkey are the subject of separate ESIAs that discuss the direct impacts associated with those activities.

This Section presents the assessment of cumulative impacts that may result from the interactions of construction and operation of the BTC pipeline with other projects and activities.

The IFC Procedure for Environmental and Social Review of Projects (IFC, December 1998) states that environmental assessment should include consideration of:

“Cumulative impacts of existing projects, the proposed project and anticipated future projects.”

To identify which other projects need to be considered alongside the project being assessed the IFC Procedure states that:

“Assessment of cumulative impacts would take into account projects or potential developments that are realistically defined at the time the environmental assessment is undertaken, where such projects and developments could impact on the project area”.

Cumulative impacts are those that may result from the combined or incremental effects of past, present or future activities. While a single activity may itself, result in an insignificant impact, when combined with other impacts (significant or insignificant) in the same geographical area and occurring at the same time, it may result in a cumulative impact. Cumulative impact assessment has a number of components including:

- Assessment of the effects over the area of the impact of the project resulting from interactions between the project activities and other activities in the same geographical area
- An assessment of the effects of project activities over an extended timeframe including the past, present and future resulting from interactions between the project activities and other activities occurring at the same time

The assessment of cumulative impacts presented below follows the same outline methodology used for the overall impacts assessment described in Section 7. In the first instance, the spatial and temporal boundaries of the assessment have been defined based on the degree of influence, if any, the project may have on environmental and social issues at a regional, national and local basis. The temporal boundaries of the assessment have been defined based on the time span of the project during its main phases, construction and operation.

Having identified the boundaries of the assessment, the projects or activities that will occur within these boundaries have been identified and their main interactions with the BTC project highlighted. Each project or activity was then assessed with regard to its potential cumulative impacts on the following receptors and issues:

- Air quality
- Greenhouse gas emissions
- Water resources
- Ecology
- Landscape
- Waste management
- Wealth and livelihoods

Much of the information regarding cumulative socio-economic impacts of the pipeline was gained through the in-depth interviews conducted during consultation. This included information from communities that had been affected by the construction of the WREP pipeline and information from pipeline affected communities regarding the BTC and SCP pipelines.

The potential impacts identified were assessed in the light of mitigation measures that can be applied as part of the BTC mitigation plan and those that are beyond the specific remit of the BTC project such as the Environmental Investment Plan and the Community Investment Plan. Residual impacts at route level have been ranked wherever possible according to the same principles described in Section 7.

13.2 SPATIAL AND TEMPORAL BOUNDARIES

The cumulative effects of the project are considered in this section at three spatial levels: Regional Projects Overview (Section 13.3); National Level Assessment (Section 13.4) and Route Level (Section 13.5).

Regional level: The spatial boundaries of the regional cumulative effects assessment reflect the overall geographic span of the project scheme from the Caspian Sea to Turkey. Within this region and in the context of oil and gas production and transportation systems, the region can be defined as including the Caspian Sea, the Caucasian belt and Southern Russia, the Black Sea and Turkey. The region will be hereinafter referred to as the Trans-Caucasian belt. The assessment of cumulative effects on the natural and social environment, therefore, includes all regional activities directly and indirectly related to the project. For BTC this would include the development of the ACG fields and other oil fields in the Caspian Sea and the construction of the overall transportation system and the shipment of the product through the Mediterranean Sea. The regional assessment has been largely carried out as part of a regional review, presented separately from this ESIA. A summary of the regional issues is presented in Section 13.3 below.

National level: In this ESIA report, national level cumulative effects refer to effects that could occur within Georgia as a result of the interaction of the various projects taking place within the country. These include other oil and gas related projects in Georgia (eg oil products terminal in Kulevi; transport of Tengiz's oil through Georgia by railway, WREP); other non-oil and gas projects in the area (eg expansion of Poti port, irrigation and drainage rehabilitation projects, Borjomi Mineral Water valorization and export, expansion of Gardabani power plant). Trans-boundary impacts are also addressed in this section. Cumulative effects at national level include the social and industrial changes that will result from increased power availability, the increased mobility of people and goods that will result from the upgrade to roads and the geopolitical implications of Georgia's increased autonomy from Russia with regard to fossil fuels and/or energy.

Route level: The cumulative effects assessment at route level is based on the likely construction and operation of the BTC and SCP pipelines in the same corridor, which will extend the overall construction period and therefore the period over which impacts are felt, as well as magnitude of those impacts.

The temporal boundaries of the assessment coincide with the operational life of the pipeline, that is 40 years. The majority of the effects will occur in the short and medium term during construction whilst some long lasting social and industrial trends could extend for as long as and beyond the project life span.

13.3 REGIONAL PROJECTS OVERVIEW

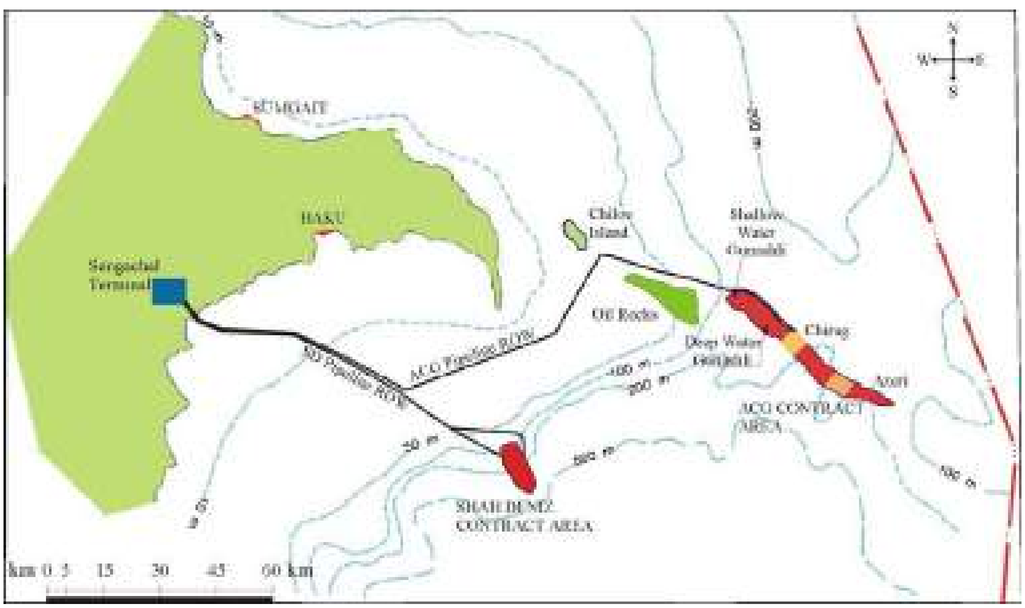
The Trans-Caucasian belt has been the theatre of recent developments in the oil and gas sector following the discovery of new fields in both the Caspian Sea and onshore in many areas of the overall region. The implementation of upstream activities and early transportation systems has heightened environmental awareness in the region and brought to the attention of developers the abundance of environmentally sensitive areas and socially fragile environments.

The BTC pipeline project is part of one of these developments, generally referred to as the ACG Full Field Development (FFD). The routes of export pipelines from Azerbaijan, both existing and proposed are shown in Figure 13-1, while Figure 13-2 shows the location of the offshore fields which will export hydrocarbons through the BTC and SCP pipelines. Also shown are the approximate routes of the offshore pipelines and the location of the Sangachal Terminal.

Other projects involve extraction and transportation of oil as well as natural gas, and activities unrelated to oil & gas. The ACG development, as well as other major projects, which are taking place in the region, are briefly discussed below.

Figure 13-1 BTC alignment in relationship to other export pipelines from Azerbaijan

Figure 13-2 ACG and Shah Deniz reservoirs and offshore pipelines



13.3.1 The ACG development

The ACG project consists of the development of the Azeri, Chirag and shallow water Gunashli oil fields, offshore Azerbaijan. One production platform (Chirag-1) is currently producing approximately 120,000 barrels of crude oil per day, which is transported by offshore pipeline to the Sangachal Terminal for processing. The oil is then primarily exported via the WREP to Supsa on the Black Sea coast of Georgia and then by ship to international markets. A portion may also be exported by the NREP to Novorossysk on the Russian Black Sea Coast for further shipment. The future expansion of the ACG project consists of three elements described below.

Phase 1: Development of offshore production, drilling and quarters platform (PDQ), a compression and water injection platform (C&WP) bridge-linked to the PDQ platform. These facilities will be linked by inter-field pipelines, to accommodate oil transfer from Chirag-1 platform to the PDQ platform and gas transfer from the Chirag-1 to the C&WP. Oil from the PDQ will also be exported to the Sangachal Terminal facility via a new 30" oil export line. Gas will be transported from the PDQ to Sangachal via a new pipeline.

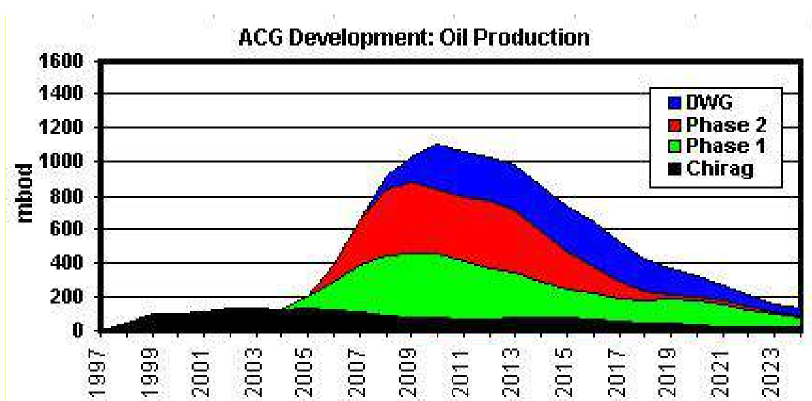
The Sangachal Terminal will be expanded to process the additional oil and gas produced. This will include a new oil and gas inlet, two additional oil storage tanks, gas compression and delivery facilities.

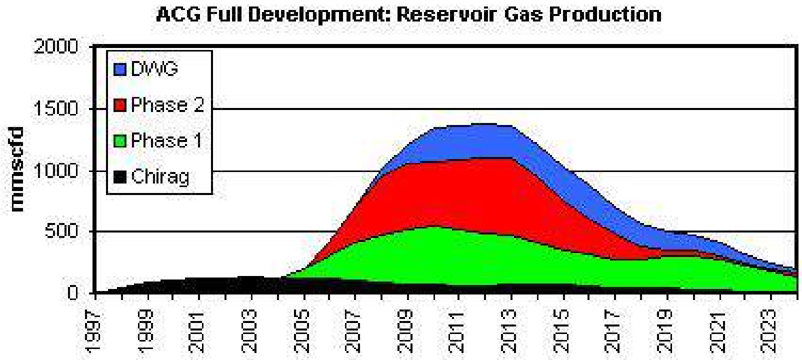
Phase 2: Development will constitute the FFD of the ACG field. The Phase 2 Project will be designed to develop the remaining part of the Azeri field and is expected to consist of two PDQ platforms; one in the West Azeri field and one in East Azeri, with associated pipelines and further expansion of the Sangachal Terminal to process the additional oil and gas produced.

Phase 3 of the ACG project will enable the development of the Deep Water Gunashli (DWG) field and is expected to consist of two platforms: a Drilling and Production (D&P) platform and a utilities and quarters platform with water injection facilities and bridge-linked to the D&P platform.

Predicted production profiles for the ACG Phase 1 and Phase 2 developments are shown in Figure 13-3.

Figure 13-3 Production profiles from ACG Phase 1 and FFD (DWG)





13.3.2 The Shah Deniz project and SCP

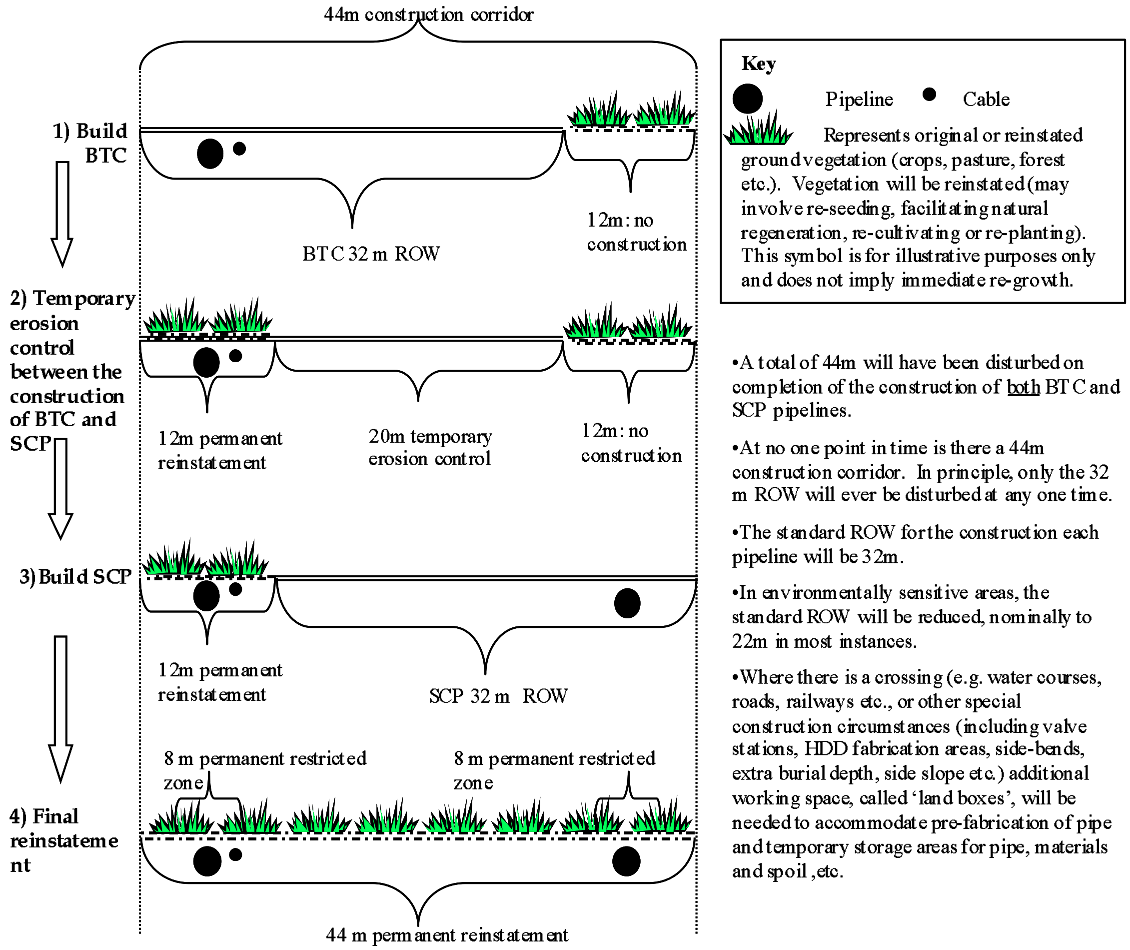
The Shah Deniz project involves the extraction of gas from offshore deposits in the Caspian Sea and exporting the gas to Turkey through Azerbaijan and Georgia. The gas will be used in Turkey to power energy plants in currently underdeveloped areas of Turkey. A total of 8.2bcm of gas per year over a 30 year period will be extracted. Of these, 1bcm per year will remain in Azerbaijan, 0.6bcm per year will be delivered to Georgia whilst the remaining 6.6bcm per year will be delivered to Turkey.

The Shah Deniz FFD will consist of a Production-Drilling Platform (PD1), gas pipeline to the onshore terminal, and expansion of the onshore Sangachal Terminal facilities.

The offshore development concept utilizes one in-field platform, capable of supporting a re-locatable modular drilling rig, with associated subsea templates tied back to the platform. The platform will be located on the East Flank of the field in 105m of water. Gas and condensate will be delivered via two dedicated marine pipelines to an onshore reception and gas processing terminal, located adjacent to the existing oil terminal at Sangachal. Gas will be conditioned for export and the stabilised condensate produced at the onshore terminal will be blended with the crude oil produced from the ACG development.

The gas will be pumped through the SCP from Azerbaijan through Georgia to a delivery point at the Georgian-Turkish border, from where it will be taken to a delivery point in Turkey and distributed to users in Turkey by the Turkish gas transportation company (BOTAS). It is intended that the SCP follows the same path as the BTC pipeline. The pipeline will be 42" in diameter and is approximately 690km long, terminating at the Georgia/Turkey border. It is proposed to build the BTC pipeline and SCP with one project team. The two pipelines will be built within a combined ROW of approximately 44m. Construction of BTC will commence in 2003 within a ROW of 32m, whilst SCP is expected to commence construction in 2004. Where possible an area of 12m will be reinstated after BTC construction to aid restoration and protect the installed pipe.

Figure 13-4 Facilities construction and installation Right of Way (FCI-ROW) configuration (illustrative only)



As stated above, SCP construction is currently programmed to follow in the year immediately after the construction of the BTC pipeline. However, the potential cumulative impacts from the construction of the SCP at varying periods after the construction of the BTC pipeline have also been considered in this Section according to the three scenarios below:

- Scenario 1 – SCP to follow BTC immediately; base case
- Scenario 2 – SCP follows BTC within 2 – 4 years
- Scenario 3 – SCP follows BTC at a time longer than four years

It is understood that plans are being made for the construction of power plants in Turkey based on the supply of gas from the SCP and from the "Blue Stream" pipeline (see 13.3.5).

13.3.3 The WREP and NREP

Two pipelines were initially constructed by the AIOC to guarantee exports from the early production activities carried out by the consortium in the Caspian Sea. The two pipelines, known as the NREP and WREP are currently in operation and transport 100Mbd and 115Mbd respectively.

13.3.4 The Northern Caspian oil fields and the CPC pipeline

Whereas the Shah Deniz and ACG projects originate from the Southern Caspian offshore fields, significant hydrocarbon production takes place in the Northern section of the Caspian Sea in Kazakhstan and Russia. Existing oil fields such as the onshore Tengiz facilities in Kazakhstan and large offshore fields both in Kazakhstan and Russia, have the capacity to increase the current oil & gas production in the region by an order of magnitude.

In 1999, total liquids production from the Tengiz Field increased to 214Mbd. The expectation is to grow this production to 700Mbd by 2010. Tengiz crude is transported by a variety of means, including pipeline, rail and barge. Principal destinations include the Black Sea ports of Odessa, Feodosia and Batumi. Crude production exported by railcar reached 161Mbd in 1999 (77% of the total production).

Current exports from Kazakhstan through the region of interest in this study are shipped to Azerbaijan on tanker ships and subsequently transported by rail through Azerbaijan and Georgia to the Black Sea port of Batumi. These exports amount to approximately 100Mbd and exit the Trans Caucasian belt through the Bosphorus Straits on oil tankers.

The operators of the Tengiz oil field have, however, recently commissioned the CPC (Caspian Pipeline Consortium) pipeline that, at full regime, will have the capacity of transporting approximately 1,500Mbd. The pipeline ends at Novorossiysk on the Black Sea from which crude oil is either shipped to Western Markets on oil tankers through the Bosphorus Straits or piped to European refineries through the Central European pipeline systems. It is expected that the CPC pipeline will be used for export from other oil fields in the Northern Caspian Sea, currently in their early stages of development.

13.3.5 The Blue Stream gas pipeline

The Blue Stream gas pipeline is a gas export system from Russia to Turkey that is currently under construction. The project relies on the construction of a subsea pipeline through the Black Sea and its aim is to provide Turkey with a reliable supply of natural gas to meet the expected increased demand for power generation.

Currently published figures indicate that the Blue Stream pipeline will carry approximately 16bcm of natural gas per year from Russia to Turkey.

13.3.6 The minor projects

Several more modest projects are also being considered or developed in the region. These are associated with the development of onshore oil and gas fields in Azerbaijan, Georgia, Southern Russia and the related transportation and utilization of the produced fluids. From publicly available sources it can be estimated that the overall contribution of the minor projects to the flow of hydrocarbons in the region is less than 5% of the main flows described in the previous Sections. In Georgia, the subject country of this document, the most relevant projects under way include the operation of onshore oil fields in the Samgori region to the East of Tbilisi, the development of a refined product handling terminal in Kulevi, on the Black Sea coast, the proposed upgrade of the Batumi refinery and the development of an LNG plant also in Batumi.

Other proposed projects, which have not yet reached the planning stages, include the development of a crude oil refinery in Supsa and the development of offshore hydrocarbon deposits in the Black Sea.

13.3.7 Summary of hydrocarbons flow in the Trans-Caucasian Belt

Table 13-1 below summarizes the main developments taking place in the region and the associated flows of hydrocarbons through the Trans-Caucasian belt when all identified projects will be at peak capacity (approximately 2011).

Table 13-1 Summary of predicted regional flow of hydrocarbons

Project Name	Crude Oil (barrels per day)	Natural Gas (bcm/year)
Shah Deniz/SCP	54,000 [a]	8.2
ACG	1,100,000	14
Tengiz	700,000	Not known
Other Northern Caspian oil and gas fields	800,000	Not known
Blue Stream		16
Minor projects	250,000	0.5
[a] Condensate separated from the gas.		

It is worth noting that the above summary does not include the oil & gas production in the Southern Caspian or the onshore production from Turkmenistan and Uzbekistan that flows to Iran. The figures also do not include current oil & gas imports into Turkey and refined products imports through the Black Sea.

13.3.8 Non oil & gas projects

In addition to the oil & gas projects in the region, international funding has been allocated to some of Georgia's main infrastructure needs and to strengthening the institutional capacity with regard to national environmental management. Some ongoing projects include the funding of a large irrigation and drainage improvement scheme, the promotion of a Black Sea environmental monitoring programme and the development of a National Oil Spill Plan.

In addition, the redevelopment and upgrade of the Borjomi Mineral Water extraction plan is one of the most significant private developments currently under way in the region. This consists of the upgrade of an existing mineral water production plant that draws its supply from the Borjomi thermal springs. The Borjomi springs have been known for centuries and in the last two centuries their therapeutic properties have become popular and subject of commercial exploitation. The current development and upgrade plan includes the addition of other types of water (fresh spring water and mineral water from other local geothermal fields) to the production range, the promotion of the product within the national and international market and the progressive restructuring and upgrade of the production facilities.

There are plans to build an EU funded transport corridor project, TRACECA, which aims to connect Europe with Asia via nine trans-Balkan highways. A new East-West road running roughly parallel to the existing Baku-Tbilisi highway, but in some places replacing it, is currently under construction. This road is commonly referred to as the 'Silk Road'.

Table 13-2 provides a summary of the proposed construction schedules of these developments covering the period up to 2005. Potentially the main temporal cumulative impacts relates to the combined effects of the development of the BTC pipeline, the SCP and the Silk Road.

The exact schedules of the other projects listed in Table 13-2 are not known in detail, but while these projects are within the same region, their proximity to the BTC construction is such that cumulative impacts are not likely.

Table 13-2 Comparative schedules of projects in the South Caucasus

Projects	2002	2003	2004	2005
BTC Pipeline (1,750km) ‡				
SCP Pipeline (690km) *				
Tbilisi Baku Highway (Silk Route)	Ongoing			
Tbilisi Baku Railway (Silk Route)	Ongoing			
Borjormi Mineral Water Development	Ongoing			

‡ Combined length of pipeline in Azerbaijan, Georgia and Turkey
* Combined length of pipeline in Azerbaijan and Georgia

13.3.9 Assessment of regional impacts

The assessment of cumulative impacts is complemented by a broad-based review commissioned by BP to identify the economic, social and environmental implications of the ACG, BTC and Shah Deniz projects at the regional and national level. The assessment provides advice to BP and other interested parties, on steps to enhance the sustainable development opportunities presented by the projects and to minimize any risks that they present.

The study is entitled "Economic, Social and Environmental Review in the National and Regional Context." The Review concluded that the ACG, BTC and Shah Deniz projects will have a large effect on the development of Azerbaijan and Georgia primarily because of their size in relation to the rest of the economy. The extent to which they contribute to sustainable development depends largely on the decisions taken by government, especially concerning revenue use.

The Review concluded that the major economic and socio-economic implications of the projects are expected to be in Azerbaijan and Georgia.

Poverty and inequality, corruption, human rights and conflict are issues in each of the countries to varying extents. There are initiatives by governments and the international community to reduce poverty, to bolster human rights and to resolve the several 'frozen' conflicts in the region. The BTC project may help to bolster government efforts in these areas by demonstrating high standards in the management of these issues as they relate to the project.

The projects will make a contribution to the shortfall of energy available in Azerbaijan and Georgia largely by providing gas into both countries' systems. The project will also generate revenues that could be used to finance reform and re-development. However, the projects alone will not solve the deep and complex problems of access to energy.

From a regional environmental perspective, the Review concluded that the projects would facilitate the large-scale introduction of international standards for health, safety and environmental protection.

13.4 NATIONAL LEVEL ASSESSMENT

The projects that together with BTC could generate negative or positive impacts at national level are the following:

- Oil and gas projects within Georgia
- Nationwide industrial reconstruction
- Silk Road project
- Borjomi Mineral Water development
- SCP project
- WREP
- BTC Partners financed Environmental and Community Investment Plans

Of these, the last five have been considered at "route level". The sections below address the cumulative impacts of BTC and the Oil and Gas projects within Georgia, as well as Nation-wide Industrial Reconstruction.

The assessment of potential cumulative impacts at national level has been carried out on a receptor or issue basis, in areas that would have significant cumulative impacts as a result of the co-occurrence of BTC and other industrial development projects. The receptors and issues discussed are:

- Air quality
- GHG
- Water resources
- Ecology
- Landscape
- Waste management
- Wealth and livelihoods

13.4.1 Air quality

The potential for a cumulative impact upon human health through atmospheric emissions can be attributed to the:

- Operation of the proposed BTC facilities
- Operation of the proposed SCP facilities
- Existing industrial emissions (and forecast based on current trend of industrial reconstruction)
- Existing and proposed oil & gas projects in Georgia

Historical air quality demonstrates that the progressive redundancy of major industry within Georgia since 1990, has led to an improvement in air quality in areas of heavy industry (State of the Environment, Georgia: www.parliament.ge/soegeor). Currently, major industrial areas within Georgia comprise (values in parentheses represent estimated proportions of national industrial emissions of harmful pollutants (predominately CO, NO_x, SO_2):

- Gardabani Power Plant (25.5%)
- Batumi Oil Refinery (3.3%)
- Rustavi Metallurgical Factory (20%)
- Rustavi Plant "Azoti" (2.1%)
- Rustavi Cement Plant (4.8%)
- Zestaponi Plant of Ferrous Compounds (2.0%)
- Kaspi Cement Plant (18.7%)
- Kutaisi Automobile Factory (3.3%)
- Tbilisi "Tsentroliti" Factory (0.7%)

The above demonstrates that a significant proportion of existing industrial emissions are released to the atmosphere in the general area of the proposed site of PSG1. However, baseline data collected at the proposed site indicate that air quality is currently good at the proposed PSG1 site. Therefore project emissions are highly unlikely to impact human health when considered in a cumulative context to the prevailing air quality in Georgia (particularly given that appropriate stack heights associated with turbines have considered prevailing air quality in their design).

