Chapter 10 Environmental and Social Impacts and Mitigations (Planned Activities)

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10 ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION (PLANNED ACTIVITIES)

10.1 Introduction

This chapter describes the potential changes to the baseline environmental and social conditions that are considered most likely to be caused when the planned activities described in Chapter 5 (Project Description) are carried out. It presents the findings of an assessment of the likely significance of those changes, applying the methodology that is presented in Chapter 3.

This chapter also discusses the mitigation measures that have been proposed with the aim of avoiding or minimising the SCPX Project's potential impacts or enhancing its potential beneficial effects.

This chapter does not describe or assess unplanned and accidental events during the project operational phase (e.g. pipeline rupture); those events are discussed in Chapter 12 (Hazard Analysis and Risk Assessment). However, this chapter does describe and assess unplanned events that may occur during the construction phase such as spills and traffic accidents.

10.1.1 Activity, Aspect Impact and Mitigation Tables

The activities, aspects, likely impacts, proposed mitigation measures and residual impacts associated with the SCPX Project are presented in three tables in Appendix B to this ESIA:

- Table B-1 presents a matrix of **activities and environmental, social and cultural heritage issues** associated with:
    - The facilities at CSG1, CSG2 and the PRMS
    - The SCPX pipeline loop, including river crossings
    - The permanent access road to CSG2
    - Construction camps, pipe yards and equipment lay-down areas
    - Temporary access roads to the SCPX pipeline loop ROW
    - Logistics.

  Shaded cells identify which issues are relevant to each construction, commissioning and operational activity. Each issue is numbered (A1 to A41) to aid traceability throughout this section and in the wider report
- Table B-2 presents **generic potential project impacts** associated with each issue identified in Table B-1, and scores the likely significance of the potential impacts (as High, Medium or Low Adverse, or Beneficial) using the tables in Chapter 3 that take account of the sensitivity of the receptor and the magnitude of the potential impact. It outlines mitigation measures that are proposed with the aim of reducing adverse impacts or enhancing potential beneficial effects, and then scores the residual impacts on the basis that the proposed mitigation measures are implemented
- A generic impact usually does not vary in significance according to where it occurs. Mitigation measures are proposed and included in the significance assessment in Table B-2
- Table B-3 presents **potential location-specific impacts** (i.e. those impacts relating to places where the baseline surveys outlined in Chapters 7 and 8 noted particular environmental, social or cultural heritage sensitivity). The potential impacts on them are scored, mitigation measures are proposed and the residual impacts are scored in the same way as Table B-2.

Sections 10.3 to 10.16 discuss the potential for environmental and social impacts from SCPX Project activities on various environmental and social components. In each case, impact avoidance and mitigation measures are proposed. The mitigation measures are numbered to allow cross-referencing to Tables B-2 and B-3 and to the Commitments Register presented in Appendix E. The numbers for commitments are referenced in the following way:

00-00 Topic-specific, generic construction commitments
X Location-specific commitments
OP Operational commitments
D Design commitments
DE Decommissioning commitments
LACF Land acquisition and compensation framework commitments

Figure 10-1 shows the relationship between the impact assessments, commitments register and the environment and social management and monitoring plan.

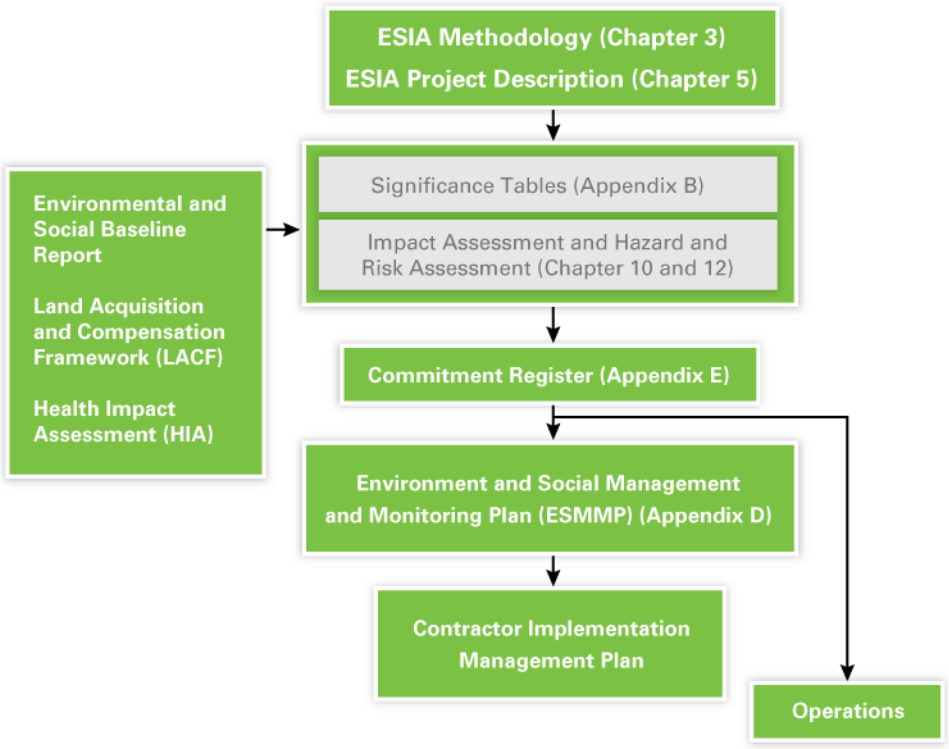

Figure 10-1: Schematic Showing Relationship between Impact Assessment and Commitments Register

To avoid repetition, where a mitigation measure relates to a number of different impacts in Sections 10.3 to 10.16 and has been discussed previously in the chapter, it is included in other relevant impact assessment tables which follow, but not repeated in the explanatory text.

10.1.2 Commitments Register

The Commitments Register (Appendix E) sets out all the specific mitigation measures that the Project currently proposes to adopt in relation to potential impacts identified in the ESIA. It is the exclusive and authoritative record of the mitigation measures proposed. The Commitments Register is intended to be read in conjunction with the full text of this ESIA document, which provides important context and background as well as describing the

impacts that the listed measures aim to mitigate or manage and the residual impact that may remain.

10.1.3 Monitoring and Management Plans

The Project's Environmental and Social Management and Monitoring Plan (ESMMP) presented in Appendix D is the primary mechanism for implementing the measures listed in the Commitments Register during construction. The ESMMP forms the basis of contractual agreements between the Project and the main contractors involved in Project construction. The ESMMP contains a set of 14 topic-specific management plans as listed below.

- Reinstatement Plan
- Landscape Management Plan
- Ecological Management Plan
- Waste Management Plan
- Pollution Prevention Plan
- Resources Management Plan
- Construction Camp Management Plan
- Infrastructure and Services Management Plan
- Community Health, Safety and Security Plan
- Community Liaison Plan
- Local Recruitment and Training Plan
- Procurement and Supply Plan
- Cultural Heritage Management Plan
- Land Management Plan.

The Commitments Register identifies which management plan(s) addresses each commitment.

The construction contractor will have a documented and operational ESMS aligned with the requirements of ISO 14001 Environmental Management Systems (1-13).

Operational management and monitoring plans will be developed to implement operational commitments before the project moves to the operations phase. Chapter 13 provides more detail on construction and operations phase management and monitoring. An on-going training programme for facility personnel will be implemented to include environmental compliance and reporting (OP18).

10.1.4 Constraints Maps

Appendix A presents maps that show physical, biological, cultural heritage and social constraints in the SCPX Project area. The maps illustrate the environmental and social baseline descriptions in Chapters 7 and 8, showing the places where location-specific sensitivities referred to in Table B-3 occur. They may also facilitate comprehension of this chapter, and the maps should also be referred to when reading this chapter.