Future oil and gas developments, which comprise the blue stream project and other minor projects are, similarly, unlikely to lead to a cumulative impact to air quality with emissions from BTC facilities. This will be owing to either the geographical dispersion of these projects and their associated emissions, and because any new facility developed near to a BTC AGI will consider BTC emissions in the design of their atmospheric emissions control (such as stack heights associated with power plant). Such an approach will ensure the future mitigation of any potentially cumulative impact to air quality.

Green house gases

Although the BTC and SCP project GHGs emissions should be considered in a cumulative context, there is no established scientific understanding that indicates that such emissions will directly impact the national climate of Georgia. Indirect influence of project emissions upon the climate of Georgia is expected to be insignificant. In a global context, the contribution to GHG emissions is extremely small.

Operation of the pipelines will lead to the annual generation, for specified years, of:

For 2005

- 58,400 tonnes of $CO_{2(eq)}$ for SCP operation
- 263,500 tonnes of $CO_{2(eq)}$ for BTC operation

For 2010

- 58,400 tonnes of $CO_{2(eq)}$ for SCP operation (see SCP ESIA); and
- 542,600 tonnes of $CO_{2(eq)}$ for BTC operation.

($CO_{2(eq)}$ represents the total emission of GHG in terms of CO_2 equivalent tonnes, including GHGs other than CO_2 factored by their Global Warming Potential relative to CO_2).

The relative contribution of SCP and BTC GHGs can be compared to forecast National GHG emission for Georgia in Figures 13-5 and 13-6.

Figure 13-5 SCP and BTC contribution to Georgian national GHG emissions - 2005

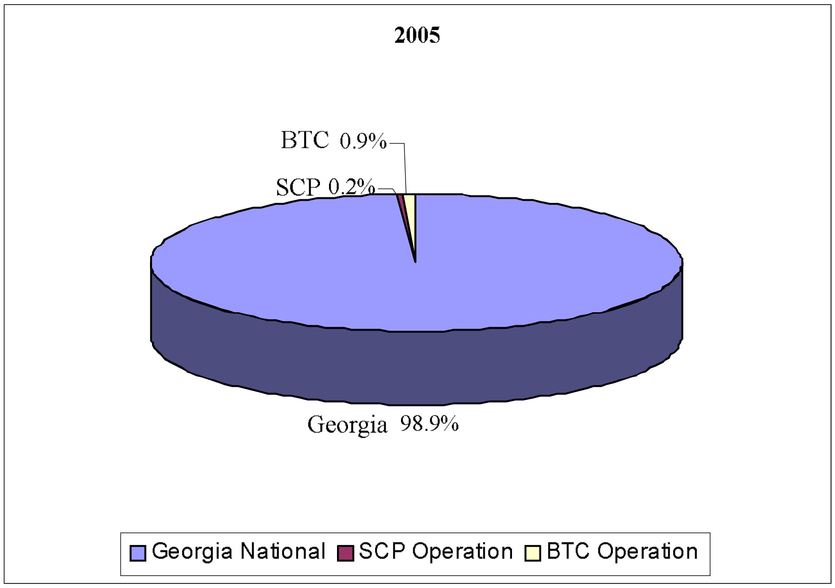
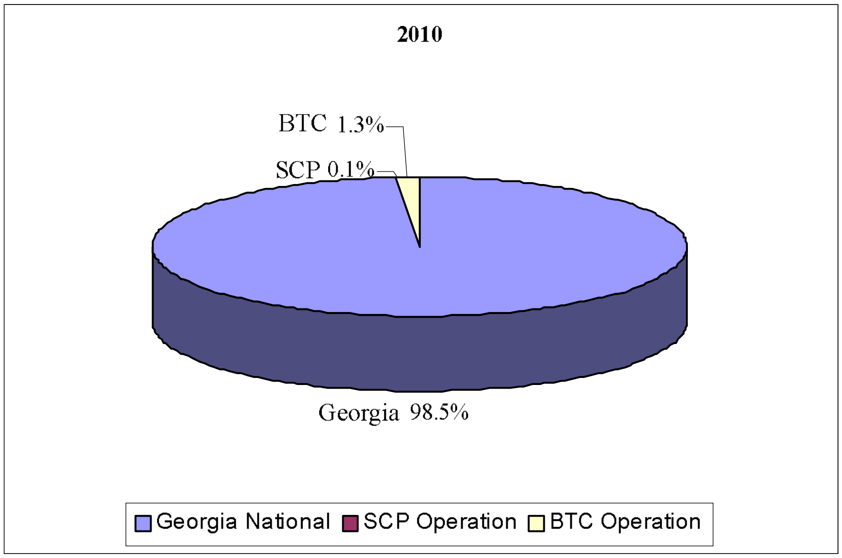


Figure 13-6 SCP and BTC contribution to Georgian national GHG emissions - 2010



It can be seen from the above figures that the relative contribution of project activities is, as a worst case, relatively small for a major infrastructure development of Georgia. It is important to note that project emissions will represent a smaller fraction of Georgia's national GHG emissions beyond 2006 should all combustion plant operate using Shah Deniz natural gas. Similarly, project emissions will represent a considerably smaller contribution to Georgia's GHG emissions beyond 2010 following the continued re-establishment of Georgia's industry and power generation, and through a reduction in project emissions as export crude and gas volumes begin to decline (see Section 5).

Trans-boundary atmospheric impacts

Trans-boundary impacts are impacts that affect the natural environment and/or human health outside of the country in which project activities are proposed to occur. Potential trans-boundary impacts are not necessarily limited to those countries that directly neighbour the project's host country rather can include countries or areas some distance away, such as is the case for GHGs (discussed above).

Trans-boundary impacts can be either negative or positive. In this Section, the focus is on atmospheric emissions associated with project activities that have the potential to cause negative trans-boundary impacts.

As discussed in Section 10, throughout the duration of the project, a number of activities will lead to the release of a number of potentially polluting atmospheric gases. These gases have a number of potential effects upon the environment, as discussed earlier, including several potential trans-boundary impacts:

- acid deposition (wet and dry) and the formation of acid rain
- deterioration of air quality (directly or indirectly)

The potential for these gases to result in trans-boundary impacts is dependent upon the residence time and the behaviour of the gas once released to the atmosphere. For the majority of gases, the residence time (or atmospheric lifetime) in the atmosphere following release is one or two days.

Trans-boundary human health impacts

Mean tropospheric lifetimes for NO_x and SO_x are 1.5 and 16 days respectively. Hence, a fraction of NO_X and SO_X emitted to the atmosphere may persist in the atmosphere and be transported up to distances of several thousand kilometres from the point of release in a single day (assuming a 5m/s wind speed). This would be sufficient for these gases to enter the atmosphere of neighbouring countries, such as Azerbaijan, particularly emissions of these species from the PSG1 facility.

It is important to recognize, however, that the concentration of these gases would not be sufficient to cause impacts on human health in neighbouring countries, because maximum concentrations are predicted to occur within 2km of each of the project sites, and then rapidly decrease. Transport over longer distances (eg, 4km) would therefore afford suitable dispersion of emissions to achieve all relevant air quality standards for the protection of human health. Therefore, trans-boundary impacts to human health from atmospheric emissions as a result of BTC operation are deemed to represent a negligible trans-boundary risk to human health.

Acidification

Apart from potential effects on human health, NO_x and SO_x may undergo transformation in the atmosphere to acidic species (Table 13-3), potentially leading to acid rain deposition.

Table 13-3 Transformation of releases to acidic species

Gas	Transformation to Acidic Species
NO_2	$NO_2 + OH \rightarrow HNO_3$
SO_2	$SO_2 + OH \rightarrow HSO_3$
HSO_3	$HSO_3 + O_2 \rightarrow HO_2 + SO_3$
SO_3	$SO_3 + H_2O \rightarrow H_2SO_4$
SO_3	$SO_3 + H_2O \rightarrow H_2SO_4$
OH: Hydroxyl radical, a very important atmospheric gas, which leads to the removal of almost all organic, and many inorganic gases. It exists within the sunlit atmosphere at permanent measurable concentrations (steady state) HNO_3: Nitric acid HSO_3: Sulphurous acid H_2SO_4: Sulphuric acid	

These transformations represent important removal mechanisms for these species from the atmosphere. As the products of the above reactions are both highly soluble and acidic, their presence may lead to the formation of 'acid rain'. Acid rain has historically been shown to lead to stress of ecosystems and damage to structures such as those constructed of limestone.

Acid rain and its impact have been reported downwind of cities and countries where extensive and sustained generation of SO_x and NO_x in the atmosphere has taken place. For example, impacts of acid rain have been reported within ecosystems several hundreds of kilometres downwind of the UK, where UK-based industry, transport and high domestic fuel consumption lead to the generation of over 1,500,000 and 1,700,000 tonnes of SO_x and NO_x respectively (Year 2000 data, NETCEN UK National Inventory).

At present, there is no available evidence indicating that large-scale acid rain scenarios take place in the Caspian region. The BTC pipeline facilities are anticipated to lead to the generation of 3,360 tonnes/yr of NO_x and 630 tonnes/yr of SO_x during peak export.

It can be seen that this is substantially lower than the levels reported for the UK and, in the absence of any significant additional sources of NO_x and SO_x, it is anticipated that potentially acidifying species from the BTC project would not lead to any noticeable stress upon sensitive trans-boundary ecosystems downwind of the proposed developments sites.

The degree of national, and to some extent regional levels of emissions of SO_2 and NO_x (see Section 8) will have seen a reduction since the early nineties owing to significantly reduced industrial output (and only partially offset by small rises in vehicle emissions). However, SO_2 and NO_X emissions from BTC and SCP operational activities are still considered relatively minor in terms of national outputs. This is due largely to the continued use of heavy fuel oils in relatively old plant.

13.4.2 Ecology (flora, fauna and biodiversity)

The nature of the oil & gas transportation projects is such that the potential and actual environmental impacts are distributed throughout the territory that is encroached by the transportation projects. The BTC and SCP combined projects will have impacts on ecological issues that will be managed through a series of site-specific mitigation measures. However, the BTC and SCP pipeline projects largely occur in a part of Georgia where no other major oil and gas transportation projects exist. The exception is the first 20km of the pipeline in Georgia where BTC is adjacent to the WREP. Therefore, no cumulative impacts at site specific level are expected owing to the coexistence of BTC with other oil and gas transportation projects.

Similarly, it is expected that unrelated industrial developments will not occur within the sensitive ecological zone that can be found along some sections of the BTC route and, therefore, also in this case no cumulative effects are expected at site-specific level.

On a national level, it has to be recognized that impacts on biodiversity associated with all projects considered may have cumulative effects even though the impacts are not occurring in the same geographic area. For example, impacts on bear populations associated with the BTC project could be added to impacts to bear populations in other areas of the Caucasus owing to mining forestry operations. The diversity of avian fauna throughout Georgia could be reduced as a combined effect of the BTC construction project through sensitive avian habitats and the development of petroleum handling facilities on the Kolkheti wetlands in Western Georgia.

Trans-boundary ecological impacts

In the unlikely event of an oil spill from the BTC pipeline that were to occur in the catchment of the river Mtkvari there exists the possibility of migration of the oil from Georgia to Azerbaijan. Although this possibility exists, the conditions that would have to be in place for the trans-boundary migration to occur are such that the likelihood of the event is almost negligible. The consequences of this impact would be of medium to high ranking depending on the extent to which any receptors may be affected. Given the very low likelihood of the event, the overall impact ranking is considered to be medium at the most. The conditions required for the trans-boundary migration to occur are discussed below:

1) Full rupture or very large leak in the proximity of a water course; It is estimated that a minor or medium size leak would result in oil being dispersed in the water or deposited on the river banks, unless a spill occurred in the immediate proximity of the border with Azerbaijan (KP 0-20 approximately)

2) Occurrence of the full rupture between KP0 and KP 105 or between KP 175 and 248. Between KP 105 and KP 175 a spill that were to reach a water course would be intercepted by the Tsalka reservoir and thus would be very unlikely to migrate further. From KP 175 to 248 the probability of trans-boundary impacts is reduced by the very long distance from any potential spill site to the Georgia-Azerbaijan border, through the surface water network and the likelihood of the oil to be dispersed or deposited on river banks

3) High water velocity in the river: this would be associated with seasonal floods only (March, April and rarely May)

4) Failure to intercept the oil downstream of the spill site: this would only be likely if the spill occurred in the section from KP 0 to 20, as the migration velocity would be greater than the response time

13.4.3 Hydrology and hydrogeology

The coexistence of the BTC project with all existing and forthcoming projects of oil and gas transportation and industrial development will necessarily involve a higher degree of exploitation of water resources. There will also be a higher potential for contamination of surface and/or groundwater as a result of discharges of effluents, small spills of fuel or lubricants and in case of large-scale accidents.

The use of water resources will be distributed throughout the country and will, therefore, be unlikely to create a perceptible detrimental effect on the availability of water. The increased probability of accidents with consequent large scale contamination is a real issue that is being addressed by institutional agencies with actions such as the development of a national oil spill response plan.

The mitigation measures associated with the BTC project also include a comprehensive oil spill response plan and will include training of local personnel and local environmental agencies. In addition, the need for oil spill response equipment and services will stimulate the development of specialist service firms and thus establish the presence throughout the country of suitable resources to deal with contamination of water.

13.4.4 Soil

Soil erosion is a localized effect owing to a combination of factors such as nature of the soil, vegetation cover, gradient of the ground and meteorological conditions. Although soil erosion impacts will potentially occur along the BTC route these will be minimized through the implementation of a reinstatement specification and will not be evident beyond the BTC route.

The only area where the BTC project could have cumulative effects with other projects is the section of route where BTC is adjacent to the WREP for the first 20km of the proposed BTC route. Given the nature of the soil in this area, and the generally flat gradient, it is not expected that the coexistence of the two projects will cause cumulative effects with regard to soil erosion.

13.4.5 Landscape

The BTC project will have significant impacts on the landscape, some of which will have a short-term duration whilst others will be long-term or permanent modifications of the landscape. Similar impacts can be expected whenever a new development takes place in an area otherwise unaffected by industrial operations or man-made structures. Of the projects considered in the assessment of cumulative impacts at a national level, linear projects, including oil & gas exploration, production and pipeline or rail-based petroleum transportation, will have a similar impact on landscape.

The BTC project will adopt a range of mitigation measures to minimize the magnitude of the short-term impacts and shorten the duration of the visual effect of any long-term landscape modification, as far as possible. The mitigation measures will include botanical reinstatement measures to re-create the vegetation cover that existed prior to the pipeline construction, partial reforestation of the ROW, when this encroaches a forest, and careful architectural design of the

AGIs and their surroundings to achieve as much blending into the landscape as possible. In addition, all temporary facilities will be restored to their pre-existing conditions upon completion of the construction process (Appendix E, Annex I). The BTC pipeline-specific impacts will, however, occur along the route of the pipeline and, as discussed previously, none of the concurrent projects is co-located with the BTC pipeline with the exception of the WREP project, which is discussed in more detail in Section 13.5.1, below. On this basis, it is not expected that there will be significant cumulative impacts to landscape at site-specific level.

The long-term impacts to the landscape associated with the BTC project will, however, add slightly to the deterioration of the natural landscapes of the country. Landscape deterioration has already occurred in places. Owing to industrial development and the need to upgrade and expand the infrastructure network: electricity lines, railways and roads are other examples of linear developments that will inevitably have some negative effects on the landscape. The significance of these impacts varies with the location and is clearly higher when changes affect forested areas, mountain landscapes and sparsely inhabited areas in general. Landscape mitigation measures should be applied to all projects that entail temporary or permanent modification of existing landscapes.

13.4.6 Wealth and livelihoods

The cumulative socio-economic impacts resulting from the SCP, BTC and industrial development projects will, if well managed, provide an overall increase in wealth and access to livelihoods of the national population. Hence, the net effect will be positive. The main national level benefit is increased government revenues from transit of oil and gas and taxes, which could contribute to improved social services, infrastructure, or debt reduction, depending on how the Government elects to invest the revenue. In addition, provided local workers are used wherever possible, the skills base within the national population should increase, providing a more skilled workforce for future projects and increasing employment opportunities for those benefiting from skills enhancement either at home or abroad. Furthermore, if goods and services are sourced locally (ie within Georgia), the effects on indirect employment and cash flows into the local economy should be beneficial. Finally, the provision of gas through the off-take near Tbilisi, while not solving the country's energy crisis, will at least go some way towards alleviating the short fall either for the domestic consumer, or for industry (lack of energy having been identified as one of the main inhibitors to the overall growth of the Georgian economy).

However, for these benefits to impact more than the pipeline affected communities, effective 'trickle down' has to occur in terms of revenues generated into the national economy. Whether or not this takes place will depend on the management decisions taken by the Georgian Government.

13.5 ROUTE LEVEL IMPACTS

The following section addresses cumulative impacts and mitigation measures relevant at the route-level. These include:

- BTC and SCP
- BTC and WREP
- BTC and the Silk Route
- BTC and the Borjomi Mineral Water development
- BP Environment and Community Investment Plans

- BTC and the Borjomi Mineral Water development

13.5.1 BTC pipeline and WREP

The proposed BTC pipeline route is adjacent to the WREP for the first 20km. The assessment of cumulative impacts between the two projects is therefore limited to this initial section of the BTC route.

Air quality

The WREP has a pump station at KP19, where diesel generators operate continuously. All emissions from such plant are not anticipated to worsen air quality near to BTC facilities, owing to the degree of natural dispersion of emissions from each site over distances of several kilometres.

Noise

As noise from facility operation is only likely to propagate over maximum distances of several hundreds of metres, there is no anticipated cumulative impact associated with simultaneous facility operation at distances of several kilometres.

Ecology

The section of pipeline route where the BTC and WREP are adjacent does not include significant sensitive ecological receptors other than surface water resources (see below) and therefore no cumulative impacts are expected.

Hydrology and hydrogeology

This section of the route is characterised by a system of irrigation canals (Marinski irrigation system) that are connected with the Mtkvari River and the Jendari Lake. The latter is an important freshwater habitat, supports abundant fish population and provides a temporary stopover for migratory birds. The lake, which is shared between Georgia and Azerbaijan, has been proposed as a Ramsar site in Azerbaijan although not in Georgia.

The ecological stress on the surface water system associated with the construction of the pipelines has been effectively mitigated during construction of WREP, giving rise to no significant impacts, and will be mitigated during construction of BTC. The time period between the two construction projects is also such (5 years) that no prolonged disturbance has occurred. Operation of the WREP and BTC pump stations and associated noise emissions and liquid discharges will also be mitigated, and have been for WREP, so that no adverse impacts would ensue.

Soils

The section of route under consideration is generally flat and the land use is predominantly agricultural. Consequently the soils are not particularly subject to erosive processes and soil fertility is generally achieved by addition of conditioners and fertilizers. On this basis it is not expected that cumulative impacts would arise with regard to soils.

Landscape

The two projects will have a pump station each within the shared section of route and therefore will have a cumulative impact as a result of the combined permanent modification of the landscape. The landscape in the area is however generally degraded owing to the presence of several prominent industrial features and of medium to low aesthetic value as a result of the anthropogenic influence and of the terrain and vegetation characteristics. On this basis, the cumulative impacts will be of relatively low significance and will be mitigated by the adoption of a suitable planting scheme for the proposed BTC pump station.

Wealth

Several communities in Gardabani gained pipeline construction experience during WREP construction. This will assist workers from these communities in gaining employment. Hence the cumulative impact is positive.

Land and land-based livelihoods

Consultation revealed that people in some communities affected by the WREP were dissatisfied with the land acquisition process when it took place, particularly with regard to land titles and compensation arrangements. This could result in a greater degree of discontent towards the BTC pipeline and the land acquisition process.

The land compensation and land rights acquisition plan being developed will be fair, transparent and developed with significant stakeholder consultation. Together, these should mitigate any cumulative impacts for BTC.

Infrastructure

Consultation also revealed dissatisfaction with the state of some of the roads used for WREP construction after the pipeline was completed. People in some communities felt that their infrastructure had been severely degraded. Whether this was a real effect or just a perception, in terms of cumulative impacts, the effect is the same. The mitigation measures outlined in Section 11.5 (Infrastructure, Services and Natural Resources), and Section 11.6 (Local Community Relations and Management of Construction Workers and Camps) have been designed to minimize impacts during construction. The significance of this impact is therefore low provided that the communities respond as predicted to the mitigation measures.

Nuisance and community relations

Some people in four communities affected by the WREP construction in Gardabani District had particularly negative attitudes to the possible construction of the BTC pipeline [(1)]. In order to maintain positive community relations, a carefully designed Community Relations plan will be implemented, as set out in Section 11 and 14. Hence, the cumulative impact of BTC on the WREP should be positive in this district since individuals who currently have a negative view of pipeline construction may ultimately view it more positively.

(1) There were other communities along the route in which some people had particularly negative attitudes to the pipeline. However, these communities had no previous WREP experience and the reasons for their negative attitudes were for other reasons. See Table 11.14 in the Social Baseline

13.5.2 BTC and SCP

Air quality

Construction of the SCP following construction of the BTC pipeline will result in a period over which combustion emissions from vehicle exhausts are increased along the pipeline route. However, emissions from vehicles will occur over a large geographical area, and in addition will occur near to BTC facilities for a relatively short period of time.

The potential for a cumulative impact to human health to occur from the simultaneous operation of closely located industrial facilities is widely accepted. Section 10 Potential Environmental Impacts and Mitigation graphically presents the worst-case modelled spatial distribution of emissions from the proposed pump station site PSG1. The isopleths demonstrate that maximum concentrations are only likely to occur within several kilometres of the point of release.

As the nearest SCP AGI would operate at a distance of 6km from PSG1, and 70km from PSG2, the likelihood of their emissions leading to a cumulative impact to human health is very low, given the degree of dispersion over transport distances between these sites.

Noise

Construction of the SCP following the BTC pipeline installation will effectively extend the period of noise impact along the pipeline route. Most communities adjacent to the pipeline will be affected by two construction periods.

In the event that the installation of the SCP is delayed, interim reinstatement of the entire ROW will further increase noise emissions along the pipeline route, otherwise cumulative impacts would be as described above for non-delayed construction.

Ecology

The combined ROW for the two pipelines will take up a 44m wide band of land. Therefore, any loss of habitat that would have resulted from a single ROW of 32m is increased by 12m, or approximately 30%, as a consequence of the coexistence of the two projects. It is, however, arguable that the land take would be greater if the pipelines were located in separate corridors. There would also be a greater “edge effect” on wildlife with two corridors whilst the increased width of one ROW would account for no additional habitat fragmentation.

The co-existence of the BTC and SCP projects in the same corridor will inevitably cause the delay in the commencement of full reinstatement operations within part of the ROW with consequent loss of biodiversity through topsoil impoverishment. The significance of this impact is higher in areas of high ecological value as discussed in Sections 8 and 10. The cumulative aspect associated with the delayed reinstatement will not however increase the significance of the impacts associated with each project alone.

At the time of writing the ESIA, a 2.6km section on Kodiana Pass is under consideration for simultaneous lay of both pipelines, pending information from the construction contractors about the feasibility of this from a practical and logistics point of view. The simultaneous lay of both pipelines in this area, where deep excavation is required to avoid a system of landslides, would enable restoration to commence earlier. This would more efficiently mitigate the landscape modifications that would ensue as a result of the extensive earthworks required and would result in shorter duration of the visual impact.

Additional sections of the pipeline route were assessed for their suitability of laying the BTC and SCP pipeline at the same time. The overall consideration of this is driven by the fact that BTC and SCP projects, while both currently led by BP on behalf of the respective pipeline groups, are in fact separate projects, with different partner groups, different time-tables, and each with a different legal status. Further criteria that are relevant to this assessment included safety, construction logistics and practicality, engineering feasibility, and environmental sensitivity and benefits to be gained.

Hydrology and hydrogeology

Once the BTC pipeline is laid, a length of 25m either side of a water course crossing point will immediately be reinstated, whether the SCP is to be laid or not. This immediate reinstatement is intended to reduce impacts to riverbank structure as far as possible. Potential changes to the morphology of the watercourses caused by construction activities may cause erosion to the banks of watercourses and such impacts from SCP construction may be additional to those from BTC pipeline construction. Erosion of the banks results in sediment being washed away, and potential changes to river flow patterns downstream. These potential impacts would, however, be mitigated by the adoption of sediment control measures and therefore their significance reduced.

Any impacts that are caused by the increased demand on local water resources (in terms of water usage) from pipeline construction, will be increased by the construction of two pipelines. If the SCP is constructed in the year following the BTC pipeline, local water supplies may not have had time to be replenished sufficiently, resulting in a high strain on the resource.

Should the SCP construction be delayed, it is anticipated that similar cumulative impacts on hydrology and hydrogeology would occur as they would from construction in the year following BTC pipeline construction. There is one exception to this, delay to construction of the SCP by two or more years may allow the local water supplies to be sufficiently replenished by rainwater, etc, such that construction of the second pipeline does not place demands on an already reduced water supply.

Landscape

For construction of the BTC pipeline alone, the ROW would be exposed for a period only long enough to allow installation of the pipeline. As the construction teams move along the route the ROW is sequentially exposed, the pipeline installed, then the ground reinstated. Therefore, exposure of bare earth at any single point along the route would be unlikely to last for more than two months, after which visual impacts would be reduced. However, if the SCP is constructed in the year following BTC construction, the ROW will not be fully reinstated until the SCP has been installed, resulting in a longer period during which there will be a visual impact.

The new AGIs associated with the SCP will add to the structures associated with BTC. It is anticipated that the AGI compounds for the BTC pipeline will encompass the facilities for the SCP as well, resulting in slightly larger AGIs than are normally associated with single pipelines. This will occur at the location of the pump station PSG1 in the Gardabani area and at the border facilities at Vale. At both locations the landscape value is not among the highest along the route and therefore the residual impact is low. If separate AGIs were constructed for each pipeline the cumulative impact to the landscape would be greater.

Construction access routes will be installed for the BTC pipeline. If SCP construction is to follow, these will be left in place, thus resulting in no requirement for new access roads for the SCP. This is a lesser cumulative impact arising from the construction of the two pipelines along the same ROW, by comparison with the need to build two sets of access routes for two separate pipelines.

If the SCP is delayed by more than a year, reinstatement of the ROW will occur following BTC pipeline construction, reducing the visual impact. For SCP construction, part of the same ROW would then be re-stripped to allow pipeline installation, before it was reinstated again. While the overall period of bare earth exposure would be reduced for this SCP construction scenario, the length of time which the ROW takes to fully recover would be longer, giving an extended, but lower magnitude cumulative visual impact.

Soils

The co-existence of the BTC and SCP projects in the same corridor will inevitably cause the delay in the commencement of reinstatement operations within the ROW. This will be necessary to enable the construction of the second pipeline without the need for double handling of subsoil and topsoil.

Furthermore, the delayed permanent restoration of the ROW could facilitate the onset of erosive processes with associated negative impacts to the soils and, in case of extensive washout, to the natural habitats surrounding the ROW. A summary of the reinstatement specification, common to both SCP and BTC, is included as Appendix A. The specification aims to minimize these impacts and ensure soil stability in the period between construction of the two pipelines and after completion of both projects.

Unplanned events

Given the proximity of the proposed SCP and BTC pipelines, it is remotely possible, following a series of unlikely events and conditions that a failure of the SCP may lead to an explosion of gas causing a failure of the BTC pipeline. Such an event would require particular gas pipeline failure and release conditions, in combinations with particular meteorology, and therefore this scenario in reality is highly unlikely to arise.

Furthermore, pipeline spacing and burial depth, which meets relevant project codes and standards, will ensure that the risk of such an occurrence is extremely remote. In addition, the SCP gas leak detection system and maintenance programme will minimize this risk to an even greater extent.

A quantitative risk assessment has been carried out for both pipelines by the engineering consultants and has been reviewed as part of the ESIA process. The risk assessment has formed the basis for the design of the valves system of the BTC pipeline and for the formulation of site-specific mitigation measures such as in the case of the Borjomi region. The findings of the risk assessment and the mitigation measures for unplanned events are described in detail in Section 10.4.

Wealth and employment

Provided the use of local labour is maximized for both projects, the combined effect of the BTC pipeline and SCP will be to at least double the inflow of cash into the local economies along the pipeline corridor. This will be achieved through: doubling the length of/number of opportunities for employment for unskilled and semi-skilled labour; doubling the opportunities for the provision of goods and services; and doubling the knock-on effect of having salaried workers living in the local villages. In addition, workers who have experience of two projects are more attractive to future employers and opportunities for training and learning new skills for those employed are extended. Additional skills and experience gained by local workers may also lead to an increase in out-migration.

In the case of training, the knowledge that the second project is following encourages a more structured approach to training for skilled and semi-skilled workers, and greater overall investment in training for all workers.

Land and land-based livelihoods

Cumulative impacts of SCP on BTC in terms of land are more complicated. On the one hand, the effect of planning the two projects in parallel will result in reduced impacts had the alternative been to run the two pipelines independently of one another. On the other hand, the effect of running SCP after BTC will result in some of the land (ie the 20m middle strip) being out of production for at least one if not two or three seasons longer than would have otherwise been necessary. This will result in longer term impacts for individuals affected by the temporary land take. Clearly, the greater the gap between the construction of the two pipelines, the greater the impact on the local community if access to the land remains restricted between the two construction periods.

However, the compensation measures outlined in the RAP will ensure that appropriate compensation is calculated to take into account the longer duration of the impact.

The overarching goal is ‘to restore or enhance project-affected people’s living standards, income earning capacity and production to at least without-project levels’. To this end, relevant objectives of the RAP include:

- Development of fair and transparent procedures for determining compensation
- Acquisition of land through negotiated agreement, with the use of eminent domain only as a last resort
- Compensation for permanent use of land at full replacement cost, inclusive of all transaction costs
- Reinstatement of the pipeline corridor to a condition whereby landowners/users/lessees are able to resume their pre-project agricultural activities

Hence, there should be no long term impact on the livelihoods of those affected. The significance of this cumulative impact is therefore Low.

Infrastructure

The effect of two pipelines will result in increased duration of disruptions to infrastructure, in terms of temporary road closures potential draw on the telecommunications and power networks, and possible damage to roads. They will also increase the likelihood of secondary damage to property resulting from traffic vibrations, blasting or other such activities. The mitigation measures outlined in Section 11.5 (Local Infrastructure, Services and Natural Resources), and Section 11.6 (Community Relations and Management of Construction Workers and Camps) have been designed to minimize impacts including their cumulative effect. The significance of this impact is therefore Low.

Construction workers and community relations

A pro-active community relations strategy has been developed to manage community concerns resulting from the two pipelines (Section 11.6.). This includes opportunities to revise mitigation measures before the commencement of SCP with the lessons learned from BTC construction to help ensure that cumulative impacts can be reduced. If the local communities see direct benefits from BTC, the cumulative impact for SCP construction should be positive.

Nuisance and safety

Increased length of exposure to construction sites including open trenches and construction related traffic increases the opportunities for accidents within the local community. The mitigation measures outlined in Section 11 are designed to reduce the risk of accident during construction and operation. The risk for SCP should be lower than the BTC pipeline as the level of awareness of the potential dangers within the local community should already have been raised. Hence, the cumulative impact should be negligible, and lower the closer together the construction periods of the two pipelines.

In terms of nuisance, the cumulative impact will be a doubling of the level of nuisance through the extension of the construction period and the building of the second pipeline following completion of the first. Since the majority of the communities consulted have expressed more interest in the positive economic impacts than the negative nuisance impacts, the overall cumulative impact in those communities is rated as Low.

13.5.3 BTC and the Silk Route project

The BTC project and the Silk Route project (road and rail infrastructure development) are not located along the same geographical area but a number of support activities to BTC will share the same infrastructure as the Silk Route project. In addition it is expected that both BTC and the Silk Route project will require significant quantities of aggregate material (sand and gravel) and will generate large quantities of inert waste. No other cumulative impacts are expected as the Silk Road project consists of the upgrade and redevelopment of existing linear transportation infrastructure (roads and railway) and, therefore, it is assumed that no significant additional land take would occur.

Air quality

Construction of the Silk Route is likely to lead to the generation of atmospheric emissions from construction plant operation. Additionally, emissions would be associated with vehicles using the road / rail after construction. As the Silk Route and BTC do not occupy the same corridor, it is highly unlikely, given the distances over which emissions associated with construction plant or vehicle operation would disperse, that a cumulative impact to air quality would arise with emissions associated with BTC facilities operation.

Noise

As noise from BTC facility operation will propagate over maximum distances of several hundreds of metres, it is highly unlikely, given that these projects occupy separate corridors, that cumulative impact will be associated with their simultaneous operation.

Ecology

Ecological impacts associated with the coexistence of the two projects could occur in relation to the aspect of sourcing aggregate material (sand and gravel) for both projects if the sources of the material (quarries or borrow pits) are located within ecologically sensitive areas.

In order to minimize the potential for ecological impacts to occur as a result of aggregate sourcing BTC Co has undertake a screening study of borrow pits and advised the potential construction contractors of the ecological constraints that would apply in the selection of suitable sites. On this basis it is estimated that BTC contribution to any significant ecological impacts with regard to this aspect would be negligible and the mitigation measures in place for the BTC project are suitable to achieve this.

A potentially positive impact could occur if the Silk Route project were to use rock spoil or other aggregate material generated as a result of the BTC trench excavation. As part of the construction specifications the contractors are in fact encouraged to seek opportunities for re-use of trench material off the ROW if the material texture is unsuitable for backfilling the trench.

Hydrology and hydrogeology

No significant cumulative effects are expected on surface water resources as a result of the coexistence of the two projects. A limited potential exists for the increased probability of occurrence of fuel spills and consequent contamination of groundwater. The mitigation measures proposed for BTC in case of fuel spill will, however, ensure that no long-term deterioration of water resources occurs and on this basis no significant contribution to cumulative impacts is expected from the project.

Soils

No significant soil erosion or fertility issues are associated with the aspects of the two projects considered in this Section and, therefore, no cumulative impacts are expected with regard to this issue.

Landscape

As the BTC project and the Silk Road project are not located along the same geographical area there will be no cumulative significant impacts to landscape as a result of the aspects of the two projects.

Wealth and employment

If the construction of the Silk Route takes place at the same time as BTC there may be competition for skilled workers. This could reduce the local content of BTC pipeline employment and push up wages. However, together, they will contribute further to the development of a greater skills base within the local population, contributing to the long-term development of the economy. The existence of such infrastructure projects will also help to encourage other private investors into Georgia.

Competition will also be greater for the provision of goods and services. This could both push up the price of supply, and encourage international contractors to source abroad thus reducing the cumulative economic benefits for Georgia. However, it is unlikely that this will be significant.

Infrastructure

More development projects running in parallel will put greater stress on local infrastructure particularly roads, energy supply and telecommunications. Likewise, the traffic increase resulting from both projects could potentially multiply the effects of noise, dust and vibrations, and considerably increase the safety risk to local communities. Furthermore, it may be difficult to determine which project is primarily responsible for any damage to roads or properties occurring during construction. It is conceivable that the BTC pipeline could be blamed for damage to roads actually caused by other contractors, causing difficulties in terms of both compensation and relationships with local communities.

The significance of the cumulative impact will depend on whether or not the two projects run at the same time. This is unlikely since the coincidence of the two corridors is relatively short. However, it is possible that some communities could be affected by both at the same time. In this case, the cumulative impact would be medium unless it can be effectively mitigated through the community relations plan and through liaison with the Silk Road construction teams.

Land and land-based livelihoods

The Silk Road construction may require the permanent acquisition of land, and there is the potential that the landowners and users affected by this will also be affected by the BTC land acquisition process. There is a risk that if the Silk Road project fails to appropriately compensate landowners and land users there could be a general increase in hostility to any other projects where land must be acquired. BTC's compensation procedure should help to improve the attitudes of local community members towards projects requiring land and the cumulative impact should therefore be low.

Nuisance

Greater numbers of projects results in greater disturbance, and greater risk of damage to property and health. However, though there will be significant short-term disruption, it is not anticipated that the cumulative impacts will be long term in this case.

13.5.4 BTC and the Borjomi Mineral Water development

Introduction

The Borjomi Mineral Water Bottling Plant has an annual turnover of US$60 million and currently draws from an area of 10km² on the Borjomi Plateau, producing 80 million bottles a year. The plant currently employs 1,200 people and is anticipating expansion of the extraction area to cover the whole of the plateau and the vicinity of Bakuriani. Its current rate of expansion is 40% per year.

Water draw from the plant is seasonal, reflecting a combination of demand and water levels, as indicated in the table below:

Table 13-4 Seasonal production levels at Borjomi Water Bottling Plant

Winter	December	Increase in production
	January/February	Low production
Spring	March/May	Increase in production
Summer	June	Increase in production
	July (first half)	Peak production
	July (second half)	Decrease in production
	August	Low production
Autumn	September/October	Increase in production
	November	Decrease in production

The proposed BTC pipeline passes through the surface water catchment of the Borjomi natural springs and abstraction boreholes between KP175.5 and 190. The potential impacts associated with the co-existence of the BTC project and the mineral water development taking place at Borjomi have been evaluated in the context of an hypothetical oil spill in this region and how this could affect the surface and groundwater regime and quality.

The discovery of the Borjomi thermal springs dates to the early 19th Century. The mineral water is rich in dissolved minerals and gas and discharges naturally in the gorge of the Borjomola stream. The main exploitation of the Borjomi Mineral Water occurs through a network of abstraction wells that rely on the natural pressure of the geological formation that hosts the water to lift the fluid to ground level.

In recent years and as a result of the success of marketing and exporting the Borjomi Mineral Water, additional water sources have been exploited to produce low salinity or fresh "Borjomi water". These include primarily fresh water springs that are used to dilute the mineral water or for direct bottling of fresh water.

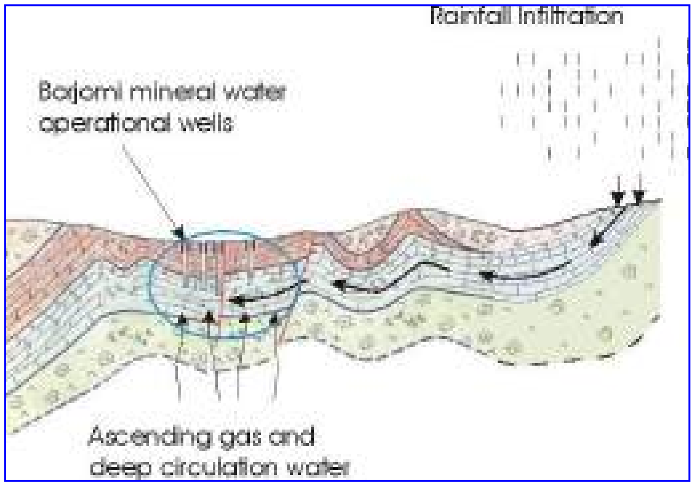
The origin of the Borjomi thermal water is still the subject of debate although general agreement has been reached on the general principles of its genesis. This is summarized below:

1. Fresh (rain) water infiltrates through the highly permeable limestone of the Upper Cretaceous-Lower Palaeocene. The recharge zone coincides with the outcrop of the limestone on the folds of the Ajara-Imereti range, to the north of the Mtkvari valley and therefore some 15km to the north of the proposed pipeline route.

2. The water descends down through the limestone to a depth of several thousand meters below ground level where gas and deep circulation water infiltrates the limestone from underlying volcanic rocks, through faults and associated fissure systems. The mixing of deep circulation fluids and relatively fresh infiltration water results in the specific characteristics of the Borjomi Mineral Water.

3. The most favourable conditions for the ascent of high pressure water occur where the limestone is folded and fractured or faulted along the axis of the fold, such as in the Borjomula valley, near the town of Borjomi. Similarly these locations are the most favourable to abstract the water through a network of wells. Figure 13-7 below shows the principles of the genesis of the mineral water.

Figure 13-7 Genesis of Borjomi Mineral Water



Fresh water springs with no association with the thermal mineral waters occur at the interface between younger rock formations (predominantly extensively fissured lava flows) and underlying low permeability marls, clays or flysch deposits. These springs have important local significance as they provide drinking water for isolated dwellings and villages and because they could be commercially exploited under the name of "Borjomi fresh water" springs, owing to their proximity to the Borjomi town.

Although the proposed pipeline lies on geological formations that could be in hydraulic continuity with the limestone, the dynamics of oil dispersion and migration in groundwater, combined with the depth of the limestone horizon and the corresponding pressure of groundwater, minimize the likelihood of downward migration and contamination of the deep mineral water aquifer through direct infiltration of oil in the ground resulting from an undetected long-term release of hydrocarbons. Such a release would most likely gradually fill the pipeline trench and eventually surface at low topographic points along the alignment. Any release of hydrocarbon to the water table should result in a shallow plume of dissolved hydrocarbon and be confined to the uppermost layer of the geological sequence. Such an event could result in the contamination of localized fresh water springs.

A large-scale spill would predominantly disperse overland and through the surface watercourses. In this case oil would probably flow along the small streams and finally flow into the Borjomula gorge and enter the Mtkvari River in Borjomi. Although oil would accumulate on the riverbed adsorbed to sediments and may extensively contaminate surface water, it is considered unlikely that downward vertical migration through faults or zones of fissured rock could occur to the extent of contaminating the underlying mineral water aquifer. This is based on the depth of the aquifer and its pressure regime which would only enable upward vertical migration of fluids in zones of higher permeability such as faults or fractures.

A large spill could however contaminate the shallower fresh water springs if the area covered by the spill included the recharge zones of the superficial aquifers. Based on the available geological mapping of the area the pipeline crosses a lava flow between KP191 and KP192.5 and is located at approximately 800m from the Borjomi lava flow between KP181 and KP183.

In summary, the consequences of a crude oil spill in the Borjomi region (intended as the section of pipeline laid within the Borjomula catchment between KP 175.5 and 190) are very unlikely to affect the mineral water aquifer where the thermal mineral water generates. Surface water contamination and contamination of fresh water springs is likely to occur in the case of a large scale spill and would result in contamination of the Borjomula gorge if the oil flow could not be intercepted before ingress in the gorge.

Given the extremely low probability of a spill occurring in this region, or elsewhere along the pipeline, the potential impacts are highly theoretical and the discussion above needs to be viewed in its appropriate probabilistic context.

A site-specific oil spill contingency plan, comprising the stationing of oil spill response equipment locally, training of local people to respond to spills and increased frequency of ROW inspection has been developed to reflect the sensitivity of the area and to mitigate adverse perceptions that may involve the business development of the mineral water company.

Wealth and employment

The overall expansion of the Borjomi Water Bottling plant will have a positive impact on the local economy in the Borjomi region, and of Georgia as a whole, given its distribution throughout Georgia and export to Russia. However, it is anticipated that there will not be any significant cumulative effect with the pipeline project except for temporarily increasing the numbers of local people employed in Borjomi. There are sufficient people in the region who remain unemployed for there to be no competition for unskilled jobs.

Nuisance and safety

There will be no cumulative effects of the pipeline and the plant in terms of nuisance and safety.

Land and land-based livelihoods

There are unlikely to be any cumulative effects on land and land-based livelihoods, as the pipeline will not draw water from the sensitive area.

Community relations

If the pipelines are perceived as a threat to the integrity of the local mineral water supply, community relations in the area could become extremely difficult. This impact should be mitigated through the implementation of both the mitigation measures outlined above in Section 13.5.5.1, and through the Community Relations Plan outlined in Section 11.6 during both construction and operation.

Infrastructure and resources

There are unlikely to be any cumulative impacts on infrastructure. However, there may be temporary competition for energy supply for the period that the pipeline is being constructed in the region. Borjomi is generally better supplied with power than other areas of the country as a result of its being a tourist destination. Hence, the likelihood of this resulting in a negative cumulative impact in this region is slim.

13.5.5 BTC and the environmental and community investment plans

Environmental investment plan

Whilst significant efforts have been taken to avoid areas of high biodiversity, primarily through route selection and careful siting of AGIs, it is recognized that there will be some unavoidable potential impacts on natural habitats. In line with BP policy and to meet the requirements of the World Bank Group on Natural Habitats (Operation Policy 4.04 June 2001), extensive direct mitigation measures aimed at the removal or reduction of potential adverse impacts on natural habitats or their functions have been developed and will be implemented during the project execution. These include measures to restrict habitat conversion (narrowing the ROW in forested areas), restore degraded habitats (eco-compensation through replanting a suitable number of trees for those cleared from the ROW), and strategic species retention (translocation of rare species) among others (detailed in Section 10). Reinstatement practices will also ensure that effects on natural habitats are minimized (See Summary of Reinstatement Specification, Appendix A).

In addition to the above direct mitigation and management measures, an Environmental Investment Plan (EIP) is being developed in order to go beyond direct mitigation to meet BP's commitment to maintaining and enhancing biodiversity.

In recognition of the global importance of the regions biodiversity, the aim of the EIP is to enhance biodiversity management and/or protection primarily through investments in offset projects.

Although still in the development stage, it is likely that the EIP will focus on the following areas:

- **Protected Areas and Species**: There are several existing or upcoming programmes aimed at developing or supporting a protected areas system in Georgia. The objectives of the EIP will be consistent, as much as possible, with those of the existing protected area development programmes and will explore avenues for mutually compatible opportunities
- **Areas of high ecological significance outside protected areas–** not all of the country's biodiversity resources are or will be contained in protected areas. Areas of high ecological value will be considered for initiatives under the EIP
- **Capacity Building for Biodiversity Management**: BP will consider financing projects that build capacity for biodiversity priority-setting, conservation planning, policy development, and environmental awareness raising in Georgia. This is in recognition of the fact that lack of ecological information and/or its inadequate use is one of the main challenges to biodiversity conservation in the country, and that increased capacity in this area would benefit natural resource managers, planners, policy-makers, scientists, educators, and the public

Criteria

The EIP is being developed and will be implemented according to the following principles:

- **Impact:** projects should deliver tangible benefits and, as a minimum, address the "no net loss" principle
- **Sustainability:** whether short-term or long-term in nature, projects should be designed to deliver lasting benefits
- **Linkages:** where applicable, projects should take into consideration the biodiversity priorities of the host country. In order to facilitate the success and sustainability of the EIP, linkages will also be sought with the Community Investment Plan
- **Prevention of duplication:** in selecting projects, every effort would be made to avoid duplicating the efforts of other companies, international and local agencies or government departments; opportunities to leverage existing programmes or projects and co-operate with existing organizations will be sought
- **Participation:** projects should take into account the views, roles and rights of NGOs and relevant local communities. The needs of local communities in particular should be accounted for and balanced with the goal of enhanced biological diversity
- **Partnerships:** projects should encourage the development of partnerships between BP and a wide range of organisations/civil society
- **Monitoring and Evaluation:** projects should have a strong monitoring and evaluation component in order to ensure lessons are learned and taken into account for existing or future projects. Clear targets and measurements of success for the projects should be identified
- **Transparency:** programmes and projects must be transparent and be open to internal and external scrutiny to allow potential beneficiaries, non-governmental organisations and government departments to understand the approach

Timeframe

The development of the EIP is being undertaken through consultation with stakeholders to gain an understanding of issues/areas of concern where input would be most valuable. The intention is that potential programmes or projects are developed and implemented in conjunction with relevant stakeholder bodies. Identification of potential partners is underway.

Implementation of the environmental investment plan will follow BP's business processes and control procedures for managing project performance and cost.

The plan will be publicized in more detail later in 2002, once feedback on the ESIA has been received and further consultation with authorities, NGOs and affected communities has taken place. It is expected that actual investments will begin in late 2002 or early 2003.

Hence, at the route level, the cumulative effects of the pipeline construction and the environmental investment activities on the standard of living and quality of life of the local communities will be positive.

Community investment plan

The objective of the community investment plan is to have a positive impact on communities most affected by construction activities by providing direct benefits, engaging with, and adding value, to local communities in a sustainable way. The community investment plan will go beyond the social impact mitigation measures described in the ESIA and move towards BTC Co.'s goal of having a positive influence in the areas in which BTC Co. operates.

There will be two types of community investment projects:

- **Sustainable Development Projects**, which will be larger scale and longer term in duration and will take place primarily in communities that are directly affected by pipeline activities but may be extended to nearby towns or villages
- **Local Community Projects,** which are relative small in scale and duration but respond to an immediate need in those communities that are directly affected by the construction activities

Potential projects will be developed through discussions with the communities themselves, NGOs, international development agencies and government. These discussions will ensure that BTC Co is not duplicating effort, and allows BTC Co to gain from the experience of NGOs and identify potential implementation partners. Potential projects will be selected on the basis of criteria drawn from international community investment best practice and local experience.

Hence, at the route level, the cumulative effects of the pipeline construction and the community investment activities on the standard of living and quality of life of the local communities will be positive.

13.6 SUMMARY AND CONCLUSIONS

Summary of the cumulative impacts associated with the BTC project and each one of the projects discussed above is presented in Table 13-5 on the following page.

Table 13-5 Summary of cumulative impacts

Project with which BTC Interacts	National Level Cumulative Impact	Route Level Cumulative Impact
Environmental and Community Investment Plans	*Environmental Investment Plans,* will assist Georgian agencies in improving biodiversity protection and management. *Community Investment Plans*, impacts focused on the pipeline affected communities	*Environmental Investment Plans,* significant positive offset of ecological impacts is predicted. *Community Investment Plans,* high level positive impact predicted
SCP	*Air quality*, impacts highly unlikely. *GHG*, relatively small impact over life of project. *Ecology*, impacts on biodiversity will not be significant owing to mitigation. *Hydrology*, unlikely to result in perceptible operational impacts, oil spills will be addressed through oil spill response plan. *Soil*, no cumulative impacts.	*Air quality*, impacts highly unlikely. *Noise*, cumulative impacts during construction will occur, however they are subject to mitigation to reduce the magnitude of the impacts. *Ecology*, cumulative impacts are predicted, however they are reduced in magnitude by the use of a common corridor. *Hydrology*, cumulative impacts are predicted as a

Project with which BTC Interacts	National Level Cumulative Impact	Route Level Cumulative Impact
	Landscape, significant impacts are predicted that are subject to mitigation that minimizes the impact magnitude. *Wealth and livelihoods*, a range of positive impacts are predicted, extent to which impacts pipeline affected communities will be dependent on decisions of Georgian Government	result of usage during construction of SCP. *Landscape*, significant cumulative impacts are predicted that are subject to mitigation that minimizes the impact magnitude. *Soil*, cumulative impacts are predicted that are subject to mitigation to reduce their magnitude. *Unplanned events,* catastrophic pipeline failure is considered most unlikely and therefore the breach of the BTC pipeline is even more unlikely. *Wealth and employment*, significant positive cumulative impacts predicted. *Land and land-based livelihoods,* low level cumulative impacts predicted are subject to mitigation that minimizes the impact's magnitude. *Infrastructure,* low level cumulative impacts predicted are subject to mitigation that minimizes the impact's magnitude. *Construction workers and community relations,* positive cumulative impacts predicted. *Nuisance and safety*, low level cumulative impacts predicted are subject to mitigation that minimizes the impact's magnitude
WREP	*Air quality*, impacts highly unlikely. *GHG*, very small impact over life of project. *Ecology*, impacts on biodiversity will not be significant owing to short length of overlap (20km) and mitigation lack of sensitive ecological receptors in the area. *Hydrology*, unlikely to result in perceptible operational impacts, oil spills will be addressed through oil spill	*Air quality*, cumulative impacts highly unlikely. *Noise,* cumulative impacts highly unlikely. *Ecology*, cumulative impacts highly unlikely. *Hydrology*, unlikely to result in perceptible operational impacts, oil spills will be addressed through oil spill response plan. *Soil*, no cumulative impacts. *Landscape*, low level cumulative impacts are predicted that are subject to

Project with which BTC Interacts	National Level Cumulative Impact	Route Level Cumulative Impact
	response plan. *Soil*, no cumulative impacts. *Landscape*, low level cumulative impacts are predicted, that are subject to mitigation that minimizes the impact magnitude	mitigation that minimizes the impact magnitude. *Wealth,* positive cumulative impact owing to increasing skills of local communities. *Land and land-based livelihoods,* predicted negative cumulative impacts are subject to mitigation to minimize the impact's magnitude. *Infrastructure,* predicted negative cumulative impacts are subject to mitigation to minimize the impact's magnitude. *Nuisance and community relations,* predicted negative cumulative impacts are subject to mitigation to minimize the impact's magnitude
Silk Route	*Air quality*, no cumulative impacts. *GHG*, extremely small cumulative impact over life of project. *Ecology*, no cumulative impacts. *Hydrology*, no cumulative impacts. *Soil*, no cumulative impacts. *Landscape*, no cumulative impacts	*Air quality*, no cumulative impacts anticipated. *Noise,* no cumulative impacts anticipated. *Ecology*, no cumulative impacts anticipated. *Hydrology*, no cumulative impacts anticipated. *Soil*, no cumulative impacts anticipated. *Landscape*, no cumulative impacts anticipated. *Wealth and employment*, both positive and negative cumulative impacts predicted, mitigation measures in place to minimize magnitude of negative impacts. *Infrastructure,* if construction occurs simultaneously (this is a small probability), medium level negative cumulative impacts are predicted, mitigation measures in place to minimize magnitude of impacts. *Land and land-based livelihoods,* predicted negative cumulative impacts are subject to mitigation to minimize the impact's magnitude.