10.1.5 Discussion of Impacts and Mitigation Measures

The following sections consider the environmental and social characteristics and sensitivities in the SCPX Project area in the order that they were discussed in Chapter 7 and Chapter 8, and discuss the ways in which they could be impacted as a result of construction, commissioning and operation of the SCPX Project.

Mitigation of potential impacts has been an integral part of the project conceptual design including site, process and equipment selection, which is described in detail in Chapter 4 (Project Development and Evaluation of Alternatives).

The mitigation measures incorporated into the engineering design process have been described in detail in Chapter 5 (Project Description) and these project design commitments have been incorporated into this chapter, in addition to mitigation measures which will be implemented during both construction and operation.

Secondary impacts

As introduced in Chapter 3, secondary impacts are caused by the primary interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g. a development changes the water table and thus affects a nearby wetland causing an impact on the ecology of that wetland).

Secondary impact assessment has been an integral part of the ESIA process and the identification of impacts and mitigation measures that are described in Chapters 10 and 12. To verify that all secondary impacts have been identified within the ESIA and that appropriate mitigation measures are in place, the potential interactions between each environmental and social topic areas from Chapter 10 have been evaluated. The evaluation demonstrated that all secondary impacts had been addressed through mitigation of the primary impacts.

Secondary impacts have been identified in Tables B-2 and B-3 by the following:

- Secondary impacts have been highlighted in light blue
- Impacts with both a primary and secondary impact have been highlighted in purple.

Examples of potential secondary impacts that have been identified for the proposed SCPX Project include:

- Poor re-colonisation of flora due to soil compaction
- Dust generation causing disturbance to bees and affecting honey production and the income this generates.

Examples of combined primary and secondary impacts of the SCPX Project are:

- Temporary disruption of irrigation or drainage causing loss of agricultural production
- Contamination of water used for potable water supply with sediment, fuel or chemicals.

Cumulative impacts

This chapter considers the potential cumulative (or additive) impacts of the proposed SCPX Project with existing developments such as the BTC/SCP and WREP pipelines, since they are part of the existing baseline environment.

The cumulative impacts considered in Chapter 11 (Cumulative and Transboundary Impacts) are those cumulative impacts that may result from the combined or incremental effects of future activities (i.e. those developments currently in planning and not included as part of the baseline). For clarity, on-going operational impacts from the BTC and SCP Facilities, have as relevant, been further described to demonstrate the potential for cumulative impacts from simultaneous operation between these and the SCPX Facilities.

The interaction of individual impacts from the proposed SCPX Project (in-combination impacts) is also discussed in Chapter 11. With any development, there is the potential for two or more environmental or social topic areas associated with the Project to impact on a given receptor or resource. For example, a sensitive receptor being affected by both noise and dust during construction could potentially experience a combined effect greater than the individual impacts in isolation. These are known as ‘in-combination’ impacts. The potential impacts associated with the individual topic areas are discussed in this chapter.

Consultation

During the ESIA process attention was paid to stakeholder concerns as expressed during the series of consultation meetings undertaken prior to the production of the Draft ESIA. SCPX Project design and location decisions were influenced by taking account of such concerns (Section 9.6.3). To the extent practical, and without prejudicing the safe and efficient operation of the project, changes were made with the aim of avoiding, preventing and/or reducing adverse impacts. For example, the pipeline will have a thicker wall where it is in close proximity to inhabited sites to help reduce the hazard potential.

In addition, certain impact mitigation commitments were devised, and included in a series of environmental and social management plans, to achieve the same objectives. Examples of mitigation commitments designed to deal specifically with stakeholder concerns are as follows.

Land acquisition and livelihoods: a Land Acquisition and Compensation Framework (setting out the principles and key mechanisms by which livelihoods would be maintained) and an accompanying Guide to Land Acquisition and Compensation will be prepared and provided to those likely to be affected by land acquisition. Also, natural resource features such as wetlands that are used for watering of livestock will be preserved. If that is not practicable, a substitute will be provided and access to grazing will be maintained or, if restricted, to the minimum extent reasonably practical. Finally, special commitments seeking to avoid harm to bees and reduced honey production will be implemented.

Infrastructure damage: there are a number of commitments relating to avoiding damage and, to repair, should any damage occur.

Employment opportunities: there is a presumption in favour of employing local people if the required skills are available. Targets for local recruitment will be set and local recruitment will be monitored regularly to assure that this commitment is met.

Pollution: commitments will be applied to suppressing dust and lowering noise to acceptable levels. Air pollutants will be monitored to assure that the commitments are being applied and achieving their objectives.

Ecological management: Flora and fauna along the route of the pipeline and associated facilities will be protected by a number of measures such as species translocation and pre-construction surveys.

Community health and safety: Commitments will be applied to suppressing dust, minimising risk of fuel spills, limiting speed limits for Project vehicles and lowering noise emissions from construction activities.

*Community liaison***:** Commitments will be applied to assist with timely supply of information on forthcoming Project activities to people within Project-affected communities (PACs).

Changes were also made to the ESIA in response to comments raised during the SCPX ESIA Disclosure Phase. These comments, responses and subsequent changes to the ESIA are discussed in Appendix C2.

10.1.6 Management of Change that Occurs Subsequent to the Preparation of this ESIA

There remains a possibility that changes to the Project will occur subsequent to preparation and submission of this ESIA. If this occurs, management of change procedures will include environmental and social assessment before any changes that may have detrimental effects on environmental or social receptors are adopted (39-04). In particular:

- The relevant authorities will be consulted if the need for any additional land take is identified and the relevant permits and consents will be obtained (39-01)

- Site assessments (taking into consideration ecology, cultural heritage, social, erosion risk, water resources) will be undertaken if the need for additional land is identified following submission of the ESIA (39-02)
- An environmental and social assessment report will be prepared by the Project if any additional land outside that described in the ESIA is to be used, the scale of which will depend on the proposed activities and sensitivities of the area (39-03).

The aim of this work will be to try to avoid or reduce any significant adverse impacts arising from the change and to enhance any beneficial impacts.

Should there be any significant changes to the operations of SCPX such as increased throughput, environmental policies and standards shall be considered as an integral part of any engineering assessment. This will be achieved through the Management of Change system (OP19) that will be adopted for the operations phase.

10.2 Geology and Geomorphology

This section discusses potential impacts on geology and geomorphology during construction of the SCPX Project and associated mitigation measures to be adopted. The operational phase is not expected to affect geology and geomorphology.

10.2.1 Aspects of SCPX Project that Could Affect Geology or Geomorphology

The following planned Project activities could affect geology and geomorphology in the Project area during the construction phase:

- Aggregate extraction (for access road construction, raising the CSG1 site and provided in fill for other facilities, sub-base material, and supplying pipeline padding material)
- Blasting at CSG2 and PRMS
- Facility construction civil engineering
- Access road construction in mountainous areas by CSG2
- Micro-tunnelling or horizontal directional drilling under the Mtkvari
- Removing rock from 300m of pipeline trench at KP56 with hydraulic drills.

The operational phase is not expected to impact on geology and geomorphology.

10.2.2 Key Sensitivities

The following areas of the baseline were identified to be particularly sensitive:

At CSG1, the key sensitivities are seasonal flooding (man-made) and earthquake hazard (ground shaking).

The ROW crosses the seismically active Rustavi fault at KP27 (discussed in Chapter 12). Competent rock is present at shallow depth from approximate KP56.7.

Earthquake hazard (ground shaking) and excavatability of strong competent rock for the installation of subsurface infrastructure are the main geological sensitivities at CSG2. The presence of impermeable rock at shallow depth influences drainage, especially during the spring snow melt.

Earthquake hazard (ground shaking) is the main geological sensitivity at PRMS. There is some sheet flooding in depressions.

Design of the facilities to address existing geological sensitivities is discussed in Chapter 12.