Project with which BTC Interacts	National Level Cumulative Impact	Route Level Cumulative Impact
		Nuisance, low level negative cumulative impacts are subject to mitigation measures
Borjomi Mineral Water	*Air quality*, no cumulative impacts. *GHG*, no cumulative impacts. *Ecology*, no cumulative impacts. *Hydrology*, unlikely to result in perceptible operational impacts, oil spills will be addressed through oil spill response plan. *Soil*, no cumulative impacts. *Landscape*, no cumulative impacts	*Hydrology*, unlikely to result in perceptible operational impacts, oil spills will be addressed through oil spill response plan. *Wealth and employment*, both positive and negative cumulative impacts predicted, mitigation measures in place to minimize magnitude of negative impacts. *Community relations,* predicted negative cumulative impacts are subject to mitigation to minimize the impact's magnitude. *Infrastructure and resources,* unlikely to be any cumulative impacts
Other oil & gas projects	*Air quality*, impacts highly unlikely. *GHG*, relatively small impact over life of project. *Ecology*, impacts on biodiversity will not be significant owing to mitigation. *Hydrology*, unlikely to result in perceptible operational impacts, oil spills will be addressed through oil spill response plan. *Soil*, no cumulative impacts. *Landscape*, impacts are predicted that are subject to mitigation that minimizes the impact magnitude. *Wealth and livelihoods*, a range of positive cumulative impacts are predicted	*Air quality*, cumulative impacts highly unlikely unless within a few km. *Noise*, cumulative impacts highly unlikely unless within a few km. *Ecology*, cumulative impacts highly unlikely unless within a few km. *Hydrology*, cumulative impacts may occur as a result of usage during construction. *Landscape*, cumulative impacts may occur that will be subject to mitigation that minimizes the impact magnitude. *Soil*, cumulative impacts may occur that will be subject to mitigation to reduce their magnitude. *Unplanned events,* Catastrophic failure is considered extremely unlikely and therefore the breach of the BTC pipeline is even more unlikely

Project with which BTC Interacts	**National Level Cumulative Impact**	**Route Level Cumulative Impact**
Non oil & gas industrial redevelopment	*Air quality*, impacts highly unlikely. *GHG*, relatively small impact over life of project. *Ecology*, impacts on biodiversity will not be significant owing to mitigation. *Hydrology*, unlikely to result in perceptible operational impacts, oil spills will be addressed through oil spill response plan. *Soil*, no cumulative impacts. *Landscape*, significant impacts are predicted that are subject to mitigation that minimizes the impact magnitude. *Wealth and livelihoods*, a range of positive cumulative impacts are predicted	Environmental *Air quality*, cumulative impacts highly unlikely. *Noise*, cumulative impacts highly unlikely. *Ecology*, cumulative impacts highly unlikely. *Hydrology*, cumulative impacts highly unlikely. *Landscape*, significant cumulative impacts may occur that will be subject to mitigation that minimizes the impact magnitude. *Soil*, cumulative impacts are predicted that will be subject to mitigation to reduce their magnitude
Trans-boundary effects	*Human health*, no cumulative impacts	*Acidification*, very minor cumulative impact

MANAGEMENT AND MONITORING

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14 MANAGEMENT AND MONITORING

14.1 INTRODUCTION

BTC Co's approach to Environmental and Social Management is to apply the key principles of environmental and social protection to all oil activities for which it is the Operator. These principles include:

- Prior assessment of environmental and social impact
- Minimization of potential impact through design and other mitigation controls
- Monitoring of effectiveness of controls
- Auditing of performance

This section of the ESIA document highlights how these principles have been applied to the proposed BTC project. It identifies how all the commitments made in this ESIA will be translated into actions in the field and includes a schedule for implementing the actions, through identifying key roles and responsibilities.

The BP Environment Policy (See Section 6) and BTC Statement of Social Objectives (Figure 14-1) provide a framework for the project as a whole, and particularly for the management and monitoring plans.

Figure 14-1 BTC Statement of social objectives

The BTC Project is committed to delivering mutual benefits to communities along the pipeline route and to establishing long-term relationships with these communities, during both the construction and operational phases. We will:

- Minimize potential negative social impacts through identification and mitigation, in particular via a social impact assessment
- Publish regular updates on the environmental and social aspects of the project, and conduct regular dialogue with interested organisations
- Maintain regular contact with communities along the pipeline route through a team of Community Liaison Officers (CLOs) prior to, during and following the construction period
- Compensate for damage to land and property in a legal, transparent and ethical manner that respects the interests of those involved
- Manage expectations on employment opportunities by providing information on the level and duration of employment requirements
- Seek opportunities to increase employment of country nationals, and in particular those in villages along the pipeline route, subject to availability of appropriate skills
- Establish recruitment procedures that are transparent, public and open to all regardless of ethnicity, religion or gender
- Provide periodic training to enhance the skills and capacity of both employees and contractors
- Draw up procedures and management plans for all worker camps, in relation to contacts with local communities
- Provide periodic training on liaison with local communities to all staff employed by the BTC project and contractors
- Establish a community investment programme that delivers mutual benefits to BTC Co and communities along the pipeline route
- Seek opportunities for communities to mutually benefit from the activities undertaken, and infrastructure required, by the project

14.2 ENVIRONMENTAL MANAGEMENT SYSTEM

The principal tool that will be employed to coordinate and review the environmental and social performance of the project will be the BTC Environmental Management System (EMS). Social issues will also be addressed within the EMS.

For construction phase, the EMS will be developed at two levels:

- An EMS developed by the construction contractor aimed at managing the environmental and social aspects of construction, within which there will be a series of environment and social management plans for each different issue area
- An overarching EMS developed by the Project principally aimed at providing assurance that the construction contractor is complying with the environmental and social requirements defined by the Project, including those specified in this ESIA. Key elements include: development and dissemination of a project specific environmental and social policy; development and implementation of environmental and social management plans; and ongoing monitoring and development of each element of the EMS through a programme of regular review and continual improvement

For operational phase, the Project will develop a specific operational EMS.

14.2.1 Overview of environmental & social management plans

The effective implementation of the EMS is based on the development and implementation of a number of environmental and social plans.

A summary of the environmental and social plans is presented in Table 14-1. The plans are described in terms of their purpose and objectives, anticipated date for completion, and the responsible party (either BTC Co or the Construction Contractor) for development and implementation of the plan.

In some cases draft plans have already been developed and are included in the appendices for reference. These include the Reinstatement Summary Plan, Landscape Management Plan and Cultural Heritage Management Plan. Whilst the BTC Project has developed these draft Plans, it is largely the responsibility of the construction contractor to effectively implement them. BTC Co will maintain a strong audit and overview role to ensure that the construction contractor implements the requirements of the Plans appropriately and effectively.

In other cases, measures for inclusion in the plans have been partially developed and must be finalised in conjunction with the construction contractor. The "frameworks" for these plans have been provided in this section and detail the objectives, principles, standards to be met, resources and general requirements. These frameworks include the: Community Safety Management Plan; Community Liaison Management Plan; Worker Camp Management Plan; Infrastructure and Services Management Plan; Procurement and Supply Management Plan; Employment and Training Management Plan; Resettlement Action Plan; Waste Management Plan; Pollution Prevention Management Plan; Transport Management Plan. Additional draft measures that have been developed based on the ESIA mitigation measures will be provided to the construction contractor to include in the development of the full plan.

BTC Co will review and approve these plans following their development by the construction contractor. The construction contractor is then responsible for their implementation with BTC Co maintaining a strong overview and monitoring role.

A number of plans will be fully developed prior to operations phase and include the Emergency Response Plan and Oil Spill Response Plan.

Table 14-1 List of environmental and social plans specific to the project

Plan Name	Text Reference	Purpose and Objectives of Plan	Date for Completion	Responsibility for plan Development and Implementation
1. Community Safety Management Plan	Section 14.3.1	Outlines specific actions for the construction contractor & BTC Co to ensure safety of communities along the route	A framework plan has been developed. The Construction contractor is to build on this framework and finalise the plan prior to construction. A similar plan will be drawn up by BTC Co for the operations phase	Construction contractor is responsible for development and implementation of the Community Safety Management Plan for construction phase, based upon the framework provided in this section. BTC Co responsible for development and implementation of the Plan during operations phase
2. Community Liaison Management Plan	Section 14.3.2	Outlines specific actions for the construction contractor and BTC Co to ensure positive community relations	A framework plan has been developed (Section 14.3.2). The Construction contractor is to build on the framework and finalise Plan prior to construction	The Construction contractor is responsible for development and implementation of the final Plan for construction phase, based upon the framework provided in this section. BTC Co responsible for development and implementation of the Plan during operations phase

Plan Name	Text Reference	Purpose and Objectives of Plan	Date for Completion	Responsibility for plan Development and Implementation
3. Worker Camp Management Plan	14.3.2	Ensure effective management of worker camps with regards to community relations and other potential impacts of the camps (eg on natural resources, roads, etc)	This plan is negotiated during bid proposal stage. A framework plan has been developed in this Section (14.3.2). The Construction contractor will build on this framework and finalise the Plan prior to construction	The Construction contractor is responsible for development and implementation of the final Plan for construction phase, based upon the framework provided in this section
4. Infrastructure and Services Management Plan	Section 14.3.3	Sets out specific actions for the construction contractor and BTC Co, to minimize the disruption & negative impact associated with infrastructure, natural resources, households and community assets eg land, roads, irrigation, etc	A framework plan has been developed within this Section. The Construction contractor is to build on the framework and finalise the Plan prior to construction	The Construction contractor is responsible for the development and implementation of the Plan for construction phase based upon framework provided here in this section. BTC Co responsible for development and implementation of the Plan during operations phase

Plan Name	Text Reference	Purpose and Objectives of Plan	Date for Completion	Responsibility for plan Development and Implementation
5. Employment and Training Management Plan	Section 14.3.4	Sets out specific actions for the construction contractor and BTC Co to ensure opportunities for local employment are maximised and that there is a fair distribution of jobs. The Plan also aims to manage the skills development and training process to ensure local communities can benefit from this project in the longer term	A framework plan has been developed in this section. The Construction Contractor is to build on the framework and finalise the Plan prior to construction	The Construction Contractor is responsible for the development and implementation of the Plan based upon the framework provided here in this section. BTC Co responsible for development and implementation of the Plan during operations phase
6. Procurement and Supply Management Plan	Section 14.3.5	Sets our specific actions for the construction contractor and BTC co to ensure opportunities for sourcing goods and services from local and national businesses is maximised	This plan is negotiated during bid proposal stage. A framework plan has been developed in this Section (14.3.5). The Construction contractor will build on this framework and finalise the Plan prior to construction	The Construction Contractor is responsible for the development and implementation of the Plan based upon the framework provided here in this section

Plan Name	Text Reference	Purpose and Objectives of Plan	Date for Completion	Responsibility for plan Development and Implementation
7. Transport Management Plan	Section 14.3 6	Sets out specific actions for construction contractor to properly manage traffic and its potential impacts, including safety and accidents	A framework plan has been developed in this Section. The Construction Contractor is to build on the framework and finalise the Plan prior to construction	The Construction Contractor is responsible for the development and implementation of the Plan during construction phase based upon the framework provided here in this section. BTC Co is responsible for development and implementation of the Plan during operations phase
8. Resettlement Action Plan	Section 14.3.7	Sets out the principles, process and specific actions related to land acquisition and compensation	Prior to construction	BTC Co to develop and implement Plan
9. Cultural Heritage Management Plan	Section 14.3.8	Outlines strategy and actions to avoid and/ or minimize project impacts to archaeological and historic monument sites	Draft plan provided as Appendix E Annex III to ESIA	Construction contractor to implement requirements of draft plan. BTC Co. to monitor implementation of the plan
10. Reinstate-ment Summary Plan	Section 14.3.9 Appendix A, Annex I	This Summary outlines the actions that contractor will take to implement the Reinstatement Specification (a contractual document) and achieve the reinstatement targets for erosion control and bio-restoration	The Reinstatement Specification has been completed and provided to potential Construction Contractors. A summary of this specification, the Reinstatement Summary Plan, is provided in Appendix A, Annex I	The Construction contractor is responsible for development of the final Reinstatement Plan, including method statements describing how the requirements of reinstatement specification will be implemented

Plan Name	Text Reference	Purpose and Objectives of Plan	Date for Completion	Responsibility for plan Development and Implementation
11. Landscape Management Plan	Section 14.3.10 Draft Landscape Management Plan (Appendix E Annex I)	Sets out specific actions for construction contractor and BTC Co to undertake to mitigate and minimize visual landscape impacts	Draft plan provided as Appendix E Annex I	Final Plan to be developed and implemented by both the Construction Contractor and other specialist landscape contractors
12. Pollution Prevention Management Plan	Section 14.3.11	Sets out specific actions for the Construction Contractor and BTC Co to ensure that polluting emissions and disturbance are be prevented or mitigated	A framework plan has been developed in this Section. The Construction Contractor is to build on the framework and finalise the Plan prior to construction	The Construction Contractor is responsible for the development and implementation of the Plan based upon the framework provided in this section. BTC Co is responsible for development and implementation of the Plan during operations phase
13. Waste Management Plan	Section 14.3.12	Outlines specific actions for the construction contractor and BTC Co to ensure that best practice waste management procedures are implemented	Within six months of Construction Contractor mobilisation and three months before construction starts. A framework plan has been developed in this section. The Construction Contractor is to build on the framework and finalise the Plan prior to construction	The Construction Contractor is responsible for the development and implementation of the Plan for construction phase, based upon the framework provided here in this section. BTC Co is responsible for development and implementation of the Plan during operations phase

Plan Name	Text Reference	Purpose and Objectives of Plan	Date for Completion	Responsibility for plan Development and Implementation
14. Emergency Response Plan	Section 14.3.13	Sets out specific actions for construction contractor and BTC Co to ensure that incidents, including fire and those involving spillage of chemicals or oil, are properly managed during both construction and operation	A framework plan has been developed in this Section. The Construction Contractor is to build on the framework and finalise the Plan prior to construction	The Construction Contractor is responsible for the development and implementation of the Plan during construction phase based upon the framework provided here in this section. BTC Co is responsible for development and implementation of the Plan during operations phase
15. Oil Spill Response Plan	Section 14.3.13 Appendix E Annex V	Provides guidelines for responding to incidents involving oil spills	A framework has been completed and is provided as Appendix E Annex V. The Final version will be prepared prior to operations commencing	BTC Co is responsible for development and implementation of the Plan for operations phase

The following sections describe the objectives, accountability, and resources required for the various plans in more detail.

14.3 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS

14.3.1 Community safety management plan

14.3.1.1 Introduction

Project health and safety will be managed in accordance with BTC Co's HSE Policy as outlined in Section 6. The following framework addresses specific safety aspects only in so far as they have an impact on communities (as well as livestock) and external 3rd parties and has been developed through the ESIA process. The construction contractor will then be responsible for the development of the full Community Safety Management Plan. The final plans prepared by the contractor will require review and approval by BTC Co. There will be an overlap between this plan and many of the other management plans, particularly the Infrastructure and Services Management Plan.

14.3.1.2 Objectives and targets

The following community safety objectives have been defined:

- To ensure the safety of community members is not affected by pipeline construction or operation
- To generate safety awareness in local communities to ensure they are pro-active in managing their own safety with regard to the pipeline
- To minimize the spread of diseases in local communities, particularly HIV/AIDS and other STDs

In line with these objectives, specific targets will be set and negotiated with the construction contractor. For example, a target is likely to be set around ensuring no major health or safety incidents affecting community members.

14.3.1.3 Accountability

The BTC Construction Manager will be accountable for providing assurance during the construction phase that the above objectives and agreed targets are met. The construction contractor will have primary responsibility for the implementation of the measures during the construction phase. Accountability during the operations phase will be with the BTC Co Operations Manager.

14.3.1.4 Reporting

The construction contractor will report to the BTC Co Health and Safety manager on a regular basis. These reports will advise BTC Co on the projects performance against a range of health and safety metrics, including health and safety training; tool box talks, health screening, incidents, etc. Any incidents concerning community members will be reported. Major health and safety incidents such as fatalities or serious accidents will be reported to BTC Co immediately.

The BTC Co Health and Safety manager will have responsibility for monitoring activities during both construction and operation.

14.3.1.5 Resources

The contractor's community liaison team and construction engineers, with the assistance of the BTC Co community relations team, will implement community safety measures. The engineers will assist with technical details and on specific construction measures. These measures are in addition to the project general health and safety requirements and standards.

14.3.2 Community relations plans

This section relates to two plans which both have a community relations focus:

- Community Liaison Management Plan
- Worker Camp Management Plan

14.3.2.1 Introduction

The Community Liaison Management Plan and Worker Camp Management Plan are a critical element of effective social impact management. For any project of this size, there is potential for unexpected situations to arise that will need to be resolved if relationships between communities, the construction contractor and ultimately BTC Co are to remain positive and mutually beneficial. The focus of these plans is the successful management of the construction workers and worker camps in terms of their interface with the community. However, it will also include community liaison measures for the operational phase of the pipeline. The Worker Camp Management Plan will also include measures that relate to other social impacts such as management of local infrastructure and natural resources.

14.3.2.2 Objectives

The overarching objective for the community liaison and community relation teams is to build a positive, non-dependent relationship between the project participants and the local communities. This will be the basis of strong relationships during the operational period. These relationships should be based on open communication and mutual respect.

The Objectives of the Community Liaison Management Plan and Worker Camp Management Plan are to define actions, responsibility and timing in order to:

- To provide communities affected by the project with regular information on the progress of work and the implications for these communities
- To inform the BTC Co project team and contractors of any community related issues that may impact on construction
- To monitor implementation of mitigation measures and the impact of construction via direct monitoring and feedback
- To identify any significant new issues that may arise during the construction period
- To manage any disputes between the Project Participants/contractor and communities
- To assist in identifying opportunities for construction activities to deliver benefits to local communities

In line with these objectives, specific targets will be set and negotiated with the construction contractor.

14.3.2.3 Accountability

The Construction Contractor community liaison team and a BTC Co community relation team will be appointed. As a minimum, the teams will be established as follows, although the exact make up and numbers will be based on the construction schedule defined by the contractor, following award of contract:

Table 14-2 Community liaison teams

Company	Management	Spread 1	Spread 2 (1)	Worker Camps	Total
Construction contractor Community Liaison Team		1	1	2	4
BTC Co Community Relations Team	1	0	0	4 (Supervisors – also responsible for Community Investment)	5

The BTC Co Project Manager will be accountable for ensuring that the above objectives are met and may set additional targets in these areas as an incentive to implementation of the various measures.

The construction contractor will have primary responsibility for community liaison, and will be the first point of contact with affected communities. This will be achieved by allocating specific responsibilities to staff, and by a team of dedicated Community Liaison Officers (CLOs), one of whom will be designated as the Lead CLO. This individual will have overall responsibility for the following:

- Implementation of the Community Liaison Management Plan and the community outreach aspects of the Worker Camp Management Plan and Transport Management Plan
- Training of all contractor staff with community liaison responsibilities
- Communication with communities affected by the project
- Provision of weekly and monthly reports to BTC Co
- Management of CLOs to carry out roles listed below

The construction teams in each spread will be working along an approximately 15-kilometre length at any one time. One CLO will therefore be required on each spread to liaise with communities along the pipeline route. Their role will be to:

- Meet community leaders and speak at community meetings prior to arrival of construction teams in a given locality, to inform them of the nature and length of activities in their area
- Hold fortnightly (or as required) meetings with leaders and communities while construction teams are present in their area
- Liaise with the contractor staff who have responsibility for community liaison in each work team
- Provide a focus for negotiation and resolution of specific disputes with communities if / when they arise, using the dispute resolution procedure
- Provide weekly updates to the contractor BTC Co Community Relations Manager
- Liaise with the management of the spread team on major issues arising, and provide feedback to communities on responses to these issues

There will also be CLOs working in the worker camps, and they will have responsibilities for community liaison.

(1) If only one spread is used, only 1 pipeline spread CLO will be necessary.

- Hold regular meetings with communities throughout the lifetime of the camp
- Support implementation of the Worker Camp Management Plan (to be developed by the construction contractor for bid proposal and agreed through contract negotiations)
- Advise the lead CLO, and worker camp management, on changes required to the Worker Camp Management Plan
- Meet with communities close to smaller camps and AGIs on a monthly basis, and advise contractor management, and the lead CLO on issues arising from these meetings
- Produce fortnightly reports on implementation of plan, specific incidents, and action taken to address community concerns

Further detail on the roles and responsibilities of the Contractor's liaison team and the BTC Co Community Relations Team can be found in the PCDP, in the Appendix F.

14.3.2.4 Reporting

The reporting structure is as outlined above with weekly and fortnightly reports submitted by the CLO team to the BTC Co community relations team.

14.3.3 Infrastructure and services management plan

14.3.3.1 Introduction

The Infrastructure and Services Management Plan will set out the specific actions required to minimize the disruption and negative impacts on services and infrastructure. This includes actions to minimize disruption to infrastructure and natural resources, as well as measures to avoid damage to household and community assets such as land, houses, roads, irrigation networks, etc. Many of the actions within the Infrastructure and Services Management Plan are continuous, ie they will need to be implemented with each new community or settlement along the route. A more detailed plan will be developed by the Construction Contractor, incorporating the requirements of the framework plan below. The final Plan will be require review and approval by BTC Co.

14.3.3.2 Objectives

The objectives of the plan are to define actions, responsibility and timing in order to:

- To minimize damage to community and household assets from the construction process
- To ensure 'No Net Loss' to community infrastructure, services and natural resources as a result of construction and operation

In line with these objectives, specific targets will be set and negotiated with the construction contractor.

14.3.3.3 Accountability

BTC Co will be accountable for ensuring that the above objectives are met. The construction contractor will have primary responsibility for implementation during construction, but the responsibility will fall back to BTC Co during operation. The Community Liaison team will have additional responsibility for the implementation of some of the measures.

14.3.3.4 Monitoring and review

BTC Co will have responsibility for monitoring activities during both construction and operation.

14.3.3.5 Resources

It is proposed that the engineering teams for the construction contractor and BTC Co will be able to implement measures detailed within the Infrastructure and Services Management Plan with the assistance of the community liaison team employed for the project. Community liaison staff will be able to advise communities of any measures that are proposed and seek feedback where necessary on their implementation, either to advise the engineers on modifications needed, or to provide a report to BTC Co on the effectiveness of measures in minimizing the social and economic impacts.

14.3.4 Employment and training management plan

14.3.4.1 Introduction

The Employment and Training Management Plan is vital to maximising the opportunities for local employment and ensuring a fair distribution of jobs to communities along the route. The plan will also include measures to manage the training to be provided to local workers. The construction contractor is responsible for preparation and implementation of the final Employment and Training Management Plan, and will incorporate the requirements of the framework as described below. The final plan will require review and approval by BTC Co.

14.3.4.2 Objectives

The objectives of the plan are to define actions, responsibility and timing in order to:

- Maximise local employment in skilled, semi skilled and unskilled categories during construction and operation of the BTC pipeline, where practical, without compromising safety
- Ensure that unskilled jobs are filled from pipeline affected communities
- Ensure a fair distribution of jobs between pipeline affected communities along the route
- Provide a fair and transparent recruitment process
- Enhance the local skills base through training provided during employment

14.3.4.3 Accountability

The BTC Co team will be accountable for ensuring that the above objectives are met and will set targets in these areas. The construction contractor will have primary responsibility for the implementation of these measures during construction, but the responsibility will fall back to BTC Co during operation.

14.3.4.4 Monitoring and review

BTC Co will have responsibility for monitoring activities during both construction and operation.

14.3.4.5 Resources

It is proposed that existing staff resources for the construction contractor and BTC Co will be able to implement these measures with the assistance of the community liaison team employed for the project. This team will be able to help the construction contractor to run employment recruitment at district level (eg through district level recruitment centres). BTC Co will also need to supply a member of staff during local level recruitment along the route to act as an independent figure monitoring the fairness of the recruitment process.

14.3.5 Procurement and supply management plan

14.3.5.1 Introduction

BTC Co aim to maximise the quantity of goods and services that are supplied by both local and national businesses to the project and to promote efficient and sustainable use of natural resources. This will be contingent on whether local suppliers can offer sufficient quality and reliability and can meet the stringent standards. This Plan will help BTC Co and the Construction Contractor to identify goods and services opportunities that will be suitable to local suppliers and to implement measures designed to improve the capacity of local businesses to respond to these opportunities. The plan will build on existing BTC Co supplier programmes (eg supplier seminars).

14.3.5.2 Objectives

The objectives of the plan are to define actions, responsibility and timing in order to:

- Promote opportunities for local sourcing of goods and services
- Build capacity of local suppliers to meet contracting opportunities
- To promote the efficient and sustainable use of natural resources
- Minimize procurement of potentially hazardous materials
- Promote the adoption of good environmental and social practices by suppliers

14.3.5.3 Accountability

The BTC Co team will be accountable for ensuring that the above objectives are met and will set targets in these areas. The construction contractor will have primary responsibility for the implementation of these measures during construction, but the responsibility will fall back to BTC Co during operation.

14.3.5.4 Monitoring and review

BTC Co will have responsibility for monitoring activities during both construction and operation. It is expected that monitoring will be conducted by the community relations team and project environment team.

14.3.5.5 Resources

Existing procurement resources of the construction contractor will be able to implement the Procurement and Supply Management Plan with the assistance of the community liaison team and BTC Co team managing existing supplier programmes.

14.3.6 Transport management plan

14.3.6.1 Introduction

The Transport Management Plan is required to minimize the negative impacts and enhance any positive impacts, owing to project-related traffic (both rail and road) on all communities affected by construction and subsequent operation of the BTC pipeline. This includes actions to minimize disruption to the existing road infrastructure, communities adjacent to the road network and natural resources, as well as measures to avoid damage to household and community assets such as land, houses, irrigation networks, etc. Many of the actions within the plan are continuous, ie they will need to be implemented along the route.

The Construction Contractor is responsible for preparation and implementation of a Transport Management Plan. A framework relevant to social and environmental aspects associated with transport activities is presented below. The requirements of the framework will be incorporated into the final Plan prepared by the Construction Contractor. The Plan is required to be reviewed and approved by BTC Co.

14.3.6.2 Objectives of plan

The following social and environmental objectives have been developed in relation to assist transport management:

- To provide communities affected by traffic (both rail and road) from the BTC project with sufficient information on the effects of the project-specific traffic and the opportunity to resolve traffic related complaints
- To ensure limitations on the size, number, frequency and timing of project-related vehicles on specific roads are set to minimize negative impacts on communities and the surrounding environment wherever practicable
- To control hazards associated with project-related traffic through project speed limits, driver training, journey management and appropriate signage
- To reduce impacts on the environment through effective emissions control, high standards of vehicle maintenance, adherence to relevant standards including noise emissions and defined working hours
- To review the effectiveness of the Transport Management Plan and revise the mitigation measures employed, if necessary

In order to achieve these objectives the Plan will address, as a minimum, the following:

- Vehicle sizes and schedule of movements
- Vehicle standards (axle weights, noise limits, etc)
- National traffic procedures
- Local traffic procedures
- Mobilisation / demobilisation of heavy equipment
- Description on the transport of pipe
- Liaison with local communities
- Management of transport contractors
- Management and resolution of traffic-related complaints
- Access confined to demarcated working areas
- Road capacities & define approved routes for specific categories of vehicle
- Strict enforcement of project speed limits
- Driver environmental and safety awareness training
- Journey management planning
- Effective maintenance to minimize vehicle emissions & fuel consumption
- Warning signs at road crossings
- Ensure a high standard of vehicle maintenance
- Regular maintenance of plant and equipment to meet relevant standards
- Use of silencers
- Defined working hours
- Responsible use of vehicles
- Procedure for informing local residents of noisy activities

14.3.6.3 Accountability

Prior to commencing any site work, the Contractor will develop a project-specific Transport Management Plan that will cover both contractor and BTC Co transportation during construction. The Contractor's performance will be monitored by the BTC Co Project Manager or delegate.