10.2.3 Impacts on Geology and Geomorphology

Impacts connected to geomorphology are discussed as follows: erosion issues associated with ground disturbance are discussed in Section 10.3, Soils and Ground Conditions; erosion issues at watercourses are discussed in Section 10.5, Surface Water Resources; the risk of seismic activity is addressed in Chapter 12, Hazard Analysis and Risk Assessment. None of these issues is therefore addressed in this section, which is confined to a discussion of impacts associated with aggregate use and disposal.

Pipeline construction

The SCPX Project design proposes to install the 56" pipeline loop in terrain that has sufficient depth of soil to bury the pipeline without the requirement to excavate long sections in hard rock, apart from a 300m section at the end of the pipeline loop (KP56).

Micro-tunnelling under the Mtkvari River could remove approximately 4000m^3 of rock that has to be disposed of as inert waste or re-used.

Facility construction

Aggregate will be spread over the facility sites to raise the site and form a level base for equipment construction. It is estimated that approximately 513,000m^3 of aggregates will be needed for CSG1, 48,000m^3 at CSG2, 203,500m^3 for the CSG2 access road and 52,000m^3 for the PRMS. The aggregate will be obtained from existing or new licensed quarries and/or borrow pits. Extraction and use of aggregates constitutes depletion of non-renewable natural resources. If borrow pits or quarries are poorly sited, extraction can have adverse impacts on ecology, water resources, cultural heritage and communities.

CSG2 access road

Where new sections of the CSG2 access road are constructed on hill slopes west of Kizilkilisa, construction work will cut into the hillside to form gradients suitable for use by heavy plant and construction equipment. This will require excavation and movement of rock to form the road base.

Impact summary and assessment of significance

Table 10-1 provides an assessment of the significance of impacts on geology and geomorphology before and after implementation of the proposed mitigation measures that are discussed in the following section.

Table 10-1: Potential Impacts on Geology and Geomorphology

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A1	Use of raw materials and natural resources	Depletion of natural resources, e.g. aggregates	B3 Low	1-01, 1-03, 1-06, 1-07, 1-09, 1-10, 1-12, 1-14, 9-02, D13-01, 39-01, 39-02, 39-03	B3 Low
A1	Disposal of excess rock from site	Reinstatement of borrow pits and other re-use initiatives	B2 Low	1-03, 1-12, 1-05, 1-06, 1-08, 1-09, 1-11, 39-01, 39-02, 39-03	B2 Low

*Assessed using Tables 3-2 and 3-3

10.2.4 Mitigation of Impacts on Geology and Geomorphology

In the design phase

The Project will review the flood protection philosophy at CSG1 with the aim of reducing the volume of imported material (D13-01).

The facilities sites at CSG2 and PRMS aim to achieve a balance of cut-and-fill material wherever possible so that the amount of imported materials such as aggregate will be limited as required for hardstanding, roadways and where there is a requirement for fill material to achieve a level site. As described in Section 5.6.1, during the detailed design phase the Project plans to investigate options for terracing the CSG1 and CSG2 facility sites and optimising the design of the temporary works areas with the aim of reducing the amount of earthworks and imported material required.

In the construction phase

The impact avoidance and mitigation measures summarised below will be applied to borrow pits and quarries and the use of aggregates and other quarried materials.

All excavated material will be screened and reused to the extent deemed feasible by Company to minimise the need for new aggregates (1-07). In particular, excavated subsoil will be screened and reused for padding, wherever practicable (1-14). Where this is not possible or the material is not suitable, aggregates will only be sourced from licensed sources as approved by MoENR (1-01). All potential subsoil disposal sites and disposal plans will be subject to an environmental and social review prior to their adoption (9-02).

The Project will give preference to using existing borrow pits where reasonably practical (1-03). The measures described in Section 10.1.6 (commitments 39-01, 39-02 and 39-03) to be undertaken following the identification of additional land will be implemented before a borrow pit and/or spoil pits are re-opened or a new one is established.

Environmental audits will be undertaken at any proposed third-party borrow pits and/or spoil disposal pits before they are used. Periodic audits will be undertaken by the Contractor thereafter and as considered appropriate by the Company (1-05).

Use of borrow pits will be managed in a manner that seeks to ensure that no illegal extraction (including by a third party) takes place (1-06).

When camps and lay-down areas are taken out of service, the existing aggregate will used, as approved by the Company, to landscape areas of the site before topsoil is spread; where this is not possible, the aggregate with be returned to borrow pits/Company approved disposal areas (1-08). All temporary borrow pits will be reinstated (unless instructed otherwise by regulatory authorities) (1-09).

Where excavated material is unsuitable for padding or backfilling, padding materials (e.g. sand or small-grained soils/gravel materials) will be bought or sourced from approved borrow pits (1-10).

Where benching is required, surplus subsoil will be stored on the ROW or, if disposal is necessary, it will be transported to an approved disposal site and/or approved borrow pits (1-11).

Care will be taken to ensure that the trench spoil is spread beneath the topsoil and is not left on the surface (1-12).

10.2.5 Residual Impacts

With the implementation of the proposed mitigation measures, it is considered that the residual impacts associated with aggregate use will be of low significance.

10.3 Soils and Ground Conditions

This section discusses potential impacts on soils during construction of the SCPX Project and associated mitigation measures to be adopted. The section will also consider the need for the Project to address some aspects of the baseline ground conditions as it has the potential to affect construction activities.

10.3.1 Aspects of SCPX Project that Could Affect Soils

The following planned construction activities could affect soils in the Project area:

- Use of vehicles, heavy plant and equipment on ROW (during construction and for inspection and maintenance during the operational phase)
- Civil engineering at the facility sites
- Topsoil clearance of ROW and facility sites
- Widening of existing temporary ROW access roads
- Construction of the CSG2 access road
- Pipeline trench excavation
- Topsoil and subsoil storage (for re-use in backfilling and reinstatement)
- Use of subsoil and topsoil in landscape areas
- Accidental release of potential contaminants (e.g. fuel, hazardous waste, chemicals).

10.3.2 Key Sensitivities

The following areas of the baseline were identified to be particularly sensitive:

- Areas of the pipeline loop with an existing Erosion Class of 4 at KP26–27, 29 54–54.5 and 55–56 (in areas where SCPX deviates from the SCP ROW)
- Areas of fly-tipping and building rubble along the ROW in locations at KP10, KP24.4, KP25.2, KP25.4 and KP25.8 and on the proposed CSG2 access road
- An existing aboveground pipeline that crosses the pipeline at KP14.1 and KP25.2
- KP30, where a fenced anthrax pit is located adjacent to and outside the ROW
- A number of surface working or disused sites identified at KP24.9 and KP29.7
- Wetlands between KP0 and KP01, at CSG2 and the CSG2 access road.

In addition, where the pipeline crosses underneath overhead electrical transmission lines, the potential for pipeline corrosion can be increased.

10.3.3 Impacts on Soils and Ground Conditions

Soil properties and compaction

The topsoil along the ROW is generally 100–260mm deep and the subsoil generally at least 2.5m deep, although it may be shallower in places in the last five kilometres of the route.

The bearing strength of topsoil is generally exceeded by the weight of construction vehicles. Repeated vehicle movements during construction compact the soils of the ROW, access roads and facility construction sites. Soil compaction alters the drainage characteristics of the soil. This can cause surface run-off, allow waterlogged conditions to develop or even cause localised flooding and thus damage the seed bank and microbial content of the soil. Compaction also reduces soil aeration levels and that decreases the ability of vegetation to grow back.

Topsoil will be removed from the facility sites and equipment lay-down areas, and from new sections of the CSG2 access road. The facilities and the CSG2 access road will be surfaced using other materials, and in this case the removal of topsoil will be permanent.

Excavation of a trench 2m wide and 2.5m deep along the ROW will disturb the subsoil. How much impact this disturbance has depends on how the topsoil and subsoil are separated, stored and reinstated.