14.3.6.4 Monitoring & review

The Construction Contractor will prepare weekly reports presenting the monitoring of compliance with the Transport Management Plan. The BTC Co Project Manager or his delegate will audit the activities of the Contractor at least every six months.

14.3.6.5 Resources

The Contractor will be responsible for the Transport Management Plan. Additional resources may be required in complex situations and these will be provided by the Contractor. This situation may arise in situations where community liaison is a particularly requirement. In this case the resources identified in the community relations plans (Section 14.3.2 above) will be employed.

14.3.7 Resettlement action plan

A Resettlement Action Plan is currently being produced (see summary in Section 11.4) and will be released as a public document in third quarter 2002. It will define the following:

- Indicators and performance measures that will be used in conjunction with objectives defined below to assess progress and the effectiveness of Resettlement Action Plan mitigation actions
- Monitoring activities to be taken by the Project (internal monitoring)
- Monitoring activities to be undertaken by an independent third party (external monitoring)
- Reporting requirements
- Monitoring schedule (frequency and duration of monitoring activities)

Monitoring activities are an important aspect of this Plan. The monitoring will help keep stakeholders informed of BTC Co's performance with respect to delivery of the commitments and actions described in the Plan.

14.3.7.1 Objectives

Objectives of the plan are:

- Timely and effective delivery of the commitments and actions described in the Resettlement Action Plan
- Disbursement of compensation in accordance with agreements
- Affected lands are adequately reinstated for appropriate use
- Effective delivery of measures to offset any adverse project impacts on land use, income levels or productivity
- Pre-project living standards and income levels are sustainably restored
- That grievances expressed by project affected people are followed up and, where necessary, corrective action is implemented
- Monitor any dispute that cannot be resolved by the grievance system as it progresses
- That project affected people understand the resettlement process and their rights and avenues for complaint
- Any cases of hardship are identified and, where necessary, additional support is provided

14.3.7.2 Accountability

BTC Co will have overall responsibility for ensuring that resettlement commitments are met and that other parties (involved government agencies, construction contractor, other project staff, consultants) fully understand their roles and responsibilities.

14.3.7.3 Monitoring and review

BTC Co will have overall responsibility for monitoring implementation of the Resettlement Action Plan. Mechanisms for independent third party review are presently being discussed with IFIs. Detailed monitoring arrangements will be described in the forthcoming Resettlement Action Plan.

14.3.7.4 Resources

Resources and budgets for land acquisition and resettlement monitoring will be outlined in the Resettlement Action Plan. To implement monitoring, the project will draw on some or all of the following:

- BTC Co's community liaison staff and land acquisition team
- Construction contractor's community liaison staff
- In-country NGOs
- Third party resettlement specialists

14.3.8 Cultural heritage management plan

14.3.8.1 Introduction

A draft Cultural Heritage Management Plan has been drawn up as part of this ESIA (Appendix E, Annex III) and will be implemented by the Contractor in order to minimize the negative impacts and enhance any positive impacts owing to construction of the BTC pipeline. The plan builds on work completed and ongoing as part of the ESIA process. For example initial baseline surveys along the proposed BTC project route have highlighted significant archaeological sites.

14.3.8.2 Objectives

The following are the objectives of the Cultural Heritage Management Plan:

- Conservation during the lifetime of the BTC project, protection of sites in the vicinity of construction activities wherever required, provision of access tracks where appropriate
- Pre-Construction, agree minor re-routes where possible
- During Construction, undertake archaeological digs

In order to address these objectives the Cultural Heritage Management Plan will address as a minimum the following:

- Training for Contractor staff
- Protection of sites in the vicinity of construction activities by demarcation fences
- Protect of sites through ensuring access tracks to new or existing facilities are carefully sited
- Respect the cultural heritage of the areas in which work is carried out
- Mechanism for agreeing stopping work when encountering a potential archaeological site during ROW clearance or excavation activities
- Mechanism for agreeing minor re-routes where possible
- Mechanism for agreeing "skipping" sections
- Identify sites requiring further investigation
- Complete all digs during the construction phase wherever possible

14.3.8.3 Accountability

BP is employing research teams consisting of specialist contractors to implement the different phases of the Cultural Heritage Management Plan (Appendix E, Annex III).

14.3.8.4 Reporting

A report will be prepared prior to the start of construction in any new length of activity detailing the specific Cultural Heritage Management Plan activity in the length. In order to ensure that the Cultural Heritage Management Plan is effective and reduces unnecessary delays to construction activity to a minimum there will be clear lines of communication between the Cultural Heritage Management Plan contractors (see Appendix E, annex III) and the BTC Project Manager or his delegate and weekly reporting of compliance with the Plan.

The BTC Co Project Manager or his delegate will audit the activities of the Plan contractors at least every six months.

14.3.8.5 Resources

The Cultural Heritage Management Plan contractors will be responsible for the plan. Additional resources may be required in complex situations and these will be provided by the BTC Co.

14.3.9 Reinstatement summary plan

14.3.9.1 Introduction

A summary of the reinstatement specification, the Reinstatement Summary Plan, is presented at Appendix A, Annex I. This specification is the document that outlines, in a contractual sense, the principles and the targets for erosion control and bio-restoration. The contractor will develop additional specific methods statements and procedures that will detail how the goals outlined in the specification will be met, and incorporate these to develop a final Reinstatement Management Plan.

14.3.9.2 Objectives

The Reinstatement Management Plan will outline actions, responsibilities and timing in order to:

- Protect top soil
- Stabilize the ROW
- Restore faunal and floral habitats
- Dispose of spoil appropriately
- Avoid impacts owing to side slope cuts

14.3.9.3 Accountability

The final Reinstatement Management Plan, including method Statements, Inspection Plans and Record Portfolios for all erosion control and reinstatement works will be produced by the Contractor for approval by the BTC Co Project Manager. The Contractor is responsible for the implementation and audit of the effectiveness of the Plan. The Contractor's performance will be monitored by the BTC Co Project Manager, or delegate, on at least a monthly basis.

14.3.9.4 Reporting

A report will be prepared prior to the start of construction in any new area. The report will detail the specific reinstatement activities for that area. A report will be prepared on completion of construction activity in the area and annually thereafter or until the reinstatement is agreed to be complete by the BTC Co project manager or delegate.

14.3.9.5 Resources

The Contractor will be responsible for implementation of the Plan. Additional resources may be required in complex situations and these will also be provided by the Contractor.

14.3.10 Landscape management plan

14.3.10.1 Introduction

The design of the pipeline and the AGIs and the development of landscaping mitigation measures have, and will continue to, take place in tandem. Feedback and input between landscape architects and pipeline engineers throughout the project design phase has facilitated the incorporation of landscape mitigation measures into engineering design. General landscape mitigation measures have been incorporated into the Reinstatement Specification (see Appendix A, Annex I for a Summary). More specific landscape mitigation measures are contained within the draft Landscape Management Plan (Appendix E, Annex I). These include measures for specific AGIs and specific sections of the ROW.

The Construction Contractor and specialist consultants are responsible for the development and implementation of the final Landscape Management Plan. This final plan will include detailed method statements and procedures describing how the landscape mitigation requirements will be met.

14.3.10.2 Objectives

The following are the objectives of the Landscape Management Plan:

- To minimize visual intrusion along the ROW through the adoption of mitigation measures such as grading and benching of the ROW, restoration of original contours, and implementation of reinstatement plan
- To minimize the impact of the linear character of the pipeline on the landscape through the adoption of mitigation measures including the avoidance of side-slopes, and minimization of sight lines through the use of dog-legs in the ROW and through the incorporation of scalloped edges to tree-cut-lines
- To minimize the impact of permanent above ground facilities on the landscape through the adoption of a series of mitigation measures including implementation of planting schemes, minimization of areas cleared for construction, and use of colours sympathetic to the surrounding environment
- To review the effectiveness of mitigation measures implemented through monitoring and surveillance

14.3.10.3 Accountability

The Contractor is responsible for the implementation of the Landscape Management Plan. The effectiveness of implementation will be monitored by BTC Co.

14.3.10.4 Reporting

Weekly reports will present the monitoring of compliance with the Landscape Management Plan. The BTC Co Project Manager or delegate will audit the implementation of the Landscape Management Plan at least every six months.

14.3.10.5 Resources

The Construction Contractor will be responsible for providing the bulk of the resources required to implement the Landscape Management Plan. However, BTC Co may provide additional expertise as required, in the way of specialist consultants.

14.3.11 Pollution prevention management plan

14.3.11.1 Introduction

The contractor will develop a Pollution Prevention Management Plan. It will detail the manner by which polluting emissions and disturbance associated with the project are to be prevented or mitigated. A framework for the plan is provided below. The final plan prepared by the contractor, incorporating the requirements of the framework below, and will require review and approval by BTC Co.

14.3.11.2 Objectives of plan

The following are the objectives of the Pollution Prevention Management Plan:

- Identify potential pollutants
- Provide proposals for bunding and lining of storage areas
- Provide procedures for transporting, handling, storing, using and disposing of pollutants
- Provide procedures for training and competence of operators
- Provide refuelling procedures
- Provide solid and waste water management
- Describe the proposed measures to prevent spillages and pollution to land and water
- Provide spatial and temporal constraints required adjacent to watercourses, etc
- Protect local water supplies
- Provide source and discharge procedures for hydrostatic test waters
- Provide procedures for the control of noise pollution
- Provide procedures for the control of dust and mud
- Address transport disturbance
- Provide procedures to control of blasting operations
- Provide a list of pollution control equipment

A key aspect to be covered within the Pollution Prevention Management Plan is the management of hazardous waste material. Whilst it is not anticipated that significant amounts of hazardous waste materials will be generated, specific procedures to address hazardous materials will be developed.

At a minimum, the procedures specific to hazardous materials will include measures to ensure that:

- The physical and chemical properties of the materials are understood and that appropriate measures are in place to mitigate the hazards posed by them both to humans and the environment (eg segregation of potentially reactive materials, maintenance of hazardous materials logs, provision of Material Safety Data Sheets for all stored materials)
- The volumes of hazardous materials purchased and stored by the project at any one time is minimized
- The design of fuel and hazardous material storage areas includes measures designed to minimize the potential for spillages and to ensure that spillages can be contained (eg fuel tanks will be provided within concrete-lined, bunded containment areas, hazardous material storage areas will be furnished with a dedicated surface water drainage system that is isolated from the general storm water system)
- Diesel fuel day tanks have adequately sized vent lines terminating in the open air and at an elevation where overfilling will not cause tank rupture
- Temporary tanks and fixed engines are provided with a properly drained drip tray
- Discharge lines from all tanks are fitted with shut off devices capable of being operated from a safe position, ie outside the area where the tank is located
- Accessible level indicators are fitted to the storage tanks
- There is no storage of hazardous materials in flood plains or within 30m of watercourse
- Storage of hazardous materials in areas of known groundwater vulnerability is avoided
- Storage of hazardous materials is in designated hazardous storage areas

14.3.11.3 Accountability

Prior to commencing any site work, the Construction Contractor will develop the Pollution Prevention Management Plan. The Contractor is responsible for the implementation and audit of the effectiveness of the plan. The Contractor's performance will be monitored by the BTC Co Project Manager or delegate.

14.3.11.4 Monitoring & review

A report will be prepared prior to the start of any construction detailing the specific pollution prevention management measures.

Weekly reports will present the monitoring of compliance with the Pollution Prevention Management Plan. These reports will be prepared by the Contractor for submission to the BTC Co Project Manager or delegate. The BTC Co Project Manager or his delegate will audit the activities at least every six months.

14.3.11.5 Resources

Additional resources may be required in complex situations and these will be provided by the BTC Co. This situation may arise where community liaison is a particularly requirement.

14.3.12 Waste management plan

14.3.12.1 Introduction

Waste management plans will be developed for both the construction and operational phases of the project.

The construction contractor will be required to develop a construction specific waste management plan prior to the start of the construction work.

Upon completion of the commissioning phase, the Operations Waste Management Plan will be required.

It is expected that the operator will adopt some of the third party agreements made by the construction contractor as long-term disposal routes. It is also anticipated and that some or all of the waste handling/treatment/disposal facilities established during construction will be adopted for operational use.

14.3.12.2 Objectives of plan

The following are the objectives of the Waste Management Plan:

- To provide a consolidated summary of the various regulations and restrictions governing the generation, handling, treatment and disposal of wastes generated during the construction/commissioning phases of the project
- To provide any permitting requirements for waste treatment or disposal
- To provide detailed method statements for each element of the waste management handling, treatment and disposal process
- To identify any third party agreements for waste transfer or handling
- To provide proposals to audit waste management operations
- To identify responsible use of materials to minimize waste
- To specify requirements for monitoring of compliance with the plan to reduce visual impact from waste site
- To enforce strict duty of care on the project managers and the contractors
- To establish secure waste storage in defined areas away from watercourses, drains and aquifers and secure from vermin
- To prohibit of uncontrolled burning or burial waste
- To identify the requirements for the environmental review of potential landfill & incinerator sites including site selection & proposed operation mode
- To provide monitoring and auditing procedures
- To identify provisions for inert waste
- To ensure that all potential subsoil disposal sites and disposal plans are subject to an environmental review and an environmental risk assessment prior to their adoption
- To provide procedures for offsite disposal or long term storage of contaminated material

14.3.12.3 Accountability

Ultimate responsibility for correct waste disposal lies firmly with BTC Co. and in this role it will ensure that:

- Project contractor (s) have adequate training and follow stipulated waste management procedures for minimizing, handling and storing waste
- Waste disposal contractor(s) use facilities for treatment and disposal of waste that meet acceptable standards
- Audits are carried out to ensure these are achieved

14.3.12.4 Monitoring & review

The waste management plans will be monitored prior to the start of construction and monthly thereafter. During operational activities, the waste management plan review will be an integrated part of the EMS and will regularly audited throughout the year.

14.3.12.5 Resources

Detailed waste management procedures will be put in place including the requirement for consignment notes giving an accurate description of the waste. Consignment notes follow wastes to the ultimate disposal site/operator and provide an auditable trail. All personnel employed at the project facilities will receive formal waste management awareness training, particularly regarding the correct waste segregation, storage and labelling procedures and potential recycling of waste.

14.3.13 Oil spill and emergency response plans

14.3.13.1 Introduction

The Oil Spill and Emergency Response Plans will be required for both construction and operational phases.

For construction, an Oil Spill and Emergency Response Plans must be drawn up and implemented by the Contractor in order to minimize the negative impacts owing to potential oil spills and incidents during construction.

The operational Oil Spill Response Framework is contained in Appendix E, Annex V.

These plans will seek to minimize the risk of all oil spills, accidents and incidents during construction and subsequent operation of the BTC pipeline. The plans will address contingency planning, training, and specific procedures to address accidents and incidents.

14.3.13.2 Objectives

Construction phase

The following are the objectives of the Construction Oil Spill and Emergency Response Plans:

- Provide guidelines for responding to an incident involving a significant spillage of fuel/hydrocarbons
- Outline basic principles involved in a spill site assessment
- Provide guidance for selecting appropriate response procedures depending on the characteristics of the area in which the spill has occurred

In order to address these objectives the Construction Oil Spill and Emergency Response Plan will include as a minimum the following:

- Site assessments in terms of their environmental sensitivities
- Identification of potential accidents and incidents
- Identify types of environmental incidents and near misses
- Include a Contingency plan identifying material, personnel and contact numbers
- Procedures to be followed during an incident response
- Emergency response training for all construction crews
- Releases to the atmosphere, eg techniques for isolating the source
- Spillage on land: small spillage (less than 50 L), eg
  - Techniques for isolating the source
  - Use of absorbent material to mop up spill
  - Appropriate disposal of contaminated soil
  - Incident reporting
- Spillage on land: larger spillage (more than 50 L), eg
  - Techniques for isolating the source
  - Containment of the spread of the spill using sand bags
  - Excavation of trenches down hill of spill to intercept groundwater with absorbent material in trench
  - Appropriate disposal of contaminated material
  - Incident reporting
- Spillage into water, eg
  - Techniques for isolating the source
  - Deployment of a boom downstream of the spillage and spanning the entire watercourse
  - Angling of the boom to direct pollutant to one of the banks
  - Use of floating absorbent and/or skimmers to remove the pollutant
  - Removal of contaminated material from site in accordance with statutory regulations
- Procedures to dispose of contaminated material
- Procedures for investigating actions undertaken

The construction Oil Spill and Emergency Response Plans will include procedures for incident reporting. In all cases an incident report shall be issued within 48 hours of the incident. For significant cases (eg in excess of 50 L of hydrocarbon) the incident shall be reported immediately. The Contractor will comply with the reporting requirements of the local or national authorities.

Operational phase

The objectives of the Operational Emergency Response Plan are to define:

- Emergencies and their reporting
- Organisational structure and ensure effective interfacing with stakeholders
- Procedures
- Resources
- Training

In order to address these objectives the Operational Emergency Response Plan will include as a minimum the following:

- Definition of an emergency
- Identification, initial reporting and classification of emergencies
- The Emergency Response organisation and management structure
- Interfaces with authorities, affected third party organisations and the public
- Emergency Response resources (manpower and equipment, etc)
- Responsibilities of Emergency Response personnel
- Specific procedures to be followed, including evacuation
- Training requirements for assigned emergency personnel
- Procedures for testing, reviewing and updating the plans and procedures

Operational Oil Spill Response Plan

A detailed risk assessment has been undertaken for the BTC project by BP (see Section 10). An operational Oil Spill Response Framework has been prepared and is enclosed at Appendix E, Annex V.

The objectives of the operational Oil Spill Response Plan are to:

- Control a release, which may arise from a fault in the operation of the pipeline and associated facilities
- Minimize the volume of such releases, when they do occur, by securing the source in the most appropriate way
- Minimize the extent of movement of the released oil spill from the source, by timely containment
- Minimize the environmental impact of primary releases by timely containment and recovery response
- Maximise the effectiveness of the recovery response through the selection of both the appropriate equipment and the technique to be employed. This will be based on the knowledge of the relevant properties of the oil and the changes in their properties arising from the ambient conditions into which they are released and the sea and land conditions and morphologies onto which they are released
- Maximize the effectiveness of the response through trained and competent, operational and response teams

14.3.13.3 Accountability

Prior to commencing any site work, the Contractor will develop a construction Oil Spill and Emergency Response Plans. The Contractor is responsible for the implementation and audit of the effectiveness of these. The Contractor's performance will be monitored by the BTC Co Project Manager or his delegate.

During operation the BTC Co will be responsible for the Operational Emergency Response Plan and Operational Oil Spill Response Plan.

14.3.13.4 Reporting

Monthly reports will present the monitoring of compliance with the Oil Spill and Emergency Response Plan. These reports will be prepared by the Contractor for submission to the BTC Co Project Manager or his delegate. The BTC Co Project Manager or his delegate will audit the activities of the Contractor's Community Liaison Team at least every six months.

14.3.13.5 Resources

The Contractor will be responsible for the Construction Oil Spill and Emergency Response Plan. Additional resources may be required in complex situations and the Contractor will provide these.

The BTC Co Project Manager or his delegate will be responsible for the Operational Emergency Procedures Plan and Operational Oil Spill Response Plan.

14.4 CONSTRUCTION AND OPERATION PHASE MONITORING

14.4.1 Construction phase monitoring

This section presents the different monitoring activities that will be undertaken throughout the construction activities. Monitoring is an important element of the overall EMS, encouraging implementation of the agreed measures and providing information on their effectiveness. Where mitigation measures are not effective, they will be reviewed and alternative strategies put in place.

Table 14-3 presents environmental monitoring activities for generic construction impacts & their associated specific mitigation measures on the ROW, as set out in Section 10. Figure Maps 14a-f present a summary of the mitigation measures proposed along the pipeline route.

Monitoring of social impacts mitigation (both on the ROW and in local communities) as set out in Section 11, are outlined in Table 14-4.

Where monitoring highlights that mitigation measures are ineffective or have not been fully complied with BTC Co will immediately discuss with the contractor the following:

- Steps required to ensure compliance with overall objectives
- Feasibility of mitigation measure, including cost effectiveness, so that more appropriate measures can be agreed if necessary

whether the impact has already been fully mitigated.

14.4.1.1 Key performance indicators

Key performance indicators will be set for both environmental and social management of key issues. These will be discussed and set with contractors during bid negotiations and will be integral to BTC Co's monitoring of the contractor's environmental and social management performance. Positive financial incentives may be attached to the achievement of these.

14.4.1.2 Actions and responsibilities

BTC Co monitoring and assurance activities will be mainly associated with oversight and audit of the construction contractors and the construction process following the review and approval of the contractor's method statements. In this role BTC Co will be assisted as required by experienced consultants, independent third parties, and inspection companies.

BTC Co activities will consist of the following:

- Spot-check verification of contractors' own monitoring procedures
- Audits and compliance reviews of environmental and social elements of the contract (including the ESIA)

Table 14-3 Environmental ROW monitoring activities

Receptor	KP	Potential Impact	Mitigation	Monitoring and *Frequency (BTC Co to undertake all auditing activities)*
Water Resources	0-26.3, 29, 31.9-37.5, 51-54, 73, 76, 82.5, 84.5, 114.9, 119.5, 135.3, 137.3, 172.2, 177-186 197.9, 199.6, 204.5, 205, 205.9, 210.6, 211.2, 213.5, 214.6, 221.6, 222.1, 231.5, 238.3-239, 241, 243.4-243.7	Release of suspended solids to watercourses during construction which has impact on aquatic fauna and flora	Construction Contractor to adopt river crossing construction measures to minimize disturbance to fish (continuity of water flow, sediment control measures, restrictions of potentially contaminating operations within floodplain)	On-site audit of compliance with mitigation measure *At least once at start of crossing activity and at least weekly until reinstatement is complete and approved by BTC Co*
	52-54.2, 145.5-154.5-208.7, 219.5-221.2	Erosion of ROW or other partially reinstated areas	Construction Contractor to implement temporary reinstatement after each construction season in high erosion risk areas, and a permanent reinstatement for the entire ROW	On-site audit of compliance with mitigation measure *At the end of each construction season and on completion of construction activity*
	0-26.5, 28.7-38, 50.1-54.8, 72.3-73.5, 75.6-76.6, 82-84.9, 111-113.1, 114.5-129, 134.1-135.5, 137-138, 156-167, 172-172.8, 176.4-177.5, 179-185, 197.7-198.3, 204-206.4, 210.3-215.1, 221-223, 236-244	Discharge of sanitary waste water to water courses	Construction Contractor to ensure that treated wastewater discharge and hydrotest water do not impact surface water ecology (treatment facility)	On-site audit of compliance with mitigation measure *At least once at start of crossing activity and at least weekly throughout the duration of construction activities*

Receptor	**KP**	**Potential Impact**	**Mitigation**	**Monitoring and *Frequency (BTC Co to undertake all auditing activities)***
	ALL	Spill of fuel or liquid waste and contamination of groundwater	Construction Contractor to adopt strict fuelling and spill control procedures	On-site audit of compliance with mitigation measure *Ongoing*
Ecology	0-26.3, 29, 31.9-37.5, 51-54, 73, 76, 82.5, 84.5, 114.9, 119.5, 135.3, 137.3, 172.2, 177-186 197.9, 199.6, 204.5, 205, 205.9, 210.6, 211.2, 213.5, 214.6, 221.6, 222.1, 231.5, 238.3-239, 241, 243.4-243.7	Damage to riparian flora and fish during construction	Construction Contractor to adopt river crossing construction measures to minimize disturbance to fish (continuity of water flow, sediment control measures, restrictions of potentially contaminating operations within floodplain)	On-site audit of compliance with mitigation measure *At least once at start of crossing activity and at least weekly throughout the duration of construction activities*
	0-26.5, 28.7-38, 50.1-54.8, 72.3-73.5, 75.6-76.6, 82-84.9, 111-113.1, 114.5-129, 134.1-135.5, 137-138, 156-167, 172-172.8, 176.4-177.5, 179-185, 197.7-198.3, 204-206.4, 210.3-215.1, 221-223, 236-244	Disturbance of surface waters owing to effluents discharge, hydrotest water discharge and abstraction	Construction Contractor to ensure that abstractions and discharges of hydrotest water do not impact hydrogeological balance of small lakes and surface water courses	On-site audit of compliance with mitigation measure: • *Prior to beginning abstraction or discharge* • *At least once at start of activity and at least weekly throughout the duration of construction activities*

Receptor	KP	Potential Impact	Mitigation	Monitoring and *Frequency (BTC Co to undertake all auditing activities)*
	28.7-29.4	Damage to riparian and aquatic ecology owing to directional drilling and mud circulation pits	Construction Contractor to adopt procedures during drilling to minimize release of drilling muds to the river	On-site audit of compliance with mitigation measure
	ALL	Loss of topsoil during prolonged storage	Construction Contractor to stabilise topsoil stockpiles and prevent topsoil losses	On-site audit of compliance with mitigation measure *Once on completion of stockpile activity and monthly thereafter until the topsoil is returned to ROW*
	ALL	Damage due watercourses as a result of discharge of groundwater from trenches	Construction Contractor to ensure that adequate management of groundwater occurs in the pipeline trench, including monitoring of water quality and selection of suitable discharge locations if re-circulation is not possible	On-site audit of compliance with mitigation measure *Whenever trench dewatering is required*
	29.4-53.2	Construction activities may disturb rare lizard populations	BTC Co or specialist contractor to undertake pre-construction site survey and review need for specific management measures such as relocation	Review pre-construction site survey and recommendations *Prior to clearance of the ROW*

Receptor	KP	Potential Impact	Mitigation	Monitoring and *Frequency (BTC Co to undertake all auditing activities)*
	0-26.3, 29, 31.9-37.5, 51-54, 73, 76, 82.5, 84.5, 114.9, 119.5, 135.3, 137.3, 172.2, 177-186 197.9, 199.6, 204.5, 205, 205.9, 210.6, 211.2, 213.5, 214.6, 221.6, 222.1, 231.5, 238.3-239, 241, 243.4-243.7	Damage to fish and spawning grounds owing to sediment discharge	Construction Contractor to adopt river-crossing construction measures to minimize disturbance to fish (continuity of water flow, sediment control measures, restrictions of potentially contaminating operations within floodplain). Construction Contractor to ensure that abstractions and discharges of hydrotest water do not impact hydrogeological balance of small lakes and surface watercourses	On-site audit of compliance with mitigation measures: • *Prior to beginning abstraction or discharge* • *At least once at start of activity and at least weekly throughout the duration of construction activities*
	72.8-84, 180.6-186.3, 185.2-197, 197-204	Loss of sensitive floral habitat meadows	BTC Co or Specialist Contractor to undertake pre-clearance surveys and relocation/conservation projects to manage floral species	Review pre-clearance surveys and recommendations *Prior to clearance of the ROW*
	77.3-78.8, 81.2, 82-82.7, 83-86.7, 87.8-88.5, 89.2, 89.9-90.4, 91.3-92.1, 139.7-140.5, 145.4, 177.2-178.6, 180.2-182.3, 184.9-189, 192.4-193.5, 194.5-196.6, 198.3-199, 201.5, 202.5-203, 205.2, 206.3, 221.7-222.3, 238.6-239	Loss of forest and adverse impacts on wildlife	BTC Co Specialist Contractor to replant 15 trees for every 10 trees felled at locations to be agreed with forestry and environmental agencies	Review pre-clearance survey and recommendations *On going care of the ROW reinstatement will include long term management of trees*