If topsoil and subsoil layers are mixed during construction or storage, or if subsoil left over after backfilling the trench is disposed of by spreading over topsoil or vegetation, the soil structure and nutrient content may be impaired. If topsoil is stored for a long time (e.g. greater than six months), rainfall can leach out the nutrients it contains and anaerobic conditions can develop within the topsoil pile. This could lead to a loss of fertility in the soil and a loss in viability of the seed bank it contains.

Construction in waterlogged soil or during wet conditions increases the risk of soil compaction, and loss of soil in silt-laden run off from the construction working areas and pipeline spread.

Erosion and soil loss

Erosion is a natural process by which wind and rain wear away soils that have poor cohesion or are steeply sloping. Where the land surface is disturbed and when vegetation and topsoil are removed, erosion rates increase. After reinstatement of topsoil temporarily removed from the ROW during pipeline construction or at the temporary areas, the soil is less cohesive and is much more easily erodible in wet weather.

Erosion is categorised by the Project into defined classes presented in Table 10-2.

Table 10-2: Definition of Erosion Classes

Erosion Class	Verbal Assessment	Erosion Rate (tonnes/ha)	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
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 (> 10m^2 in cross-sectional area) every 20m. Most of original surface washed away exposing pipeline. Severe damage from erosion and sedimentation on-site and downstream

A baseline assessment of the erosion class of the soil along the ROW pipeline taking account of erodibility of the soil type rainfall, slope steepness and vegetation is presented in Table 10-3.

Table 10-3: Erosion Classification on SCPX ROW

Location	Estimated Erosion Rate (t/ha)	Erosion Class
KP0–12	2.699	2
KP12	0.000	Stream
KP12–19	3.084	2
KP19–26	1.604	1
KP26–27	19.749	4
KP27–27.2	53.676	5
KP27.2–27.9	2.344	2
KP27.9–28	6.416	3
KP28–28.5	2.590	2
KP28.5–29	1.905	1
KP29–29.2	7.709	3
KP29.2–29.7	164.761	6
KP29.7–30	0.000	Mtkvari crossing
KP30–38	2.313	2
KP38–42	2.699	2
KP42–43.2	14.314	4
KP43.2–43.6	7.157	3
KP43.6–46	3.084	2
KP45.9 and 46.01	0.000	Gabions currently installed
KP46–54	3.084	2
KP54–54.4	22.148	4
KP54.4–54.5	22.148	4
KP54.5–55	2.591	2
KP55–56	25.120	4

Seven sections of the ROW are considered to be liable to high, severe or very severe erosion. The meadow grey cinnamonic soils on steep slopes east of the Mtkvari River crossing (around KP27 and KP29) are susceptible to suffusion and irrigational erosion by rain. Surface run-off here can waterlog the soil and cause more intensive erosion. The reinstated pipeline trench and the ROW are likely to experience accelerated erosion at these points reducing the potential for vegetation establishment and this has the potential to increase the sediment in local drains, ditches and watercourses.

The Project will permanently remove soil from the facility sites (CSG1 20ha, CSG2 12ha, PRMS 4.3ha) and replace it with a surface of gravel, concrete or bitumen. Erosion may be an issue in the period before the surface is in place.

Where new sections of the CSG2 access road are constructed approximately 120,000m^3 of topsoil will be removed. Approximately 15,000m^3 of this topsoil will be replaced to give 10cm of topsoil cover on roadside slopes. The remaining 32,000m^3 will be available for use in local areas. Until vegetation becomes established on the roadsides, there is the potential for soil to wash off into local watercourses.

Pre-existing land contamination

No pre-existing contamination within the Project areas was identified during the phase 1 survey undertaken in 2011. Areas of fly-tipping have been identified during preliminary site

surveys along the pipeline route and the CSG2 access road, consisting mainly of domestic waste (plastic and glass bottles, cardboard and fabric).

An anthrax pit was located outside the ROW at KP29–30.

Contamination during construction

The principal potential contaminants associated with the construction activities are as follows:

- Fuels and lubricating oils
- Paints and solvents
- Welding wastes and field welding and coating materials
- Hydrotest and cleaning chemicals (e.g. biocides, oxygen scavengers and corrosion inhibitors)
- High pH run-off from concrete batching areas
- Disturbance of unknown contamination, e.g. anthrax pits.

The soil can also be contaminated if substances from hazardous waste storage leach into the ground or if large quantities of raw sewage are discharged onto the ground.

Contamination during operation and decommissioning

The principal potential contaminants associated with operational activities include:

- Fuels and lubricating oils
- Paints and solvents
- Chemicals, e.g. glycol.

During decommissioning of some of the existing SCP facilities there is the potential for soil contamination if underground pipework or vessels are not sufficiently drained of any diesel or potentially hazardous fluids (e.g. the glycol and water mix within the water bath heaters). These potential impacts could also occur during SCPX decommissioning.

Impact summary and assessment of significance

Table 10-4 provides an assessment of the significance of impacts on soil resources before and after implementation of the proposed mitigation measures that are discussed in the following section.

Table 10-4: Impact Assessment Summary for Soils and Ground Conditions

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A2	Soil compaction	Loss of drainage capacity with increased surface water run-off	C3 Medium	2-01 to 2-04, 2-05, 2-07, 3-09, 3-15, 4-03, 4-06, 4-13, 4-08, D17-01, D17-02, OP61	C1 Low
A3	Soil erosion	Loss of topsoil necessitating importation for reinstatement	C4 Medium	3-07, 3-08, 3-17, 4-02 to 4-05, 4-07, 4-08, 4-12, 4-13, 4-18, 3-17, D5-086, 17-07, X3-01	C2 Low
A4	Loss of soil structure, fertility and seed bank	Development of anaerobic conditions in stored soil	C4 Medium	4-05, 4-04, 3-01, 3-11, 4-08, 4-09, 4-15, 4-22	C1 Low

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A5	Ground settlement following restoration of pipeline trench	Visual impact and soil erosion	B2 Low	D5-086, 9-01, 3-01, D5-065, D5-066, X3-01	B2 Low
A5	Ground settlement following decommissioning of section of SCP pipeline at Area 72	Ground subsidence	B2 Low	DE01	B1 Low
A6	Disturbance, treatment and disposal of known/unknown contaminated land	Mobilisation of soil contaminants	C3 Medium	3-01, D3-04, 6-01, 6-02, 6-13, 6-14, 6-16, 6-18, 6-22, 6-25, X6-04, 7-05, OP121, D5-104	C Beneficial
A7	Disposal of solid and liquid waste, release of hazardous materials	Contamination of soil	C3 Medium	X3-03, 7-01 to 7-04, 4-14, 6-03, 6-04 to 6-14, 6-20, 6-21, 6-24, 6-16, 6-18, 7-08, 7-10, 7-11, 7-12, 7-13, 7-14, 7-15, D5-028, D5-029, D5-030, D5-106, DE02, DE03, DE04, DE05, DE06	C1 Low
A9	Disposal of surplus subsoil and aggregate	Loss of soil structure, fertility and seed bank	C2 Low	1-08, 1-12, 9-01, 9-02, 9-04, D5-066	C1 Low

* Assessed using Tables 3-2 and 3-3

Table 10-5: Soil Impact Assessment at Sensitive Locations

Location	Issue	Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
KP0–1 wetland CSG2 and CSG2 access road	Soil compaction	Compaction of wetland	A3 Low	2-01, D17-01, D17-02, 2-03, D17-08	A2 Low
KP26 Slopes east of Mtkvari	Soil erosion	Surface water erosion and landslip	B4 Medium	X3-02, 3-01, 3-03, 3-05, 3-07, 3-08, 3-17, X7-08, 3-26, 03-28, 4-12, 1-12, 2-05, D5-065, 2-07, 3-15, D5-086	B3 Low
KP29–30 Slopes east of Mtkvari	Soil erosion	Surface water erosion and landslip	B4 Medium		B3 Low
KP54 Slope east of Algeti	Soil erosion	Surface water erosion and landslip	B3 Low		B3 Low
CSG1, CSG2, PRMS, CSG2 access road	Soil erosion	Surface water drainage causes erosion	B3 Low		B3 Low

* Assessed using Tables 3-2 and 3-3

10.3.4 Mitigation of Impacts on Soils and Ground Conditions

The impact avoidance and mitigation measures summarised below will be applied to appropriate activities, including those that could compact the soil, cause erosion or pollute the soil.

At the design stage

General

Contamination
In accordance with the SCPX Waste Management Plan, solid wastes generated by construction activities will be collected in waste storage areas (WSA) located at the camps (D5-028) before being transported to agreed disposal sites in accordance with the pollution prevention plan included in Appendix D. All wastes from the SCPX Project will be managed with the aim of minimising (a) impacts to the natural environment and (b) health hazards to personnel. Where appropriate, waste materials will be reused or recycled, with disposal to landfill as a last resort. In this case, inert and non-hazardous waste will be disposed of to the licensed BP operated landfill site near Rustavi (D5-029). Hazardous waste will be forwarded to a waste disposal contractor licensed to receive and treat hazardous waste (D5-030).

Pipeline

Soil compaction and erosion
A suite of erosion control measure 'tool boxes' was used on the BTC and SCP pipelines and has proved effective. These erosion toolboxes are methods of erosion control that define the detailed requirements at specific locations. The toolboxes are used to design the location-specific erosion control measures that are included on the pipeline alignment sheets. The measures are summarised below in Table 10-6 and will be implemented along the new pipeline loop according to the erosion risk at each location to design erosion control measures that meet Erosion Class 3 or better.

Table 10-6: Tool boxes to be Applied for Erosion Control

Toolbox Number	Tool Box Definition
1	Top soil storage away from erosion areas, upslope from ROW
2	Subsoil and spoil storage away from erosion areas, downslope from ROW
3	Re-vegetation, reseeding and replanting
4	Erosion mats, sandbags, jute or geotextile
5	Diverter berms or upslope header ditches with 10m spacing

Contamination
The selected pipeline route has avoided areas of soil contamination, such as the known anthrax-contaminated area close to the Mtkvari crossing (D3-04) at KP30.

Facilities and access roads

Soil compaction and erosion
Surface water drainage from operational areas including access roads and temporary facilities will be designed to minimise soil erosion in accordance with sustainable urban drainage systems (SUDS) principles (3-26).

The CSG2 access road route has been selected to follow existing roads and tracks and to avoid plantations, wetlands and cultural heritage sites as far as practicable (D17-02). During detailed design, the CSG2 access route has been adjusted to avoid the majority of the wetland area near Kuschi and to route the permanent and temporary footprint away from the area of active corncrake habitat between Kuschi and Berta villages (D17-08).

Construction of CSG2 facility and lay-down areas will avoid building on the larger area of wetland at the site (D17-01).

In the construction phase

During construction a number of mitigations will be applied to reduce the impacts on soil and ground conditions, which are discussed in the following sections.

General mitigation measures

Soil compaction and erosion

To avoid compaction impacts outside the cleared areas (i.e. ROW and facilities), vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency) (2-02).

Temporary erosion control measures will be developed and implemented after initial land disturbance and if construction activity on the working areas is suspended over the winter before reinstatement has been completed (3-28).

If topsoil is stored for more than six months, the stacks will be monitored for anaerobic conditions and manual aeration will be undertaken if they develop (4-04). This aims to provide sufficient fertility for reinstatement at the end of the construction period.

Stored subsoil and topsoil will be segregated in a manner that avoids mixing (4-02). Topsoil stacks along the ROW will be free draining and stored in accordance with the Project Reinstatement Specification (4-05). Topsoil will be stored outside the running track used by construction plant, equipment and vehicles (4-03). Soil storage areas will be protected from vehicle movements to avoid soil compaction (4-06). Keeping the topsoil mounds free from disturbance in this manner will reduce risk of physical damage and compaction.

Where the Project considers that ground is sufficiently steep (generally greater than 25%), topsoil stockpiles will be protected with silt fence to help reduce washout and loss of topsoil during heavy rains (4-07). Topsoil stacks will be regularly inspected for compaction and erosion; corrective measures will be implemented if compaction or erosion is identified (4-13). The topsoil and subsoil stack surface will be compacted sufficiently with the aim of preventing erosion, without leading to the development of anaerobic conditions (4-08). Reinstatement will be undertaken as early as practicable and in accordance with the Reinstatement Specification (4-09). The Project will seek to achieve an increasing trend in vegetation re-growth and species diversity (specifically species composition) in reinstated areas with reference to nearby areas undisturbed by Project activities, as recorded by the percent similarity and commonality indices (17-07). This will help reduce erosion and should help create a sustainable, self-generating plant community.

Contamination

A baseline survey of visible contamination has been carried out and will be repeated before construction begins to include camp and pipe storage areas (6-01). All known areas of surface contamination (within the Project footprint) will be cleared before construction begins (6-02). The Company will carry out a due diligence exercise to identify and manage the risk of anthrax (6-22). The fencing at the known anthrax pit at KP30 will be maintained during construction to help protect the area from disturbance and workers will be made aware of the risks posed by this area and the need to avoid disturbance (X6-04). If any animal burial pits are identified during construction, works will cease in this location until the affected area has been subject to sampling by qualified personnel to determine if there is a risk of anthrax (6-25).

Contaminated soil will be segregated from uncontaminated materials and stored at least 50m away from any surface water or seasonal surface water bed (7-05). Any contaminated material storage areas will be provided with containment measures (for example bunds

ditches, impermeable base membranes, covers) to help minimise run off and airborne losses soil (6-18).

The following mitigation measures will be implemented with the aim of reducing the risk of soil contamination:

- The storage of hazardous materials will be restricted to designated impermeable hazardous materials storage areas located at least 50m from any surface water course or seasonal water channel (6-03)
- The requirements for the establishment of hazardous materials storage areas (e.g. bunding, impermeable surfaces, secure drainage, limited access, labelling) will be identified in the Contractor's Pollution Prevention Implementation Plan (6-04)
- A refuelling procedure will be developed by the Contractor, which will include a restriction on refuelling within 50m of any watercourse. Any deviation will be subject to approval by the Company (6-05)
- The Contractor's Implementation Plan will detail requirements for record keeping and on-site maintenance of material safety data sheets (MSDS) (6-06)
- Materials that can potentially react with each other will be segregated during storage (6-07)
- Procedures will be established to determine acceptability of material storage and to promote the minimisation of storage volumes (6-08)
- Hazardous chemicals will be securely stored on site in a designated storage area (7-11)
- Relevant personnel will be trained in safe use and handling of hazardous materials (6-09)
- The need for remedial work in any specific area will be determined on the basis of the observed contaminants, sampling and analysis to determine their concentrations and the risks that they may pose to local receptors (social and environmental) in accordance with Project Standards (6-13)
- In each area of identified contamination, a site-specific remedial action plan will be developed. The plan will include a summary of the environmental risks posed by the contamination and the procedures that are to be adopted to mitigate those risks (6-14)
- Diesel storage tanks at construction camps and CSG2 will be located in suitably sized and constructed bunded areas that are designed to be impervious to water and fuel. The bund volume will be designed to no less than 110% of the tank volume. Loading and off-loading connections will be located over secondary containment (7-10)
- Regular inspections and maintenance will be carried out of secondary containment areas at camps to confirm that they are functioning effectively (7-12)
- Relevant training will be provided to those with responsibilities for monitoring of effluent discharges and emissions at the construction camps such as effluent sample taking and chain of custody (7-13)
- Information will be incorporated into the Site induction process and will outline the role of personnel in the management of waste and emissions from site and spill response procedures. (7-14)
- Site induction training will be supplemented by regular ‘toolbox’ talks with relevant personnel if inspections or audits highlight failings in waste management (7-15).