Receptor	KP	Potential Impact	Mitigation	Monitoring and *Frequency (BTC Co to undertake all auditing activities)*
	ALL	Loss of sensitive floral habitats	BTC Co or Specialist Contractor to ensure that reinstatement of suitable floral species reflects habitat characteristics	Review pre-clearance survey and recommendations *After relocation/planting has been carried out*
	89-89.3, 175.8, 178.8- 180, 184.8-185.9, 189.9-190.5, 191.5-191.7, 243.6	Loss of forest and adverse impacts on large and medium-sized mammals	BTC Co or Specialist Contractor to implement conservation projects to preserve rare and endangered wildlife species disturbed by clearance process	Review pre-clearance survey and recommendations *Ongoing*
	84-92	Loss of continuous forest habitat and meadows with adverse impacts on floral associations and large and medium-sized mammals	BTC Co or Specialist Contractor to undertake pre-clearance surveys to manage floral species. Construction Contractor to replant 15 trees for every 10 trees felled. BTC Co or Specialist Contractor to ensure reinstatement of suitable floral species to reflect habitat characteristics. BTC Co to implement conservation projects to preserve rare and endangered species disturbed by clearance process	Review pre-clearance survey and recommendations *Prior to ROW clearance and after planting has been carried out*
	29-53.4, 87.5-91.4, 153-164.8, 175-204, 238.2-238.9	Disturbance to sensitive fauna	Construction Contractor to limit high disturbance activities to faunal species during defined time periods To be agreed with BTC Co	Review pre-clearance survey and recommendations *Daily until completion of the activities*
	82.2-99, 153-164.8, 175-204	Disturbance to wildlife	BTC Co to develop a wildlife monitoring programme in forest areas	Compliance with plan. *Ongoing*

Receptor	KP	Potential Impact	Mitigation	Monitoring and *Frequency (BTC Co to undertake all auditing activities)*
	92-108	Loss of high mountain meadow habitat as a result of construction	BTC Co Specialist Contractor to undertake pre-clearance surveys to manage floral species. Construction Contractor to ensure reinstatement of suitable floral species reflects habitat characteristics. Implement conservation projects to preserve rare and endangered species disturbed by clearance process	Review pre-clearance survey and recommendations *Prior to ROW clearance and after planting has been carried out*
	92-105.5	Loss of marsh orchid as a result of construction	BTC Co or Specialist Contractor to undertake pre-clearance surveys to manage floral species. Implement conservation projects to preserve rare and endangered species disturbed by clearance process through relocation (botanical gardens or off the ROW)	Review pre-clearance survey and recommendations *Ongoing*
	108-120	Damage to feeding grounds of migratory birds owing to discharges to water courses	BTC Co to develop a wildlife monitoring programme in forest areas	Review survey and recommendations *Ongoing*
	151-157	Damage to R*hododendron caucasicum* scrub and black grouse populations	BTC CO Specialist Contractor to undertake pre-clearance surveys to manage floral species. Construction Contractor to replant rhododendron habitat after completion of construction. Construction Contractor to carry out clearance of the ROW before 1st May or after June 30th to avoid disturbance to black grouse during nesting/breeding	Review pre-clearance survey and recommendations *During ROW clearance and after planting has been carried out*

Receptor	KP	Potential Impact	Mitigation	**Monitoring and** ***Frequency (BTC Co to undertake all auditing activities)***
	157-160	Damage to wetlands and indirect impacts on mammals owing to construction	Construction Contractor to avoid blasting and trenching during the months of April and May. BTC Co to develop a wildlife monitoring programme	Review pre-clearance survey and recommendations *Ongoing*
	157-160	Damage to wetlands and indirect impacts on flora owing to construction	BTC Co Specialist Contractor to undertake pre-clearance surveys to manage floral species. BTC Co Specialist Contractor to ensure that reinstatement of suitable floral species reflects habitat characteristics	Review pre-clearance survey and recommendations *Prior to ROW clearance and after planting has been carried out*
	238-238.5	Damage to globe-daisy populations owing to river crossing activity	BTC Co Specialist Contractor to undertake pre-clearance surveys to manage floral species. BTC Co Specialist will replant suitable number of globe daisy. BTC Co Specialist Contractor to ensure reinstatement of suitable floral species reflects habitat characteristics	Review pre-clearance survey and recommendations *Prior to ROW clearance and after planting has been carried out receipt of report*
	243-243.8	Damage to solitary oriental thorn specimen owing to construction activity	BTC Co Specialist Contractor to undertake pre-clearance surveys to manage floral species. BTC Co Specialist Contractor to ensure reinstatement of suitable floral species reflects habitat characteristics. BTC Co to implement conservation projects to preserve rare and endangered species disturbed by clearance process	Review pre-clearance survey and recommendations *Prior to ROW clearance and after planting has been carried out*

Receptor	KP	Potential Impact	Mitigation	Monitoring and *Frequency (BTC Co to undertake all auditing activities)*
Noise and vibration	2, 4, 8.7, 11.5, 15, 15.35, 19.8, 20.8, 22.8, 26-27, 28.7, 30.7, 31.5, 34.3, 35, 36.3, 36.3-39, 39.1, 39.3, 40.5, 42.5, 42-45.5, 52.8, 53, 53.4, 54.2, 56.8, 57-59.6, 73.7, 77.4, 77.9, 79.2, 80.2-82, 83-84.2, 111.8, 112.2, 115-115.8, 118.8-119.5, 119.8, 127.3, 127.5, 129.3, 134.3, 135.3, 134.7-135.9, 138-139.5, 138.2-139.6, 163.6-164.5, 184.7-185.3, 197.8-199.8, 205.2, 209.3-211.8, 213.6-215.1, 222.3, 223.6-224.8, 225, 226.5, 228.4, 231.4, 237.4, 239.4, 241, 241.8, 241.2-242.6, 247.2, 247.7	Nuisance to human receptors	Construction Contractor to minimize noisy operations during nighttime. Construction Contractor to ensure the use of noise control techniques on noisy equipment	On-site audit of compliance with mitigation measure *Weekly throughout the duration of construction activities*
	29-53.3, 87.5-91.3, 107.8-120, 151-164.5, 175-203.9, 238.2-238.8	Disturbance to fauna	Contractor to limit high disturbance activities to faunal species during defined time periods. BTC Co to develop a wildlife monitoring programme in forest areas. Contractor to minimize noisy operations during nighttime. Contractor to ensure the use of noise control techniques on noisy equipment	Compliance with programme On-site audit of compliance with mitigation measure *Weekly throughout the duration of construction activities*

Receptor	**KP**	**Potential Impact**	**Mitigation**	**Monitoring and *Frequency (BTC Co to undertake all auditing activities)***
Air quality	All	Emissions of GHS to atmosphere	Construction Contractor to adopt best control technologies to reduce emissions to atmosphere	On-site audit of compliance with mitigation measure *Ongoing*
	2, 11.5, 15.4, 22.8, 26-27, 28.7, 30.7, 31.5, 36.3-39, 39.1, 40.5, 57-59.6, 112.2, 118.8-119.5, 127.5, 135.3, 138.2-139.6, 184.7-185.3, 228.4, 237.4, 247.2, 247.7	Nuisance to human receptors during construction	Construction Contractor to implement dust suppression techniques on ROW when working near residential areas during dry weather conditions	On-site audit of compliance with mitigation measure *Ongoing*
Soil	ALL	Reduced value of topsoil during stockpiling	Construction Contractor to stabilise topsoil stockpiles	On-site audit of compliance with mitigation measure *Ongoing*
	All	Erosion of topsoil	Construction Contractor to implement an interim reinstatement plan after each construction season and a permanent reinstatement plan for the entire ROW	On-site audit of compliance with mitigation measure *Ongoing*
Landscape and visual intrusion	9.1, 18, 28, 34.5, 51.1, 55.9, 76.4, 87, 94.1, 109.5, 119, 128.5, 137, 138.4, 146.8, 154.6, 161.1, 178.8, 182.9, 187.3, 196.9, 205, 213, 221.3, 223.7, 237.8, 243.5	Long term visual intrusion as a result of construction of AGIs	Construction Contractor to implement a landscaping plan for all AGIs and all areas of high landscape value	*On site audit of landscape plan implementation by BTC Co*

Receptor	KP	Potential Impact	Mitigation	Monitoring and *Frequency (BTC Co to undertake all auditing activities)*
	29, 31.9-37.5, 51-54, 73, 76, 82.5, 84.5, 114.9, 119.5, 135.3, 137.3, 172.2, 177-186 197.9, 199.6, 204.5, 205, 205.9, 210.6, 211.2, 213.5, 214.6, 221.6, 222.1, 231.5, 238.3-239, 241, 243.4-243.7	Construction and reinstatement will cause landscape impacts at river crossings	Construction Contractor to comply with the implementation requirements of landscaping plan for all general guidance provided for select examples of river crossings	On-site audit of compliance with mitigation measure *On site audit of landscape plan implementation by BTC Co*
	84-92 182-186	Construction and reinstatement will cause landscape impacts in forest areas	Construction Contractor to comply with the implementation requirements of landscaping plan for all forest areas	On-site audit of compliance with mitigation measure *On site audit of landscape plan implementation by BTC Co*
Contami-nation of land	ALL	Accidental spills	Construction Contractor to adopt strict fuelling and spill control procedures	On-site audit of compliance with mitigation measure *Ongoing*
Archae-ology	0-9, 13, 52-68, 84-101, 102.4-h105.7, 121.2-128, 139-141, 155, 169-170, 181-185, 213-218.7, 223.5-246.5	Damage to known or yet unknown archaeological sites through excavation	Construction Contractor to comply with the implementation requirements of heritage and archaeological management plan. Archaeologists to be on site during clearance and trenching operations	On-site audit of compliance with mitigation measure *Ongoing*

Table 14-4 Social monitoring plan during construction

Mitigation Measure	Monitoring Action	Responsibility for Monitoring	Frequency/Timing
DURING CONSTRUCTION			
Community Relations			
Community Grievance Process	Spot follow up of complaints recorded in complaints register to assess whether process has been carried out correctly	BTC Co Community Relations Team	Monthly
General Community Relations Management	Random attendance at community meetings: 1. Preliminary meetings – to assess whether appropriate information is being provided to communities and whether sufficient information collected from communities in order to ensure mitigation will be carried out effectively (eg road documentation process, identification of bee owners, etc) 2. Meetings during construction in vicinity of village to assess whether complaints and issues are being dealt with effectively and to gauge the feelings of community members towards the project Spot monitoring on whether liaison with informal communities (eg herders, internally displaced people) who are affected by the construction process have been consulted with. (Check for written reports of meetings, talk with these communities informally to ask whether they have been consulted)	BTC Co Community Relations Team	Meeting each month for communities along pipeline route Bi-monthly for community meetings at worker camp affected locations Bi-monthly for informal communities along route
Worker induction training (by CLOs)	Review induction training materials Review induction training course	BTC Co Community Relations Team	Before implementation of training Once during main recruitment period along route, once more during any secondary recruitment drives further along route

Mitigation Measure	Monitoring Action	Responsibility for Monitoring	Frequency/Timing
Worker Camp Disciplinary Procedures	Review HR Records, disciplinary log books, etc at worker camps to ensure that worker camp rules are being implemented effectively, the extent to which there are infringements of the rules, and the effectiveness of community liaison following any incident	BTC Co Community Relations Team	Once two months after a camp is in operation. If major issues are found, then review one month later, until issues are being managed satisfactorily. If issues found in first review are minor, monitor each 3-4 months during operational lifetime
General Review of Community Relations Mitigation Measures	Monitor any changes to community relations mitigation measures via: formal review meetings with CLO team. Acceptance of formal requests for changes to measures where appropriate. Spot checks to identify where mitigation has changed but has not been notified to BTC Co via general review of mitigation activities	BTC Co Community Relations Team	Every month for first three months and then on a six monthly basis or as needed. Monthly at worker camps and at construction sites on ROW
Construction Impacts			
Implementation of general construction mitigation measures	Spot checks at ROW, construction sites and affected communities to ensure mitigation measures are being implemented. This will look specifically at: • Implementation of measures to avoid disruption to infrastructural services such as telecoms, electricity, gas and water • Implementation of community safety measures (fencing near residential areas, fencing on public trench crossings, warning lights and warning signs at open areas of trench) • Suitable diversions are in place where necessary • Dust and noise mitigation measures are in place • Alternative water sources are provided as appropriate	BTC Co – Engineering Project Manager and BTC Co Community Relations Team	Monthly for first 3 months. If implementation of mitigation measures is proceeding appropriately, reduce monitoring to bi-monthly with review of written activity reports submitted on a weekly basis

Mitigation Measure	Monitoring Action	Responsibility for Monitoring	Frequency/Timing
	• Activity is taking place only within approved construction areas and these approved areas are clearly de-marcated • Sediment prevention measures are in place as appropriate • Quality of repair work done on any damaged property (egg houses, fencing, irrigation channels, etc) is acceptable to BTC CO and has been agreed as acceptable with property owner. With housing compare repaired state with documentation from pre-construction assessment • Equipment secured appropriately over night and night security and storage measures are being implemented (egg organic waste removed, night watchmen employed, lighting over open trench)		
Traffic Management Plan	See Environmental monitoring measures		
Additional project sites	Verify that appropriate social impact assessment and consultation has been completed for any additional sites to be used by project (eg waste sites, aggregate sites, additional camps or pipeyards). Review documentation of community consultation data as appropriate	BTC Co Community Relations Team and Environmental Management Team	As needed
Community consultation on roads	Spot monitoring of community consultation and documentation re construction of new roads and quality of existing roads	BTC Co Community Relations Team	In two to three locations during in first two to three months of construction process. If implementation of measures is considered insufficient, continue to monitor two to three communities on a bi-monthly basis. If implementation is satisfactory, spot monitor two to three communities on a six monthly basis

Mitigation Measure	Monitoring Action	Responsibility for Monitoring	Frequency/Timing
Condition of roads	Routine monitoring standard of roads being used during construction process (as identified in the TMP) against initial documentation	BTC Co – Engineering Project Manager	Monthly for first three months. If implementation of mitigation measures outlined in Section 11 is proceeding appropriately, reduce monitoring to bi-monthly with review of written activity reports submitted on a weekly basis
Use of Power and Water resources by project	Review monthly power and water reports to assess whether they are within guidelines set out in ESIA and spot monitor at worker camps during construction/AGIs (during operation) to verify data being reported	BTC Co Community Relations Team in conjunction with Engineering Project Manager	Monthly review of reports Six monthly spot reviews. If resource usage is considerably over guidelines, monitor every two months until usage is within acceptable norms
Local Sourcing	Review of purchasing arrangements against local sourcing plan and targets/KPIs set during bid negotiations	BTC Co Community Relations Manager	Bi-monthly
Health and Safety			
Community safety	Spot monitoring of health and safety incidence rates for community members and full review of any serious incidents. Spot monitoring of community traffic safety meetings	BTC Co Health and Safety manager	Monthly Two to three times in first four months and if training is seen as acceptable, revert to once every six months. If training is not of sufficient quality then continue at two to three every four months

Mitigation Measure	Monitoring Action	Responsibility for Monitoring	Frequency/Timing
General safety measures during construction	Spot monitoring of implementation of safety measures during construction as outlined in 'Implementation of general construction mitigation measures', General Construction Impacts section above	BTC Co – Engineering Project Manager	Monthly for first three months. If implementation of mitigation measures is proceeding appropriately, reduce monitoring to bi-monthly with review of written activity reports submitted on a weekly basis
Health and safety training	Monitor HR records to ensure training is provided to all workers and spot monitor all courses (general health and safety, safe driving training, job specific health and safety) provided to ensure training is adequate	BTC Co Health and Safety Manager	
Employment			
Recruitment targets	Monitor monthly recruitment targets through monthly reports from construction contractor	BTC Co Community Relations Team	Monthly
Recruitment process	Assess construction contractor's recruitment strategy for effectiveness at ensuring reasonable geographic spread before recruitment begins. Validation of appropriate identification system. Review job descriptions to be provided at recruitment centres to ensure accurate and adequate information is provided	Independent third party, eg NGO BTC Co Community Relations Team	Pre-construction Pre-construction and as new job descriptions are developed
Inequities in recruitment process	Independent person to oversee all recruitment in addition to BTC Co person. Sample monitoring of recruitment days	BTC Co Community Relations Team Independent third party, eg NGO	All major recruitment days Presence at two to three of monitoring days in initial recruitment round

Mitigation Measure	Monitoring Action	Responsibility for Monitoring	Frequency/Timing
Working Conditions	Sample audits of Constructor's HR documentation recording working conditions for all workers. This should include inspection of records of hours worked, wages paid, disciplinary actions taken, etc	BTC Co Human Resources and Community Relations Teams	Once in first three months. If conditions meet local legal requirements and international standards, spot review every six months. If standards have not been met, spot review every one-two months until standards are reached

14.4.2 Operational phase monitoring

The following table presents the operational monitoring plan. Environmental impacts associated with the operation of an oil pipeline are limited to surveillance activities of the ROW and the operation of the AGIs. Therefore the unit based impact assessment methodology previously used for construction activities no longer is applied. Impacts are presented on a site or activity basis.

Table 14-5 Operational phase monitoring

Receptor	Location of Impact	Potential Impact	Mitigation	Responsibility for Implementation
Water Resources	ROW	Release of sediments as a result of scour around pipe	Undertake periodic monitoring of river crossings and gorge crossings for signs of instability. This will be undertaken as part of pipeline surveillance	Operator
	AGIs	Discharge of sanitary waste water to water courses	Discharges of treated effluent from permanently manned facilities will be monitored regularly	Operator
	AGIs	Spill of fuel or liquid waste and contamination of groundwater	Integrity of secondary containment for all petroleum containing tanks at Pump stations and valves to be monitored monthly	Operator
Ecology	ROW	Soil erosion and habitat deterioration	Ongoing inspection and maintenance of drainage control and erosion control features. This would be undertaken during operation as part of pipeline inspection. No vehicular access on reinstated ROW other than in case of emergency. This will be achieved by gates / restricted access and appropriate signs. Illegal access to the ROW will be discouraged by means of placing obstructions, such as fencing, large stones, logs, etc. along key locations of reinstated ROW. Maintenance of reinstated areas and areas damaged by third party vehicular access or by emergency access. Damaged areas will be identified through pipeline surveillance undertaken by horse or foot on a weekly basis	Operator

Receptor	Location of Impact	Potential Impact	Mitigation	Responsibility for Implementation
	AGIs	Noise disturbance	Noise suppression technologies for pump station drivers and valves generators will be adopted. Techniques will include buffer zones such as re-forested areas or screening rows. In addition, periodic noise monitoring will be undertaken to determine the effectiveness of such measures	Operator Specialist Ecological/Noise Contractor
	AGIs	Visual disturbance	Suitable lighting will be adopted (vertical diffusion lighting) to minimize glow effect of pump stations (particularly PSG2) at night. Specialist Ecological/Lighting Contractor	Operator Specialist Ecological/Lighting Contractor
Noise	AGIs	Noise nuisance	Noise evaluation will be undertaken if new dwellings or built up structures which are constructed within 500m of project pump stations and IPSs	Operator Specialist Noise Contractor
Air Quality	AGIs	Emissions and nuisance	Emissions monitoring of combustion plant on an annual basis for NO_x, SO_2, CO, and particulate matter will be undertaken. All combustion plant to operate on CTD (or equivalent) with a maximum sulphur content of 0.2%. Combustion plant to be dual-fuelled and will operate on natural gas as soon as practicable when an appropriate source becomes available	Operator Specialist air consultants and operators
Contamination of land	AGIs	Spills and leaks	Refer to oil spill and emergency response plan	Operator
Soil	AGIs	Spills and leaks	Integrity of secondary containment for all petroleum containing tanks at Pump stations and valves to be monitored monthly	Operator

Receptor	Location of Impact	Potential Impact	Mitigation	Responsibility for Implementation
Landscape and visual intrusion	AGIs	Degradation of landscape over time	A landscaping plan will be implemented which will use grass, shrubs and trees, where practicable, to screen the AGIs and associated access roads. These plans will be integrated at the design stage for major AGIs (pump stations and IPSs) and at construction stage for other AGIs. Screening will be subject to ongoing monitoring. Other mitigation measures applicable to all AGIs are: Within the perimeter of the AGI, buildings and facilities will be interspersed with open grass cover and where practicable, shrubs and trees. Built structures, fences and gates will be painted using colours sympathetic to the surrounding environment; Site lighting (where applicable) will be designed and located to reduce off-site glare to a minimum, and minimize the impact on visual amenity at night, having regard to security and safety requirements	Operator
Heritage and Archaeology	ROW	Contamination as a result of spills	Implement oil spill and emergency plan	Operator
Community Relations – General	ROW and facilities	Resentment towards pipeline	Random presence at community meetings	Operator, 6 monthly
Community Relations – Infrastructure	ROW and Facilities	Hostility towards pipeline	Publication of power draw figures	Operator, Monthly
Local employment	ROW and Facilities	Local employment is maximised	Monitor local employment figures and report on website	Operator, 6 monthly

14.4.3 Institutional monitoring

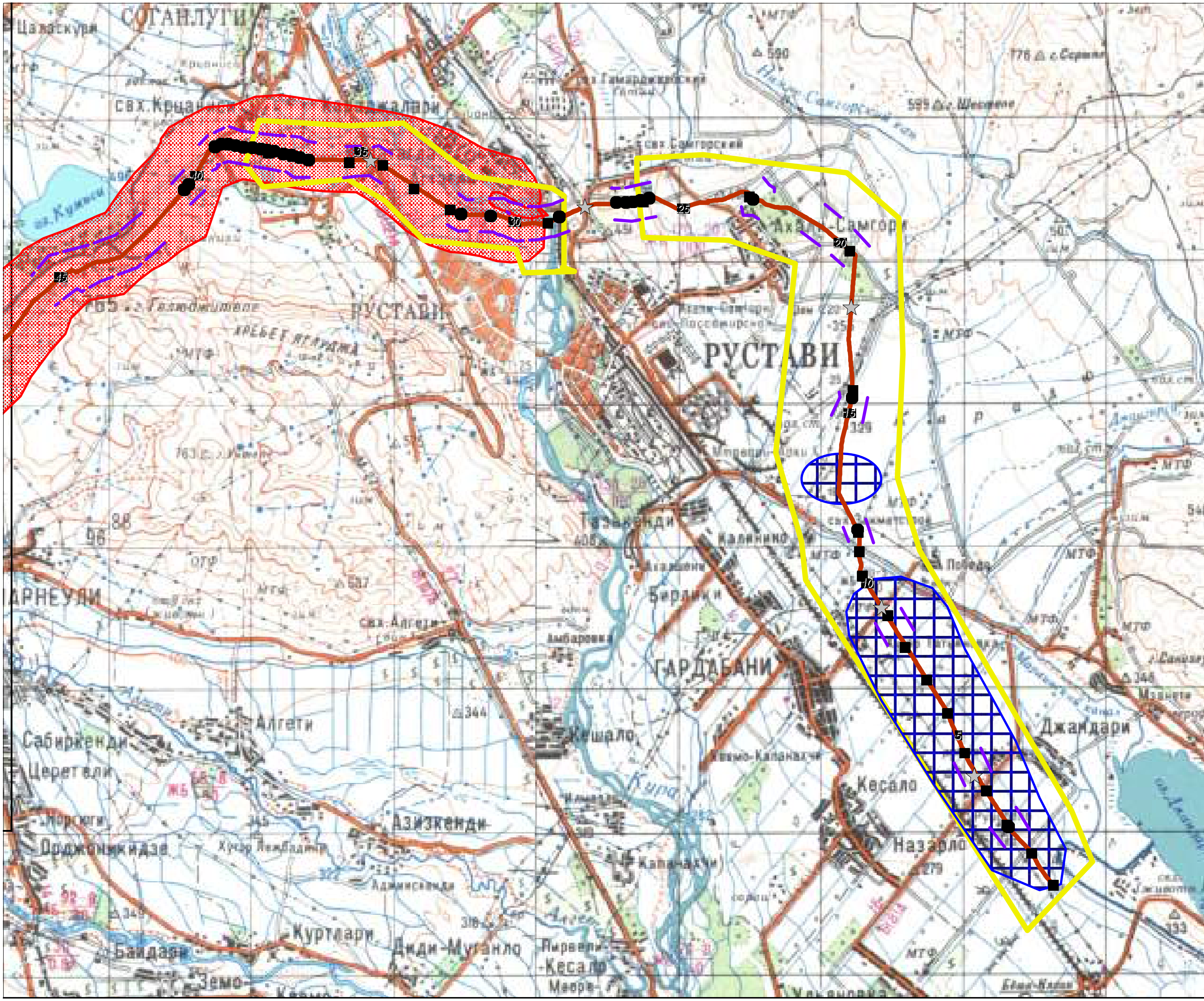
It is likely that the BTC Project will seek international finance. This ESIA will be submitted to the IFC for their review and approval.

It is likely that the IFC will also take a role in checking the implementation of commitments made in the ESIA. This may include audit and reviews during both construction and operations phases.

14.4.4 Monitoring of the EMS

The environmental management of the project will be continually subjected to assurance review through a series of internal and external audits. The EMS for both construction and operation phases must be meet ISO 14001 requirements. Hence, audits of the EMS will be conducted against the requirements of this standard, as well as the requirements contained within this section as relevant. These will be recorded and reported and corrective actions issued for any non-compliance.

As noted in the section above, the Construction Contractor is responsible for development and implementation of an EMS, including the requirements and framework plans specified in this ESIA. BTC Co will review and approve the final plans. BTC Co's principal role will be one of assurance that the Construction Contractor is effectively implementing mitigation measures and management plans.