If a spill does occur, the following measures will reduce the associated potential impacts:

- Spill response equipment (absorbents etc.) will be available in hazardous materials storage areas (6-10)

- Relevant construction personnel will be trained in use of spill kits and disposal practices (6-11)
- A trained rapid response team will be mobilised in the event of spillage of hazardous materials (6-12)
- Vehicles delivering fuel or hazardous liquids will carry appropriate spill kits to allow an initial response to any spill to be deployed (6-20)
- All mobile plant (excluding vehicles) will be integrally bunded or will be equipped with a bund or drip tray which will be regularly inspected and emptied to prevent rainwater accumulating (6-21)
- Remedial work will be implemented as described above in commitments 6-13 and 6-14
- The preferred options for the treatment of contaminated soil will be based on the risks posed by the material. In keeping with the aim of minimising the transportation of hazardous materials and minimising waste generation, preference will be given to in situ and low technology remedial approaches (6-16).

In accordance with the Project standards identified in Chapter 6, clean-up will follow the methodology from the UK Environment Agency, which is based on the source–pathway–receptor principle and which seeks to establish the linkages between the pollutants and the receptor and whether harm to health or the environment is likely to occur.

The following waste management measures will be implemented to minimise the risk of ground contamination:

- Controlled or uncontrolled burning of waste will not be allowed (with the exception of Company-approved incinerators) (7-01)
- Non-hazardous waste will be disposed of at a Company- and Government-approved landfill site (7-02)
- A secure hazardous wastes accumulation area that meets Project requirements will be used for temporary storage at Project sites prior to transfer to an approved final hazardous storage or disposal facility (7-03)
- Waste management practices will be subject to regular monitoring and auditing (7-04)
- Disposal of the drilling mud will be subject to an environmental risk assessment (6-24)
- Waste will be segregated to facilitate recycling and re-use (7-08).

Restoration

To facilitate natural re-vegetation of the ROW, the separately stockpiled topsoil and vegetation debris will be spread over the surface of the ROW following completion of grading as appropriate (D5-086). Once the topsoil has been replaced it will be stone picked to remove any large stones which are not in keeping with the surrounding soil texture (3-11). Upon completion of subsoil and topsoil reinstatement, the contractor and Company personnel will inspect disturbed areas jointly for signs of erosion, slope stability, relief, topographic diversity, acceptable surface water drainage capacity and function, and compaction and implement remedial measures, if necessary, at locations where reinstatement does not meet Project criteria (3-15). Re-contouring should be sympathetic and in keeping with the surrounding landscape, and as approved by the Company, where this is not precluded by risk to integrity of the pipeline or erosion considerations (9-01). In the case of an unplanned event, any damage will be reinstated and compensated where appropriate (4-14).

A soil survey of camp sites and pipe storage areas that will be undertaken (4-22) to inform the reinstatement of these areas. Appropriate reinstatement techniques will be used following construction to stimulate the subsequent re-establishment of vegetation and

thereby reduce the risk of soil erosion. A Project-specific Reinstatement Plan has been prepared that includes mitigation for impacts to soils as described below.

Pipeline

Soil compaction and erosion

A soil survey will be undertaken (based on a representative sample) prior to construction to measure the depth of the topsoil layer along the pipeline route and will be used to determine the depth of topsoil stripping (4-15). The construction contractor(s) will produce method statements incorporating plans for erosion control, sediment control and reinstatement before work begins at river crossings (4-12).

Load-bearing materials, such as bog mats and/or geotextile membranes, will be used to support heavy loads in areas of soft ground (including wetland areas) unless deemed impractical by the Company (2-01). Driving along the ROW will not be permitted in excessively wet conditions unless otherwise approved by the Company (2-03). Temporary drainage will be provided where necessary (as determined by the Company) to prevent ponding or water-logging of the working area (2-04).

Erosion control measures will be implemented with the aim of achieving erosion Class 3 (3-03) to reduce the risk of soil erosion on the ROW, including:

- Temporary trench dewatering or stabilisation will be undertaken where required to minimise slumping of trench walls (3-05)
- Trench breakers will be installed where downhill flow within the trench may lead to erosion (3-07)
- Soil loss will be monitored and corrective actions taken if it exceeds erosion class 3, in accordance with the Reinstatement Plan (3-08) as defined in Table 10-2. This is most likely to occur on the slopes above the eastern bank of the Mtkvari (KP27, KP29) and at CSG2
- Local people will be actively discouraged from using the ROW as an access road (through use of signage, public education, etc.) (3-09)
- During disposal of pipe trench water and hydrotest water the rate of discharge of water will be controlled to reduce the risk of soil erosion (3-17)
- The ROW slopes at KP28 and KP30 that have a high erosion risk will be reseeded using hay and an appropriate seed mix (X7-08)
- In sensitive areas of thin topsoil (as defined by Company) additional precautions will be taken with the aim of preserving the topsoil for subsequent replacement as deemed feasible by the Company (4-18).

Contamination

The existing micro-tunnelling shaft on the east bank of the Mtkvari is full of waste material that has not been classified. The waste will be dug out, assessed and managed in accordance with the Pollution Prevention Plan and Waste Management Plan (X3-03).

Restoration

Back-fill will be adequately (but not excessively) compacted to prevent future settlement (2-05) in sloping terrain (usually 10 degrees and over) trench breakers (e.g. bags filled with soil/cement mix) will be installed across the width of the trench at suitable intervals up to the graded ground level (D5-065) to avoid subsidence as a consequence of rain water channelling. Care will be taken to ensure that trench spoil is spread beneath the topsoil and is not left on the surface (1-12). After backfilling, the subsoil beneath the running track will be ripped prior to reinstatement of agricultural land (2-07) to alleviate compaction. Upon completion of subsoil and topsoil reinstatement, the contractor and Company personnel will inspect disturbed areas jointly for signs of erosion, slope stability, relief, topographic diversity, acceptable surface water drainage capacity and function, and compaction.

Remedial measures will be implemented, if necessary, at locations where reinstatement does not meet the Project criteria (3-15).

Any surplus subsoil from trench excavations will normally be spread within the working width 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 (D5-066).

Facilities

Soil compaction and erosion

Topsoil removed from the facilities (and any excess subsoil) will be stored in designated areas within the site area for potential use in the landscape works (3-01) to prevent the seed bank in the topsoil being diluted by mixing with the subsoil. Topsoil from the access road will be stored in allocated areas along the access road and used preferentially for reinstatement of road banks. Surplus topsoil from the CSG2 access road construction will be spread at agreed locations or on municipal land (X3-01). Mitigation measures 2-01, 2-02 and 2-03 described above will also apply to the CSG2 Access Road.

Both the pipeline and the facility working areas will be prone to erosion once the topsoil is removed. At the facility sites this will be relatively short lived until sub base and surfacing is in place.

Restoration

In addition to the general mitigation measures described above, which are applicable to both the pipeline and facilities, the CSG2 access road embankments will be reinstated with an appropriate seed mix (X3-02).

Operations

Pipeline

When patrolling the pipeline, the Project will use horse patrols wherever practicable, minimising vehicular access except where necessary for maintenance purposes (OP61).

When the 56”-diameter pipeline is operating, regular patrols of the pipeline by ROW horse patrols, vehicular patrols (using existing access tracks) and security patrols will, lessen the risk of third party interference (OP121) and minimise the potential for fly-tipping over the pipeline.

The long-term visual effects of the pipeline are considered in Section 10.4.5.

Facilities

Hazardous chemicals will be securely stored on site in special containers in a designated storage area (7-11).

Regular inspections and maintenance will be carried out of secondary containment areas and emissions control techniques at Facilities to confirm that they are functioning effectively (7-12).

Relevant training will be provided to those with responsibilities for monitoring of effluent discharges and emissions at the Facilities such as effluent sample taking and chain of custody (7-13).

Further consideration of the potential for contamination to surface waters is discussed in Section 10.5.4 and groundwater in Section 10.6.4.