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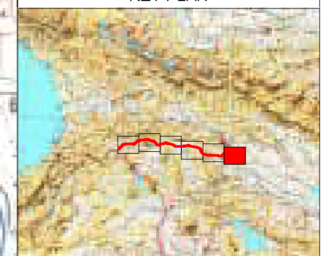
NOTES

1. COORDINATE SYSTEM PARAMETERS:
ELLIPSOID: KRASSOVSKY (1940)
PROJECTION: GAUSS-KRUGER
GEODETIC DATUM: PULKOVO (1942) ZONE 8
VERTICAL COORDINATE SYSTEM: KRONSTADT (BALTIC SEA) DATUM

2. MAPPING IS BASED ON SCANNED 1:200,000 DATA.

KEY PLAN



LEGEND

- Current Route with KPs
- Pre-clearance surveys
- Tree replanting
- Floral conservation projects
- Limit disturbance to fauna
- Wildlife monitoring programme
- Water mitigation measures
- Heritage and archaeological management plan
- Reinstatement to avoid erosion
- River crossings mitigation measures
- Landscaping plan
- Dust and air emissions suppression measures
- Noise mitigation measures

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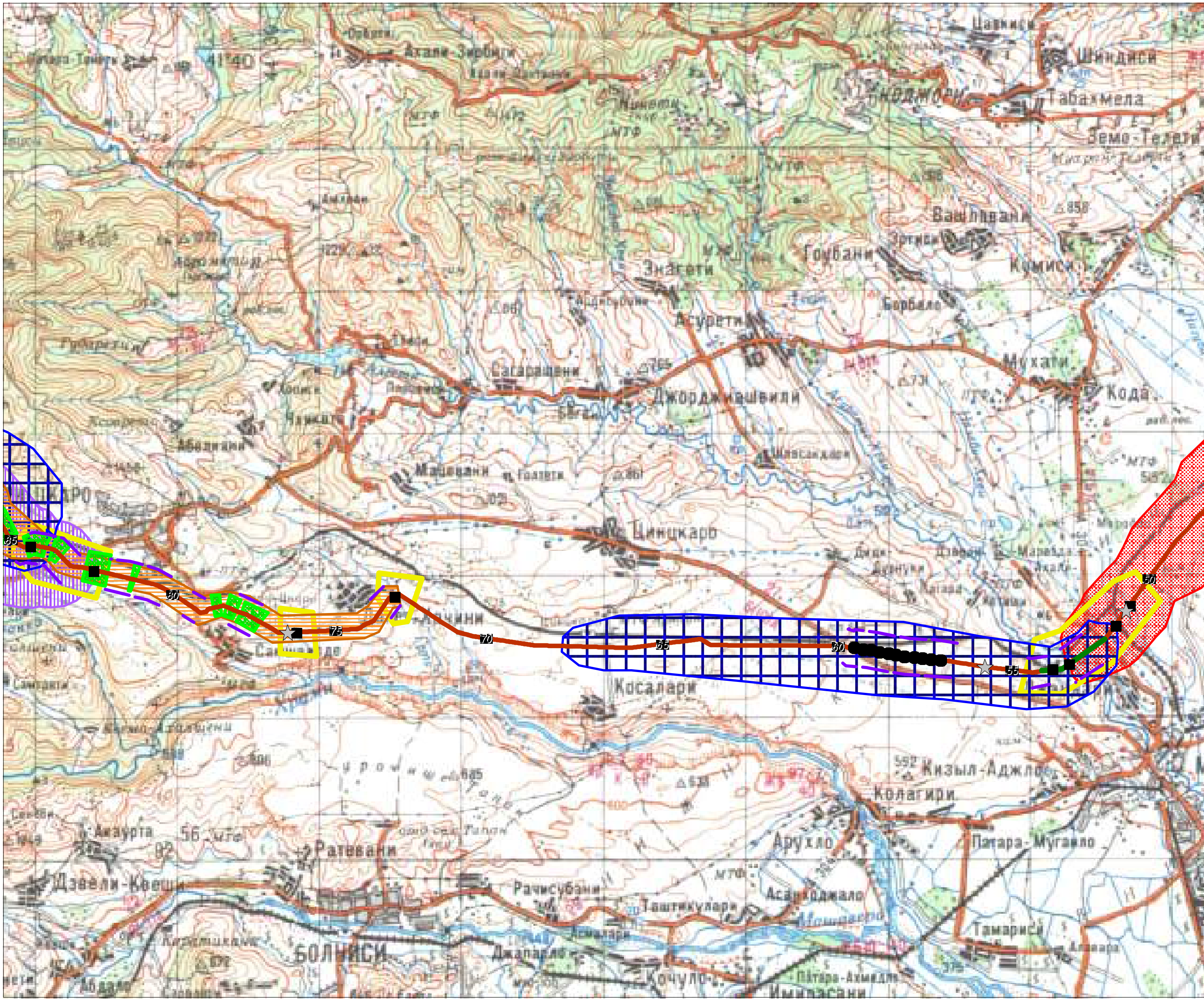
BTC ESIA

TITLE: **Mitigation Measures**

SCALE 1:100,000

Figure: MAP 14a



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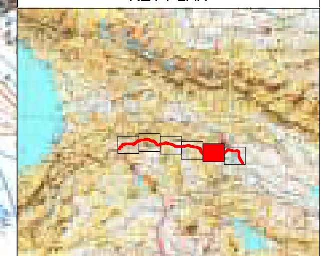

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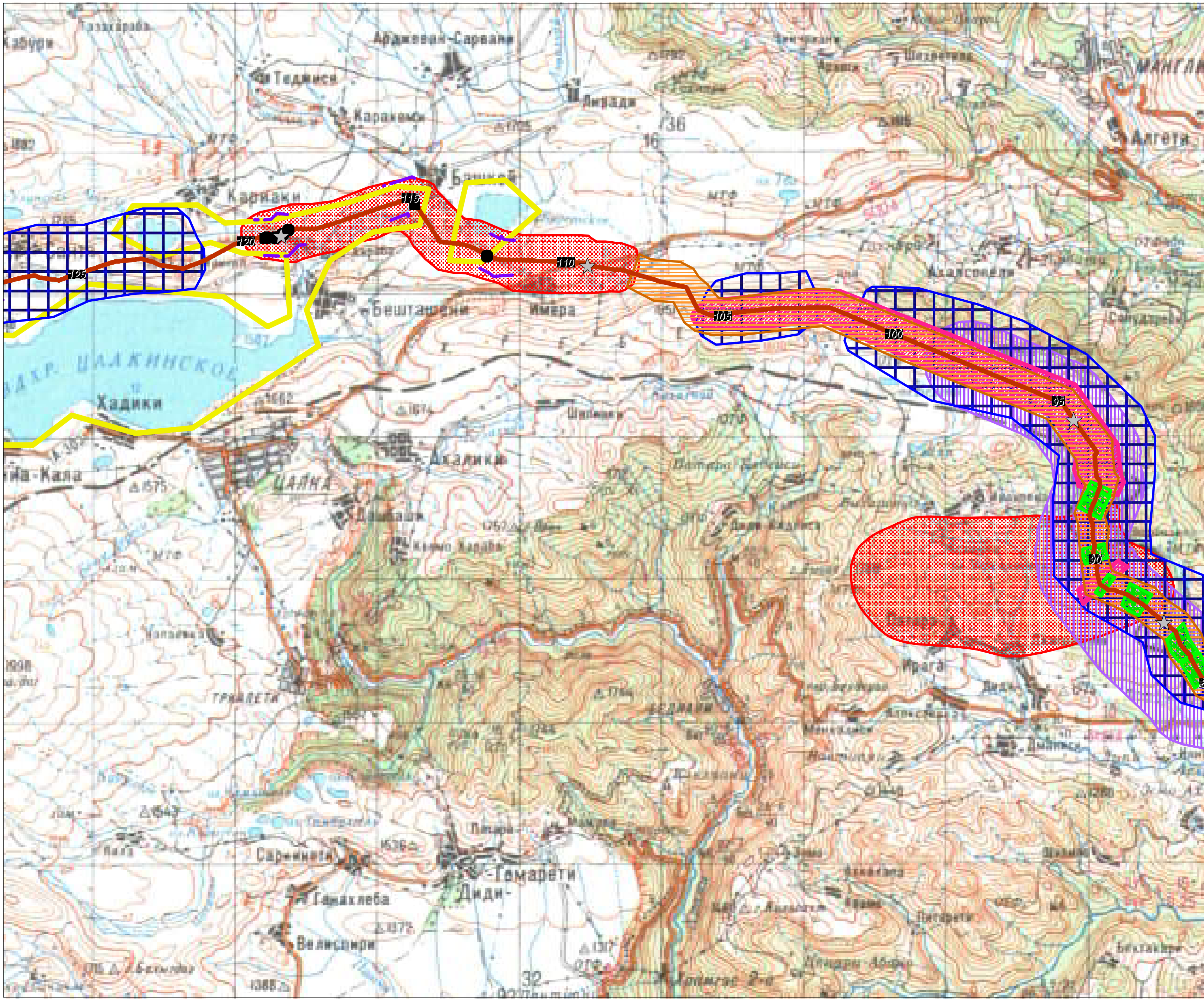
BTC ESIA

TITLE:
Mitigation Measures

SCALE 1:100,000

Figure: MAP 14b



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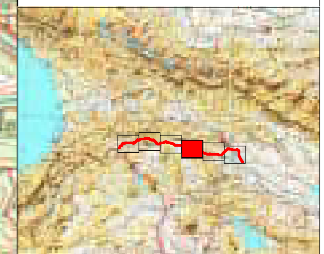

LEGEND

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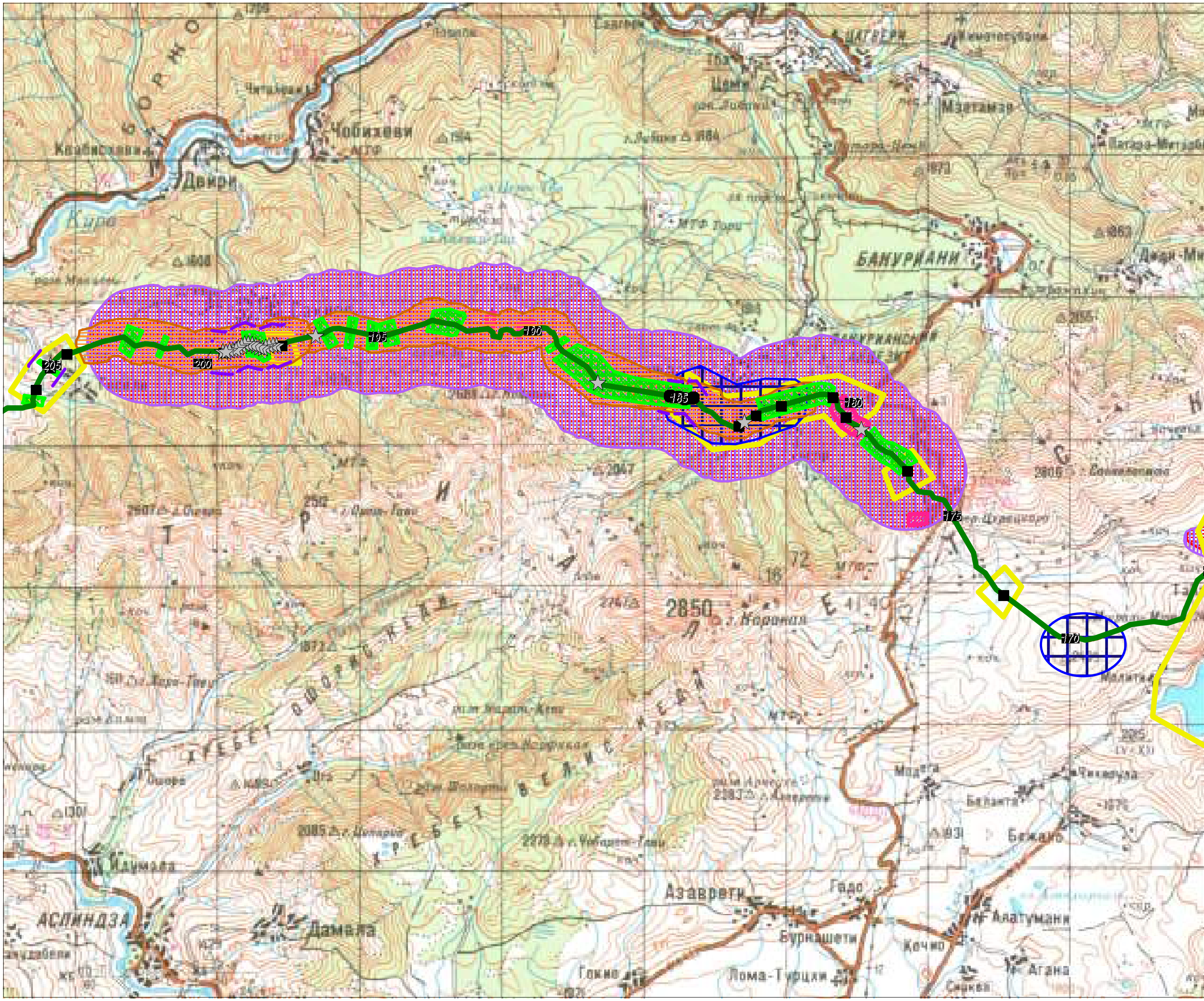
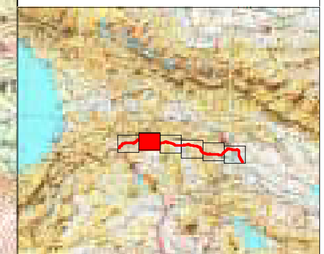
BTC ESIA

TITLE: **Mitigation Measures**

SCALE 1:100,000

Figure: MAP 14c





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- Dust and air emissions suppression measures
- Noise mitigation measures

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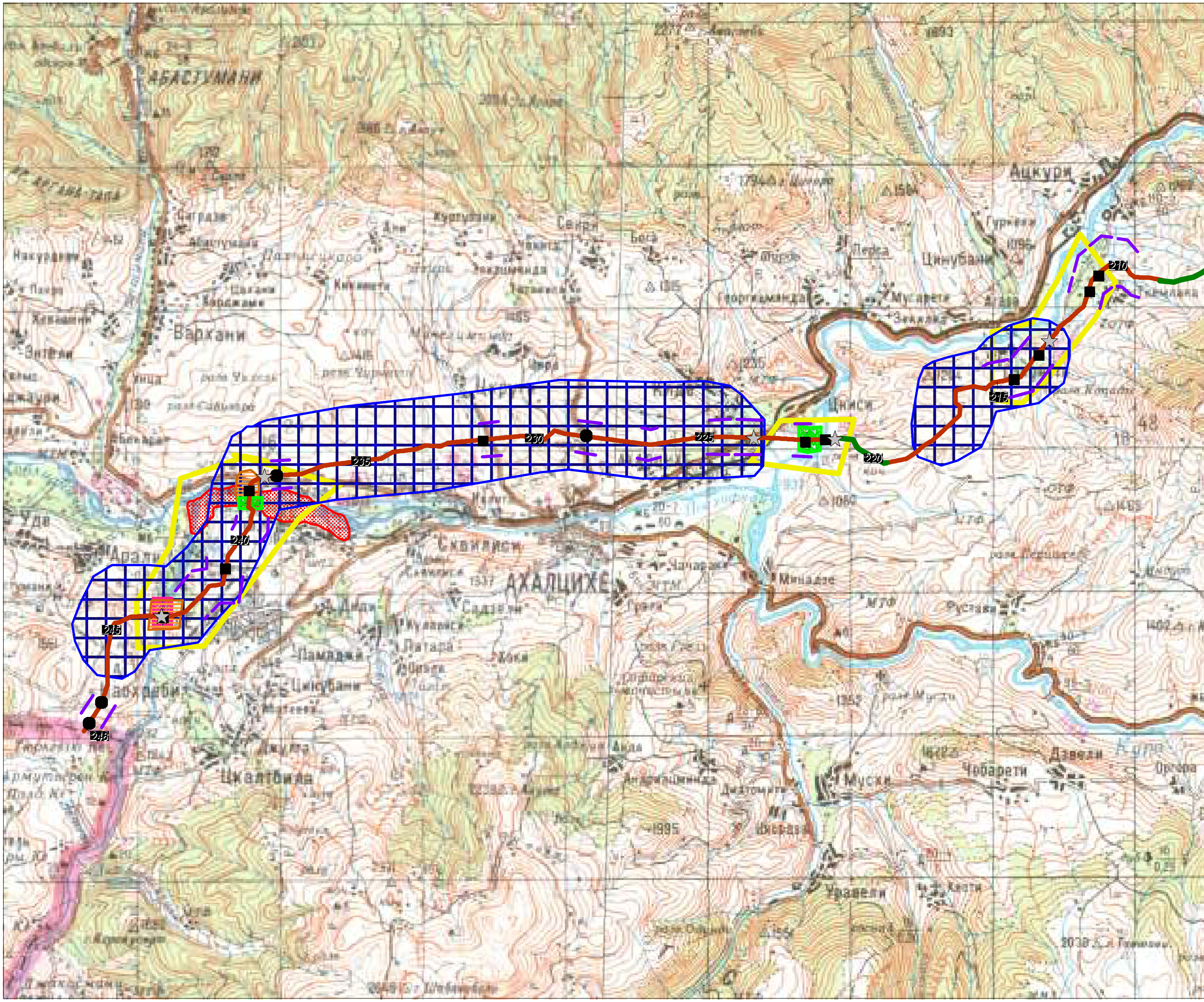
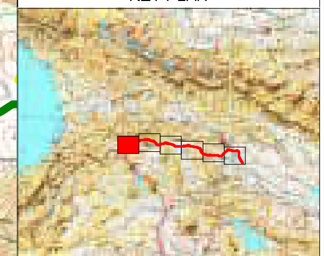
BTC ESIA

TITLE:
Mitigation Measures

SCALE 1:100,000

Figure: MAP 14e





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- Dust and air emissions suppression measures
- Noise mitigation measures

12/03/02

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BTC ESIA

TITLE:
Mitigation Measures

SCALE 1:100,000

Figure: MAP 14f

OVERALL PROJECT ASSESSMENT

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15 OVERALL PROJECT ASSESSMENT

15.1 INTRODUCTION

The BTC pipeline will enable Caspian ACG crude volumes to be exported, from the land-locked Caspian Sea, to open market without incremental increase in volumes shipped through the Bosphorus Straits. The BTC pipeline is the environmentally preferred option compared to the alternative transport options such as road and rail. Turkey has been selected as the most suitable export destination as it's the nearest country to Azerbaijan with access to the Mediterranean Sea, the latter providing the nearest open market point of delivery. Georgia has been selected as the most suitable intermediate transit country.

Alternative pipeline routes were evaluated, with the overall route selection and project design philosophy based on the following inherent mitigations:

- Avoidance of impact through careful design and route selection. Maximum potential to avoid impacts was achieved in the early project design stages through careful pipeline routing and avoidance of areas of environmental, cultural or social sensitivity
- Avoidance of houses and property so preventing the need for physical resettlement
- The BTC route has been selected through an extensive assessment process based on the following key considerations: environmental and social issues, terrain and geohazard assessment, constructability and long-term integrity of the pipeline, and security and safety
- Development and incorporation of direct mitigation measures into the design and construction process
- Environmental and community investment plans will be developed to offset any unavoidable High or Medium level residual impacts. The principle of 'no net loss' is applied
- Furthermore, where possible, the intent is to deliver a sustainable benefit to communities and the environment as a result of the BTC project
- Consultation with potentially impacted communities, NGOs, scientists and other interested stakeholders has been key to the impact assessment process and development of avoidance, minimization, and mitigation and compensation measures

The ESIA process has identified those BTC project activities that are predicted to result in environmental and social impacts, and provides an evaluation as to the extent of those impacts. Mitigation plans have been developed for each of the impacts to accentuate any positive benefits and to minimize or remove any negative impacts.

The environmental and social mitigation measures identified in this ESIA describe how impacts will be managed throughout the various phases of the project. Impacts that could not be fully mitigated are termed "residual". The proposed mitigation measures have reduced the level of almost all of the residual impacts to a Low or Beneficial ranking. However, as discussed below, there are certain residual impacts that remain Medium or High. The criteria and process for determining the residual impact rankings are described in Section 7 – ESIA Methodology.

Where practical, options for environmental and social programmes to offset these High and Medium residual impacts are being developed.

15.2 ENVIRONMENTAL PROJECT ASSESSMENT

The assessment process has shown that several beneficial impacts will ensue as a result of the BTC project. The key positive impacts are summarized below:

- In order to meet the ‘no net loss’ principle the BTC Project is developing an Environmental Investment Plan (EIP). Wherever possible, the EIP will go further than the “no net loss” principle with the objective of enhancement of biodiversity and provision of environmental additionality. The EIP projects will include consideration of protected areas (either designated or proposed) and protected species; areas of high ecological significance outside protected areas system, and capacity building for biodiversity management.
- Contribution to an increased knowledge basis of the Georgian environment as a function of the BTC project baseline studies. The collected data will be shared and made public. This includes, for example, baseline data on flora, fauna, archaeology and cultural heritage; additional geotechnical data; and aerial and topographic mapping.
- Clean up of identified areas of 3rd party pre-existing land contamination in areas required for the project, based upon contaminated land studies.
- Skills transfer between international and national environmental consultancies and scientists eg, data gathering and survey techniques; data interpretation, and national ecological expertise.
- Capacity building at national and local level, including increased skills and knowledge that can be used by local organisations in response to future tenders, and for individuals to access future employment.
- Increased public awareness of environmental issues, and increased opportunities for public, community, NGO and stakeholder participation in the EIA processes.
- Implementation and increased awareness of international EIA standards.

The assessment also showed that the majority of the negative impacts will be associated with the construction phase, and that most of these impacts can be mitigated through the implementation of good construction practices and application of site specific measures to protect localised receptors. The main residual impacts associated with the construction of the BTC pipeline in Georgia are impacts to the landscape, to the ecology and, to a lesser degree, disturbance associated with noise. The sections below summarize the conclusions of the assessment for each of these three issues during construction and operation of the pipeline, and in the eventuality that unplanned events were to occur. The interaction of the project with other related or unrelated activities is also addressed.

15.2.1 Construction

15.2.1.1 Landscape impacts

High ranking landscape impacts due to permanent modifications of high value landscapes are predicted to occur at the following locations:

- Tetritskaro (KP 84-92): forest landscape
- Mt Tavkvetili (KP 151-157): volcanic landscape identified as a "landscape monument" in the Georgian Red Data Book
- Tskhratskaro pass to Sakire (KP175.5-204): forest and alpine meadows
- River Mtkvari West crossing (KP 221): riparian landscape
- River Potshkovi North crossing (KP 238): riparian landscape

Residual impacts of Medium ranking to the landscape will occur throughout the ROW as a result of either the short-term visual intrusion, caused by the construction equipment in areas of high landscape value, or by permanent modifications of the landscape in a small number of areas of medium landscape value. With the exception of degraded landscapes that occur in the westernmost and eastern part of the route for an overall length of approximately 80km, the majority of the proposed pipeline route will be affected by short term visual intrusion and therefore by Medium ranking impacts.

The implementation of mitigation measures for several years after completion of construction activities will, however, reduce the significance of the impacts over time as the reinstated vegetation features will blend with the surrounding landscape.

15.2.1.2 Ecological impacts

The impacts to ecology are due to the proposed pipeline route encroaching sensitive habitats, including a protected area (Ktsia Tabatskuri Managed Reserve) and the support zone of a national park (Borjomi Kharagauli National Park Support Zone). The High and Medium ranking residual impacts are summarized below:

- High ranking residual impacts to flora will occur as a result of clearing the ROW in two areas of dense primary forest: Tetritskaro (KP 84-92) and Tsikhisjvari /Sakire (KP 182 to 204). It must be noted that not all the ROW in these areas is covered by forest. The overall area of continuous forest encroached by the ROW at the two locations mentioned above is approximately 55 hectares. The clearance of forest along the ROW will result in the loss of a large number of trees of high conservation value, including a Georgian Red Data Book species (high mountain oak). It must be noted, however, that, no significant impacts are expected to occur with regard to the forestry practice in Georgia, or to forestry management in general, as the forests affected by the proposed pipeline project are a small fraction of the overall forest heritage of the country.
- An additional High rank impact is the loss of the habitat (rhododendron scrub) of the globally threatened Caucasian black grouse on Mt Tavkvetili within the Ktsia Tabatskuri Managed reserve. The impact will be mitigated by clearing the scrub prior to the

breeding/nesting season so that loss of individuals will be minimized. In addition, the scrub will be replanted after completion of the ROW reinstatement thus further mitigating the overall impact to the birds population.

- The loss of localised populations of Georgian Red Data Book floral species during construction and until full restoration has taken place has been ranked as a Medium residual impact. This impact will occur in the Tetritskaro forest area and in the alpine meadows between Tskhratskharo and Sakire. These impacts will be mitigated by collecting the plants or their seeds/bulbs. The collected plants will be transplanted temporarily to suitable botanical gardens (most probably Tbilisi and Bakuriani), and re-planted after completion of the ROW reinstatement. If seeds were collected, replanting would take place through the sowing of the seeds or bulbs and subsequent management of the area.
- Fragmentation of a continuous forest habitat in an area (Tetriskaro) that could be important from a mammal migration standpoint has not been assigned a ranking. The significance of this residual impact is not fully understood as there is no conclusive evidence that the ROW clearance and construction operations would significantly affect the migratory behaviour of such mammals. Additional surveys and monitoring will be undertaken to assess this issue further and develop suitable mitigation measures if required.

Medium ranking impacts are summarised below:

- Kumisi plain (KP 29.4-53.2): potential impacts to rare populations of snake eyed lizard during construction
- Algeti River crossing (KP 53.2-53.8) and River Geti Crossing (KP 72.8): loss of regionally important riparian habitat
- Bedeni ridge (KP 92-108): Potential loss of part of extensive marsh orchid habitat
- Kizil Kilisa (KP 140): Fragmentation of local wildlife habitat (pine plantation)
- Mt Tavkvetili (KP 151-157): Potential loss of alpine wetland

15.2.1.3 Noise

Residual impacts with regard to noise fall in the “Medium” ranked category, and will occur where houses and human receptors are located within the band of influence of the construction noise. The impacts are primarily short-term, due to the fast moving nature of the pipeline construction activities. While measures will be implemented to mitigate the noise, it is not expected that these impacts can be mitigated completely. Community relations and other forms of social relations management will ensure that no long-term adverse effects will result from this issue.

15.2.2 Pipeline operation

The operation of the pipeline will result in limited localised impacts. The most significant direct impacts of operation have been ranked as Medium and will be the generation of noise and visual intrusion at the location of Pump Station PSG2, given the importance of the general area as wildlife habitat and its high landscape value. There will also be impacts of a lesser extent including the visual intrusion of some of the other AGIs associated with the pipeline (in particular

IPSG1, Block Valve G-B12, Block Valve G-B14 and Block Valve G-B15) located in areas of high ecological conservation value or with a very high landscape value. The implementation of the Landscape Management Plan will minimize these impacts.

15.2.3 Unplanned events

The potential for unplanned events and the consequence of such events on the habitats, rivers and groundwater resources crossed by the pipeline have also been analysed, with the aid of mathematical models that simulate the behaviour of the spilled oil in case of accident. The assessment shows that the likelihood of any event occurring and the risk of significant impacts resulting, are very low. In the unlikely case of an incident, the consequences of the impact could be significant depending on the scale of the event, the geographic location of the event site, and the local meteorological, geological and hydrogeological conditions.