Decommissioning

SCP
An environmental risk assessment will be undertaken prior to decommissioning of Area 72 to identify the potential environmental risks, including to soil and groundwater. The mitigations developed will be incorporated into the Decommissioning plan (DE-03). During decommissioning of some of the existing facilities at Area 72, the glycol and water mix drained from the Area 72 water bath heater during decommissioning will be disposed of in accordance with the Project waste management plan (DE-02) to reduce potential impacts of contamination. Scrap metal removed from Area 72 will be sent to recycling facilities where available (DE-04).

At Area 72, the section of SCP pipeline under the road will be cut either side of the crossing, injected with suitable grouting and capped to prevent collapse (DE-01).

SCPX
Within 30 days of termination of the Host Government Agreement, a plan must be prepared describing how abandonment will be achieved. This Abandonment Plan will be subject to approval by the Government. An ESIA will be prepared prior to implementation of the Abandonment Plan to assess and minimise potential environmental and social impacts arising from the abandonment operations. This abandonment ESIA will be submitted to the Government (DE-05). 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 (DE-06).

10.3.5 Residual Impacts

With the implementation of mitigation measures, the residual impacts on soil can be summarised as follows:

- Soil compaction will be relieved by the proposed mitigation measures. The residual impact is expected to be of low significance
- Topsoil management will reduce the impact on the viability of the soil and seed bank to low significance
- Soil erosion from the ROW and cleared construction sites will be reduced. The residual impact is expected to be of low significance
- Correct reinstatement will help to reduce ground settlement impact to low
- Clearing fly-tipped waste from the ROW and the CSG2 access road is likely to be beneficial
- Disposal of liquid waste in a controlled manner and controls regarding the storage and disposal of hazardous substances will help ensure that the impacts on soil are of low significance.

10.4 Landscape and Visual Impacts

This section discusses potential impacts on landscape and the views afforded to visual receptors during the construction and operation phases of the SCPX Project and the associated mitigation measures to be adopted. Photomontages are provided in Appendix A showing the modelled facility as it will appear from key view points before and after mitigation.

10.4.1 Aspects of SCPX Project that Could Affect Landscape and Views

The following planned Project activities could affect the landscape and views from vantage points in the Project area:

- Temporary use of land for construction (ROW, construction camps, equipment lay-down areas, ROW access roads, borrow or spoil disposal pits)
- Permanent land take (facilities and CSG2 access road)

- Vegetation clearance from ROW, facilities, access roads and construction camps, equipment lay-down areas
- Construction of buildings, exhaust stacks and vent stacks at facilities
- Temporary lighting of river crossings and micro-tunnelling areas, road and rail crossings and hydrotesting area on the ROW
- Permanent lighting of facilities
- Permanent landscape works.

10.4.2 Key Sensitivities

Landscape character

The ROW has low landscape sensitivity. The ROW has predominantly flat relief, though varied topography occurs such as the terraces above the Mtkvari River. The natural landscape has been strongly degraded and modified by agricultural use, particularly the section KP0 to KP12 where the large fields and irrigation channels are laid out in a rectilinear functional man-made pattern. The broad, distant views include many industrial features (chimneystacks, power station and electricity transmission towers).

CSG1 has low landscape sensitivity. It is characterised by a flat arable field and the landscape is influenced by the presence of the existing PSG1 and SCP Area 72 facilities.

In the area around CSG2, the distinctive natural landforms are only partially modified by the presence of large linear pine plantations. The quality, condition and character of the landscape at and around the CSG2 site have a medium sensitivity to the introduction of new unnatural features.

The PRMS also has low landscape sensitivity. It is characterised by an open plateau of grassland and the presence of the existing facility at Area 80.

Visual

For the pipeline visual receptors are limited to road users (medium sensitivity) and shepherds (medium sensitivity).

For CSG1 visual receptors are limited to the local settlements and roads including the outskirts of Nazarlo the village of Lemshveniera (both high sensitivity) and road users travelling south toward Jandari (medium sensitivity).

For CSG2 visual receptors are limited to local settlements and roads including the villages, Rekha and Khando (high sensitivity) and the road between Rekha and Khando (medium sensitivity).

For PRMS visual receptors are limited to distant view from settlements located on the valley sides to the north-east and south-east, including views from the village of Julda and Vale (high sensitivity).

10.4.3 Landscape and Visual Impacts

The potential landscape and visual impacts of constructing the pipeline and facilities may be broadly defined as follows:

- Landscape impacts:
    - direct impacts upon specific landscape elements within and adjacent to the pipeline route and facilities, e.g. grasslands, field boundaries, trees, woodlands, and watercourses
    - effects on the overall pattern of the landscape elements that combine to form the landscape character of the sites and their surroundings

- Visual impacts:
    - direct impacts of the development upon views in the landscape

- overall impact on visual amenity.

After construction, the degree and duration of any landscape or visual impact will be determined by the nature of the landscape crossed. For example, arable land, grasslands and woodlands, respectively, take an increasing length of time to re-establish following reinstatement. However, these impacts are only likely to be temporary in duration.

Pipeline and temporary facilities

For the vast majority of its route, the construction of the pipeline will only impact on the landscape in the short-term, during construction and for a brief period afterwards. The pipeline working width will be visible through the landscape during construction when the vegetation are removed and topsoil stripped back within the construction corridor. Once construction is complete the pipeline will be buried and the land will be reinstated to the original land use.

The time taken for impacted areas to integrate into the landscape will depend on the land use or habitat type affected. For the majority of the pipeline route, through arable and pastoral fields, it is expected that the land will be returned to agricultural use within approximately 12 months following reinstatement. For more complex grassland habitats, although vegetation may become established within two years, it is likely to take five years or more for the vegetation to visually merge with adjacent habitat. There will be a permanent landscape/visual impact owing to the presence of the aerial and pipeline markers required to identify the route.

The block valve located at KP28 and the pigging station located at KP56 will consist of fenced compounds with associated access tracks. The sites will be visible in close proximity but will be a small feature within the overall landscape.

Figure 10-2: Typical Block Valve

The pipeline lay-down area is located on existing industrial land and the pipeline camp on an area of rough grassland and will have short-term visual and landscape effects.

CSG1

Photomontage visualisations and viewpoint location plans have been prepared that illustrate the potential visual impacts of the proposed CGS1 facilities with and without mitigation measures. These are contained in Appendix A.

Landscape character
The CSG1 site area is of low landscape sensitivity; the addition of the new facilities will not affect the overall landscape character of the area.

Visual impact
Figure A2.2 illustrates the potential visual effects from the outskirts of Nazarlo. The photomontage illustrates that the roof tops and the exhaust stacks of the compressor building may be seen protruding above the intervening tree lines, seen against the backdrop of distant hills. The vent stack may also be seen protruding above the intervening tree line and seen against the backdrop of the distant hills and the sky. The remainder of the proposed CSG1 site is effectively screened by intervening vegetation.

Similarly, from Lemshveniera, Figure A2.4 illustrates that only the rooftops and exhaust stacks of the compressor buildings and the vent stack may be seen protruding above the intervening tree lines, seen against the backdrop of distant hills. The majority of the proposed development is being screened by the intervening vegetation.

From both Nazarlo and Lemshveniera the proposed CSG1 development is expected to result in minor changes to views without affecting the overall character and quality of the views.

For road users travelling towards Jandari, Figure A2.6 viewpoint 14 illustrates that much of the proposed development will be seen. However, the CSG1 facility will be seen in combination with and adjacent to the existing PSG1 and SCP area 72 facilities, and together they may be perceived to be one larger facility. From Jandari Road, the proposed CSG1 development would result in no noticeable change to views and would not affect the overall character or quality of the views.

The CSG1 lay-down area and construction camp are located adjacent to the proposed development site and will be reinstated on completion of construction. They will have short-term visual and landscape effects.