Mitigation measures have been adopted to counter the risk of an oil spill on three fronts. Firstly, the design basis of the project includes many features to prevent a leak occurring, including routing around geohazards where possible and increased wall thickness in certain locations, among others. As a minimum, the pipeline has been designed to meet international standards and codes of practice thus ensuring the integrity of the system. Secondly the design also includes many features for early identification of a spill event, including a leak detection system, selected groundwater monitoring, and regular route surveillance. Finally, an Oil Spill Response Plan will be developed (see the Oil Spill Response Plan Framework in Appendix E, Annex V) which will identify resources, responsibilities and equipment necessary for responding to a spill, in the unlikely event that it should occur.

15.2.4 Cumulative impacts

Impacts caused by interaction with other projects in the area were also assessed. The main cumulative impacts result from SCP construction following on after BTC construction. This results in an increased duration for many of the construction related impacts and a longer period prior to final reinstatement. It could be however argued that two separate corridors for the BTC and SCP pipeline would have resulted in additional fragmentation of habitats and more widespread disturbance.

15.3 SOCIO-ECONOMIC PROJECT ASSESSMENT

Consultation revealed that the overall attitude of the interviewees in pipeline-affected communities[1] is positive towards the project, as their perception is that any disruption will be temporary and offset by potential economic benefits both to their community and to Georgia. There will be a number of positive social impacts associated with the BTC project. These include:

[1] Pipeline affected communities are defined as those that are locate within (or partly encroach into) a 2km corridor either side of the route, or are within 5km of a potential worker camp or pipe yard. These communities are likely to experience and be affected by the activities of construction, operation and decommissioning of the pipeline.

- A Community Investment Programme, developed and implemented in communities adjacent to the pipeline corridor and associated facilities (see Section 13, Cumulative Impacts). This is intended to deliver benefits to those communities directly impacted by the project.
- A limited number of direct employment opportunities on the project, primarily short term jobs during construction, with fewer, longer term, opportunities during operation
- Opportunity for provision of local goods and services to the project.
- Skills development and training, increasing people's employment chances after the pipeline construction period for employment in other projects or specialized industry in the region.
- Enterprise development, and transfer of business knowledge and skills eg internationally recognized standards of HSE, technical, commercial, accountancy, IT, etc.
- Infrastructure improvement, including temporary and permanent upgrade of some roads and utilities.
- Benefit of the increased knowledge basis of the Georgia social and economic conditions along the pipeline route, as a function of the BTC project baseline studies. The data collected will be made public.
- Skills transfer between international and national consultancies and increased experience in social data gathering/analysis and survey techniques.
- Raising public awareness of socio-economic issues in Georgia, on an international, and national level, through publication of documents and consultation.

Two of these positive aspects were particularly prominent during consultation: potential employment opportunities; and expenditure on local goods and services by construction workers.

The ESIA revealed that the majority of negative impacts will be associated with the construction phase, and that most of these impacts can be mitigated through the implementation of good construction practices and application of route level mitigation measures focusing on pipeline affected communities. The implementation and effectiveness of mitigation will be monitored and measures taken to reinforce, adapt or change the mitigation should it be required.

The main residual negative social impacts associated with the construction and operation of the BTC pipeline in Georgia are unmet local expectations on access to energy and employment, and ensuring effective community relations during the lifetime of the project. Impacts to infrastructure and services should be effectively mitigated and the land compensation process should minimise land and land-based livelhood impacts. Residual impacts in these two areas have been assessed as Medium significance, and the community relations measures will help to address them.

Accidents to community members, while potentially serious on an individual basis, are expected to be rare given the strong emphasis placed by BTC on health and safety. The sections below summarize the conclusions for each of the three key issues during construction and operation of the pipeline, and for the interaction of the project with other related or unrelated activities.

15.3.1 Construction and operation phase

15.3.1.1 Access to energy

During preliminary consultation, many communities with poor energy supply clearly associated the construction of pipelines with potential provision of energy to their houses, primarily during pipeline operation. While the project will not draw energy from community sources either during construction or operation, nor will it provide them with any additional power. Improving community access to energy is the responsibility of the Georgian Government, however BP is working with the relevant government departments to address these issues outside of the BTC project.

It is important that the BTC project provides accurate information on energy during the construction and operation phases (both energy usage and initiatives in partnership with the Georgian government) in order to avoid potential disappointment. After a year of regular consultation within communities energy expectations have been reduced to a certain extent, but will still require careful management in the future.

15.3.1.2 Employment expectations

There was clear evidence that communities have the expectation that the number of jobs that will be created and the duration of the employment are larger and longer than they will really be and this has been ranked as a high significance residual impact. It is therefore important to provide accurate information on this topic in order to avoid potential disappointment.

An employment strategy will be developed to ensure that local employment levels are maximised as far as practical (see Section 11, Socio-economic Impacts and Mitigation) and community consultation has sought to clearly outline the level of employment that is expected during both construction and operation of the pipeline.

15.3.1.3 Managing community relations

Only villages in Gardabani have previous pipeline experience. Hence, there is currently a lack of understanding in the majority of villages of what pipeline construction actually entails and the associated level of activity and duration. It is expected that tensions between communities and the pipeline project will inevitably rise during constuction as a result of the wide ranging number of issues that will directly affect communities.

In addition, there was also some anxiety concerning the project and its potential impacts in two specific sets of communities. The first was in a series of community settlements in Gardabani, and the second in the Akhaltsikhe region. The concern in Gardabani was primarily related to land use restrictions and compensation but also reflected general anxiety following poor experience during the WREP project.

In Akhaltsikhe the concerns were generally related to the possible influx of ‘foreign’ workers into what are ethnically homogenous and relatively closed communities. The Community Liaison Management Plan will specifically address this issue.

One of the most crucial of the mitigation measures set out in this document is the approach to community relations. The success of many of the other social, and some of the environmental measures, rests on the successful implementation of the community relations programme. Detailed management plans will be developed to assist in the formulation of effective community relations by BTC Co and the contractor. These will ensure that people working on the project respect the local way of life, and that community concerns and complaints are dealt with sensitively and in a timely manner. Ongoing consultation will also be continue with regulators, NGOs and other interested stakeholders.

Impacts on communities are considerably reduced in the operation phase of the pipeline, however given the need to ensure community and pipeline safety, it is essential that the on-going community relations programme is well implemented, providing for regular dialogue to identify and understand community concerns and ensure safety awareness is maintained. The operational community relations phase also needs to address any outstanding community issues from construction.

15.3.2 Cumulative impacts

Impacts related to the interaction of BTC with other projects at the regional, national and route levels were also assessed. The most important cumulative impact is that the overall construction period (BTC and SCP) will be longer in duration. This will increase both the beneficial and negative impacts of the project, making it vital that the mitigation measures are well implemented.

15.3.3 Conclusion

In conclusion, it is generally anticipated that both the construction and operation will bring a series of short term and long-term benefits to the communities. This is despite some residual impacts relating to the construction of the pipeline, which need to be carefully managed through the mitigation measures set out in the document. The benefits provided will include, employment, provision of goods and services and the community investment programme, which will provide long term benefits to many communities, thereby off-setting any short term negative impacts.

CONSULTATION

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16 CONSULTATION

This Section summarizes the consultation process that has been conducted at national and local levels as part of the ESIA process. It also outlines the results of that process and how they have been used to shape both the project engineering design and the development of mitigation measures as outlined in Section 11.

Further details about the process to date, including details of all the organizations consulted at different stages, can be found in the PCDP, Appendix F. The main findings from the village level consultation have been included in Sections 8 and 9 (Environmental and Socio-Economic Baselines). A detailed explanation of the data collection process for the social baseline has been included in Section 7 - Methodology.

16.1 FUNCTION OF CONSULTATION

The function of consultation is to understand as far as possible how the project will impact stakeholders, and to obtain their ideas and opinions on management of impacts in order to influence project design, implementation and follow-up. It is also an important opportunity for local people to become better informed about planned activities. The project has sought to carry out consultation in line with national regulations, international best practice and BP policies.

16.2 SUMMARY OF CONSULATION

This ESIA is specifically for the BTC pipeline. However, since the SCP is planned for construction in the same corridor, and requires its own ESIA, the consultation process has been combined as far as possible to ensure a consistent and coordinated approach to stakeholders. Hence, the summary of consultation conducted in Georgia for both the BTC and SCP projects, is provided in Table 16-1.

Table 16-1 SCP and BTC consultation – Georgia

Stage/ Phase	Type of Consultation	Date	Consultees	Forum	Methodology
Phase 1 (SCP)	Scoping Phase Introductory Meetings/Work shop	October / November 2000/1	National Government Stakeholders NGOs Regional Stakeholders	Meetings Workshop - Tbilisi Focus Group – Poti Port	One to one meetings to discuss proposed project **Presentation and discussion** Presentation and discussion
Phase 2 (SCP)	Baseline data collection	January-February 2001	Village level consultation with directly-affected communities	Meetings Interviews	Preliminary meetings with Regional and District Authorities Qualitative interviews (319 in 59 settlements) Quantitative interviews (602 in 59 settlements)
Phase 3 (SCP)	Progress report/ Finalization of scoping exercise	March 2001	National Stakeholders including NGOs	Workshop - Tbilisi	Presentation and discussion
Phase 4 (Combined SCP/BTC)	Consultation and baseline data collection relating to pipe yards, worker camps and AGIs	August 2001	Village level consultation in directly-affected communities	Interviews in settlements within 2km of potential location of pipe yards and 5km from a potential site for a major worker camp and AGIs Interviews in Kodiani summer village and in several seasonal shepherds' camps at Narianis Veli and Ktsia valley	Qualitative interviews regarding pipe yards and worker camps (126 in 12 settlements) 65 qualitative interviews on AGIs Qualitative interviews with shepherds

Stage/ Phase	Type of Consultation	Date	Consultees	Forum	Methodology
Phase 5 (Combined SCP/BTC)	Introduction to BTC/Update on SCP	October 2001	National NGOs Local NGOs	Workshop – Tbilisi Workshop – Akhaltsikhe	Presentation and discussion. Update on progress of SCP, introduction to BTC and consultation on preliminary ideas for mitigation measures
	Additional baseline data collection	November 2001	Directly-affected communities	Interviews	Quantitative interviews (106 in 13 settlements) Qualitative interviews (74 in 13 settlements) on cumulative impacts relating to two pipelines instead of one, and gathering perceptions in relation to the building of an oil pipeline, in addition to gas
Phase 6 (Combined SCP/BTC)	Testing draft mitigation measures	Nov/Jan 2001/2	Specialist Organizations	One to one meetings	One to one meetings with NGOs in Tbilisi and to consult on developed mitigation measures
			Directly-affected communities	Community workshops	Workshops at 6 villages/towns with presentation and discussions on the proposed mitigation measures
Phase 7 (Combined SCP/BTC)	Disclosure	May/June/ July 2002	National Level Stakeholders Local Level Stakeholders (NGOs, Interest Groups)	Public Meetings – Tbilisi and Rustavi	Presentation and discussion
				Two NGO workshops in Tbilisi	Presentation and discussion
			Directly-affected communities	Road Show	Village meetings, including presentation and discussion, at 10 locations along the pipeline route

16.3 OUTCOME OF CONSULTATION TO DATE

16.3.1 Key issues

Through the analysis of stakeholder perceptions, the consultation process identified a number of key issues, including both perceived benefits of the project and concerns. The issues were subsequently categorized and fed into the ESIA process and thence into the project design process with the aim of maximizing the benefits and addressing the concerns.

Key environmental issues raised include:

- Protection of archaeological sites and historical monuments
- Protection of water resources (ground and surface waters)
- Ecological protection
- Nature reserves
- Reinstatement
- Oil spill risk and groundwater contamination
- Landscape impact, reinstatement and erosion control
- Waste management
- Forests

Key socio-economic issues raised were:

- Employment
- Land acquisition and compensation
- Access to energy
- Local infrastructure and resources
- Community relations, including relations with construction workers
- Safety

16.3.2 Key concerns

Once the main issues had been identified, and the project impacts analysed, mitigation measures were developed to address as many of these issues as possible. Refining the mitigation measures is an iterative process involving extensive consultation, and was carried out over a period of a year. The consultation took the form of:

- Discussions with villagers and village leaders both formally through community workshops and village meetings and informally in one to one meetings at the village level
- Consultation with Government in Tbilisi, meetings with specific departments on issues such as employment, as well as frequent small working group meetings with GIOC and its appointed expert advisors
- Two sets of workshops with Government, NGOs and other interested groups in Tbilisi and Akhaltsikhe
- A series of one to one meetings with specialist organizations and NGOs such as UNDP and WWF to discuss issues such as employment and protection of various species

- Frequent meetings with project engineers to check the feasibility of approaches and ensure feedback from external stakeholders was fed into the project design process

During these meetings, ideas for mitigation were put forward by the project and by stakeholders and gradually refined to produce the set of measures included in this report. Recurring themes during consultation at all levels were as follows:

Archaeological sites and cultural monuments

- The need to conduct pre-construction archaeological investigations
- The need to protect archaeological sites and monuments during construction of the pipeline
- The need not to impact upon key features such as monasteries, cemeteries and ancient churches

Oil spill risk, water and groundwater contamination

- The need to protect these sensitive areas especially in the region of Borjomi and other natural mineral springs
- To ensure that river crossings are safe to prevent leaks into the water supply
- To ensure that the pipe is designed is not to break during seismic activity

Ecology and nature reserves

- To avoid impact upon Natural Reserve areas wherever practical
- To ensure that the migration paths of large mammals are not interrupted

Landscape impact, reinstatement and erosion control

- To prevent erosion of the ROW

Waste management

- To ensure that any sites chosen for waste should have minimum impact on the surrounding communities

Forests

- To ensure that as few trees are sacrificed as possible and that the visual impact on the landscape is kept to a minimum

Employment

- The need to recruit locally, from the pipeline-affected communities, as far as practical
- The recruitment process should be fair, equitable and overseen by an independent authority
- Consultation resulted in various suggestions in relation to how the recruitment process should be managed

Land acquisition and compensation

- The land acquisition process and procedures for payment of compensation should be fair and transparent
- There should be sufficient information provided about the process and how it will work in advance of actual land negotiations
- There should be information about how land can be used once construction has been completed
- Information should be given in advance of construction
- There should be a fair and equitable compensation process for damage to buildings and agricultural infrastructure as a result of construction activities
- A mechanism for complaints should be put in place
- Where new roads are needed, owners will be compensated and informed in advance if their land will be required
- There will be compensation for loss of private property including fencing, brick walls, etc

Access to energy

- Many villagers clearly had expectations early in the consultation process in terms of increased access to energy arising from the proximity, or the mere existence, of the pipeline

Safety

Villagers voiced concerns about the following issues:

- The integrity of the pipeline and whether or not villages would be in danger owing to its proximity
- Risk of injury to people during construction
- Risk of injury to animals
- The possibility of oil spills and explosions owing to gas transportation during the operational phase
- Increased traffic, particularly with regard to heavy trucks and machinery
- Need for information about the possible dangers and procedures for how to react if something happens

Infrastructure

- Roads should not be degraded as a result of the movements of pipe and heavy machinery, and should be reinstated to at least the standard existing prior to construction. It was clear that villagers' expectations are that roads will be not only maintained but actually improved as a result of the construction
- Access should be maintained to grazing lands at all times
- To restore infrastructure to their pre-existing condition or better

Worker camps

- Most villages are keen to have a worker camp in their proximity for the perceived economic benefits, but nonetheless there were always concerns associated with it

- In Kotishi, villagers expressly stated that they did not wish to have a worker camp close to the village as it would exacerbate ongoing conflicts with a neighbouring village over agricultural land
- Some people expressed concern about an influx of foreign (meaning not of their ethnic group in this context) workers and the effect this might have on communities
- Some villages expressed concern related to water and power supply to camps that may reduce their supply

Each of these issues has been addressed as far as practicable and possible either through changes in project design or through the mitigation measures developed during the course of this ESIA process and presented in Section 11. Issues raised over which there are unrealistic expectations, have been addressed through provision of information to villagers to manage expectations and, where possible and appropriate, other community investment activities.

Consultation with the local NGO community demonstrated a real desire on their part to have a participatory role in the ESIA process through attendance at workshops and meetings.

Additional details of perceptions and attitudes at the village level can be found in Section 9 - Socio-Economic Baseline.

16.4 ONGOING CONSULTATION

As outlined above, consultation is an ongoing process which does not stop once the draft ESIA has been put in the public domain in May 2002. Consultation continues to be an integral part of the design, development and implementation of the pipelines project, of which the ESIA process itself is just a part.

During construction, the consultation process is handled through two mechanisms: firstly, the Community Relations Programme implemented by the construction contractor and monitored by BTC Co, as outlined in Section 11; and, secondly, through the monitoring programme implemented by BTC Co and outlined in Section 14 - Management and Monitoring Plan. This plan will include consultation on how communities think the mitigation measures are being implemented. During operations, likely to begin in 2005, the consultation process will be handled by BTC Co through the Community Relations Programme outlined in Section 11.

16.4.1 Disclosure

This draft of the ESIA document has been prepared specifically for public disclosure and comment. The report will be widely disseminated and will be available for comment for a period of 60 days. Following the 60-day disclosure period all comments received will be incorporated as appropriate into the ESIA, prior to formal submission to the Government.

In May 2002, the draft ESIA is put in the public domain for consultation for a period of 60 days. This involves:

- Full ESIA documents, published in Georgian and English, are on deposit in a range of public locations, both in Tbilisi and the regions to be affected by the project. These locations are widely advertised. The documents are also available in English at www.caspiandevelopmentandexport.com
- Russian translations of the main volume of the ESIA (without appendices) will be available on deposit at the locations outlined above

- The Non-Technical Executive Summary, published in English, Georgian and Russian, is directly distributed to a range of stakeholders and is also available to take away from all locations at which the full ESIA is on deposit
- BTC Co will run a manned phone line for people to ring with queries
- Pamphlets describing the impacts and associated mitigation measures of the project on pipeline-affected communities, specifically dealing with their concerns and interests, will be available in Georgian, Russian and English. These community pamphlets will be distributed to all communities within 2km of the route and within 5km of a worker camp or major AGI, during late May and June. Pamphlets will also be available at all locations where the full ESIA is made available

The main milestones in the disclosure process are as follows:

- Two workshops will be held in June, one on environmental issues and one on social issues, to which international and national NGOs, donors, academics and other interest groups will be invited. The aims of the workshops will be to solicit feedback on the impacts and mitigation measures identified in the draft ESIA
- In addition, two public meetings will be held in Tbilisi and Rustavi in early July in order to present the results of the ESIA and solicit feedback on the impacts and mitigation measures that have been developed. The exact dates and locations will be advertised in the press, TV, radio and on posters in Tbilisi and Rustavi in late June
- 10 village meetings will be held along the pipeline corridor during late June. Announcements of exact dates and locations will be made in the press, TV, radio and on posters in all pipeline-affected communities prior to the meetings

16.4.2 Comments during disclosure

Anyone can comment on the ESIA at any time during the 60-day public disclosure period. Feedback forms are available with the all the disclosure documentation. All comments should be written on this form and either placed in the box provided next to the full ESIA on deposit or addressed to:

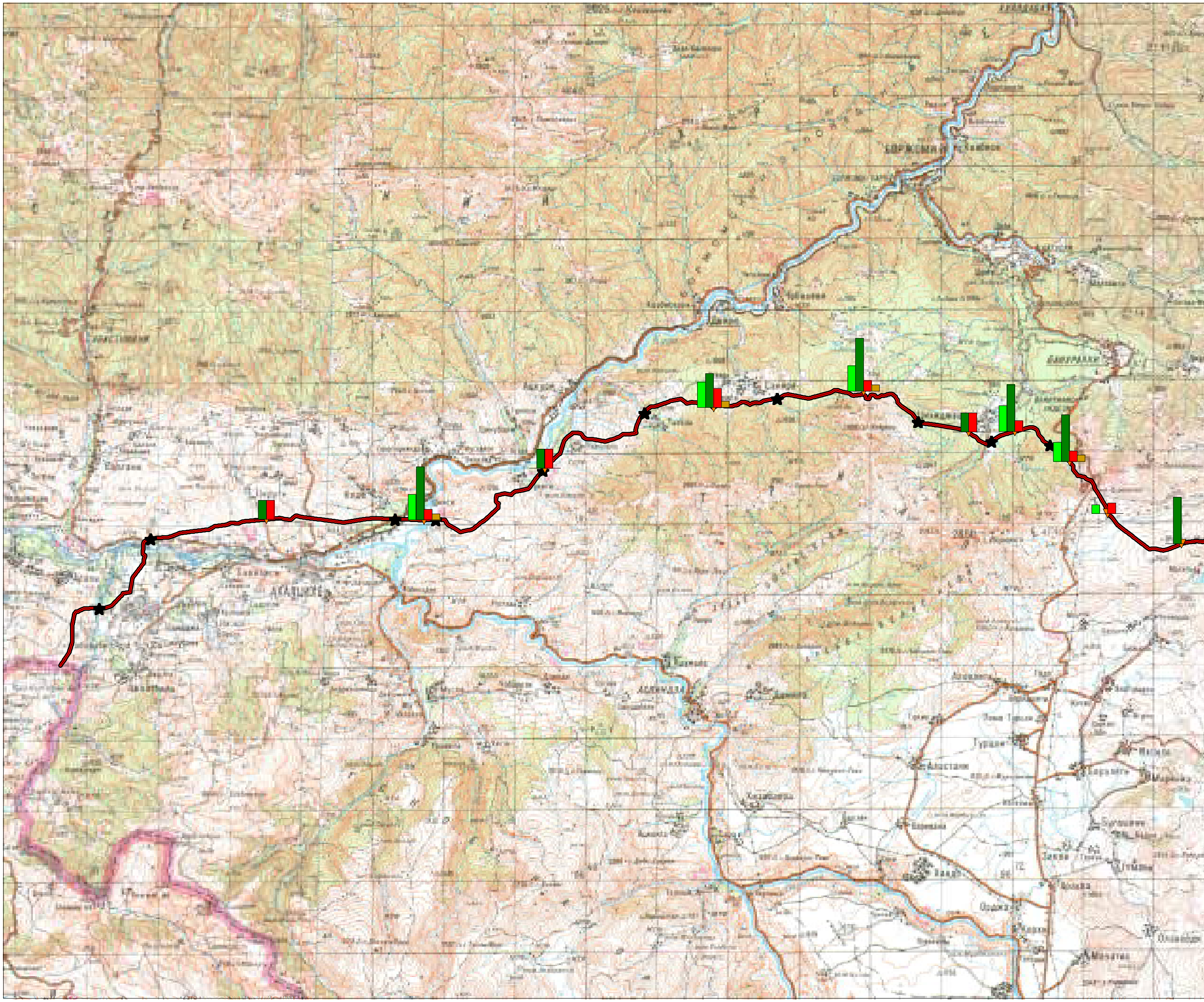
Rusudan Medzmariashvili
BP Policy Advisor
123a D.Agmashenebeli Av.
Tbilisi

Comments can also be made over the internet at www.caspiandevelopmentandexport.com

At the end of the 60-day disclosure period, all the comments will be examined according to the process outlined in the PCDP, Appendix F. The ESIA will then be redrafted, taking the comments into account. The ESIA will be submitted to the Georgian Government for approval 30 days after the end of the disclosure process. The government will review the ESIA over a period of another 30 days, at the end of which ESIA approval is expected.

16.4.3 Results of disclosure

This Section will be completed once the results of the disclosure process become available in mid-July 2002, and included in the final draft.



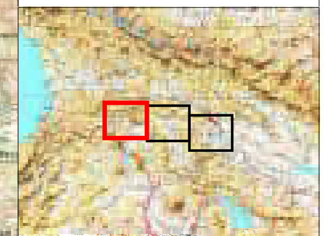
URS

NOTES

1. COORDINATE SYSTEM PARAMETERS:
ELLIPSOID: KRASSOVSKY (1940)
PROJECTION: GAUSS-KRUGER
GEODETIC DATUM: PULKOVO (1942) ZONE 8
VERTICAL COORDINATE SYSTEM: KRONSTADT (BALTIC SEA) DATUM

2. MAPPING IS BASED ON SCANNED 1:200,000 DATA.

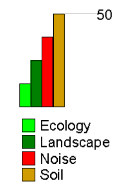
KEY PLAN



LEGEND

Current Route with KPs
Above Ground Installation

Bar Chart of Matrix



BTC ESIA

TITLE: Geographical Distribution of Residual Impacts

SCALE (A1): 1:200,000

Figure: MAP 16.01c

ESIA CONTRIBUTORS

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17 ESIA CONTRIBUTORS

The preparation of the ESIA has been co-ordinated by URS Corporation and ERM on behalf of BTC Co. URS co-ordinated the environmental impact assessment and ERM the socio-economic impact assessment for the project. Organizations and experts who have contributed to the development of the BTC ESIA are acknowledged below.

Table 17-1 List of participants and contributors

Specialist Consultants	Project Role
ERM	Socio-economic Impact Assessment
URS	Environmental Impact Assessment

In addition, the following Local Organizations, Institutes and Scientists assisted through the provision of specialist services and advice (see Table 17-2)

Table 17-2 List of local institutes and scientists

Organization/ Institute	Name
Dzelkva	David Kikodze
Dzelkva	Maia Tavartkiladze
Dzelkva	Dr Temur Svanidze
Dzelkva	Nika Kvaliashvili
Dzelkva	Dr Nana Dekanoidze
Institute of Botany	Prof Dr. Giorgi Nakhutsrishvili
Institute of Botany	Dr Tsimi Inashvili
Institute of Botany	David Chelidze
Tbilisi Central Botanical Garden	Prof Dr. Mirian Gvritishvili
Tbilisi Central Botanical Garden	Dr Mamia Loria
Noah's Arc Centre for recovery of Endangered Species	Irakli Shavgulidze
Noah's Arc Centre for recovery of Endangered Species	Irakli Macharashvili
Noah's Arc Centre for recovery of Endangered Species	Giorgi Darchiashvili
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Signed by the Project Director,

J Wright

Dr Jim Wright

Acknowledgement Page:

The key parties involved in the preparation of the ESIA are listed below.

List of participants and contributors

SPECIALIST CONSULTANTS	PROJECT ROLE
ERM	Socio-economic Impact Assessment
URS	Environmental Impact Assessment

However, many Georgian experts and consulting bodies were also heavily involved in the ESIA process. The major institutions involved is summarised below. A full list is given in Section 17 of the report.

Summary of Georgian Institutions Consulted

Dzelkva
Institute of Botany
Tbilisi Central Botanical Garden
Noah's Arc Centre for recovery of Endangered Species
Institute of Zoology
Georgia's Protected Areas Program
Department of Melioration and Water Resources Management
Georgian Politechnical University
State Department of Geology
Ministry of Environment and Natural Resources Protection
Gorbi
IPM
Centre for Archaeological Studies
State Department for Protection of Monuments