CSG2 and access road

Landscape character
The CSG2 area has a medium sensitivity to the introduction of new unnatural features. The addition of the new facilities introduces an industrial element to the landscape that is out of character with the surroundings. However, the wide expanse and scale of the landscape mitigates the site, as it is appears as a relatively small development in the wider landscape context. The straight lines (unnatural lines) of the plantation woodlands introduce a man-made element to the landscape that also mitigates the site.

Visual impact
Photomontage visualisations have been prepared to illustrate the potential visual impacts of the proposed CGS2 facilities.

Figure A2.9 illustrates that from Rekha the buildings at CSG2 will be prominent, protruding above a ridgeline in the middle distance, and will be seen against the backdrop of the distant mountains. In addition, the vent stack will be seen against the backdrop of the mountains and the sky. From Rekha the proposed CSG2 development would result in a prominent change in the quality and character of the views from Rekha.

Figure A2.14 illustrates the potential visual effects from the road between Rekha and Khando. From this road only the proposed vent stack will be noticeable, protruding above a ridgeline and clothed in coniferous plantation in the middle distance. The vent stack will be visible against the backdrop of both the distant mountains and the sky. From the Rekha to Khando road, the proposed CSG2 development would result in noticeable change to views. However, owing to the overall scale of the landscape, the overall character and quality of the views would remain similar.

Figure A2.12 illustrates that from Khando only the tops of the exhaust stacks may be visible above the intervening ridgeline, with the vent stack protruding into the sky. From Khando the proposed CSG2 development would result in minor changes to views without affecting the overall character and quality of the views.

The CSG2 access road has been routed to largely avoid plantations and woodlands and to utilise existing roads where possible to minimise effects on the landscape character of the area. The road will be visible from local villages Nardevani, Aiazmi, Burnasheti, Ozni, Kuschi and Berta. The last 5km of the road is a remote location well away for villages and local visual receptors.

The CSG2 lay-down area and construction camp are located adjacent to the proposed development site and will be reinstated on completion of construction. They will have short-term visual and landscape effects. The CSG2 access road camp is located in the vicinity of the CSG2 access road, there will be short term visual and landscape effects.

PRMS

Landscape character
The PRMS has low landscape sensitivity. The new development will be collocated with the existing Area 80 and will not be seen as a new development in the overall landscape.

Visual impact
Photomontage visualisations have been prepared to illustrate the potential visual impacts of the proposed PRMS facilities.

Figure A2.16 illustrates that from Julda the proposed PRMS will be a noticeable feature of the opposite valley side, seen against the backdrop of the hills immediately behind and in combination with the existing Area 80 facility. From Julda the proposed PRMS development would result in no noticeable change to views and would not affect the overall character or quality of the views.

Figure A2.19 illustrates that from Vale the proposed PRMS will be a noticeable feature of the opposite valley side, seen against the backdrop of the hills immediately behind and in combination with and screening the existing Area 80 facility. From Vale the proposed PRMS development would result in no noticeable change to views and would not affect the overall character or quality of the views.

The PRMS lay-down area and construction camp will be located approximately 1km from the proposed development site. The area will be reinstated on completion of construction and will have short-term visual and landscape effects.

Impact summary and assessment of significance

Table 10-7 and Table 10-8 provide an assessment of the significance of visual impacts before and after implementation of the proposed mitigation measures which are discussed in the rest of this section.

Table 10-7: Potential Landscape and Visual Impacts – Pipeline

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A8	Impact on landscape elements	Modification of landscape elements (arable land, grasslands) during pipeline construction. Topsoil removal, soil removal and storage	B3 Low	35-08, 17-07, 17-10, 9-01, D5-093, 4-09, 8-03, 3-14	B1 Low

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A8	Impact on landscape elements	Modification of landscape elements (field boundaries, watercourses and trees) during pipeline construction. Trees and vegetation removed.	B3 Low	17-07,17-10, 3-19, 8-03, 3-14, OP141	B1 Low
A8	Visual intrusion	Temporary modification of views during pipeline construction	D3 Medium	17-07, 17-10, 3-19, 8-03, 8-04, 3-14	D1 Low
A9	Disposal of surplus subsoil	Modification of landscape and views through changed topography	C3 Medium	1-08, 1-12, D5-066, 9-01, 9-02, 9-04, D5-093, 4-09, X4-06	C1 Low
A8	Visual intrusion	Modification of landscape and view from pigging station and block valve	B3 Low	D5-096, D8-02, 9-01, 4-09, 17-10, 8-03, 3-14	B3 Low

* Assessed using Table 3.4 and 3.5

Table 10-8: Potential Landscape and Visual Impacts – Facilities

Location	Issue	Potential impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
CSG1	Landscape impact	Modification to landscape features and character by CSG1	B2 Low	D5-096, D8-02, 17-10, X4-02, X4-12, 9-01, D5-021, OP141	B2 Low
CSG1	Visual intrusion	Nazarlo and Garji Modification of daytime views from Nazarlo and Garji by CSG1	D2 Medium		D1 Low
CSG1		Jandari Road Modification of daytime views from the Jandari Road by CSG1	C3 Medium		C2 Low
CSG2	Landscape Impact	Modification to landscape features and character by CSG2	C4 Medium	3-01, D8-02, X4-05, 17-10, X4-03, X4-12, 9-01, D5-024, OP141	C2 Low
CSG2	Visual intrusion	Modification of daytime views from Rekha by CSG2	D4 High		D2 Medium
CSG2		Modification of daytime views from Khando by CSG2	D1 Low		D1 Low
CSG2		Modification of daytime views from Rekha to Khando Road by CSG2	D1 Low		C1 Low
PRMS	Landscape impact	Modification to landscape features and character by PRMS	B2 Low	D5-096, D8-02, 17-10, X4-08, X4-12, 9-01, D5-027, OP141	B2 Low
PRMS	Visual intrusion	Modification of daytime views from Julda by PRMS	D2 Medium	D5-096, X4-08, X4-09, X4-12, 9-01, D5-027	D1 Low
PRMS		Modification of daytime views from Vale by PRMS	D2 Medium	D5-096, X4-08, X4-09, X4-12, 9-01, D5-027	D1 Low

Location	Issue	Potential impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
CSG2 Access Road	Landscape impact	Modification to landscape features and character by access road	C3 Medium	X4-06, X3-01, 17-10, X4-12 9-01, D5-027, 1-08, X3-02, 17-10, 17-05, 8-03, 3-14, 8-03, 9-01, 17-07, OP141	C2 Low
CSG2 Access Road	Visual intrusion	Modification of daytime views from Nardevani, Aiazmi, Burnasheti, Ozni and Berta	D3 Medium		D2 Low
Working areas and CSG1	Visual intrusion	Lighting affects night-time views Jandari Road	C3 Medium	8-04, D8-03, X4-08, X4-05	C2 Low
Working areas and CSG2		Lighting affects night-time views from Rekha	D4 High		D3 Medium
Working areas and PRMS		Lighting affects night-time views from Julda and Vale	D1 Low		D1 Low

* Assessed using Table 3.4 and 3.5

10.4.4 Mitigation of Landscape and Visual Impacts

The impact avoidance and mitigation measures summarised below will be applied to activities that could have visual and landscape impact.

At the design stage

Considerable effort has gone into the design of the Project to minimise the landscape and visual effects. This has included a detailed site selection study resulting in the selection of the chosen sites (Chapter 4). The block valve, PRMS and the CSG1 have been collocated to minimise the requirement for additional development on greenfield sites (D5-096) and resulting effects of the character of the landscape. The only location that could not be collocated is the CSG2 site, which needs to be located in the Tsalka region to achieve the design throughput.

The CSG2 access road route has been selected to follow existing roads and tracks and to avoid plantations, wetlands and cultural heritage sites as far as practicable (D17-02), which reduces change to the character of the landscape.

The Project will use sensitive lighting design to minimise light pollution and sky glow, including directional, task-specific, low-level, hooded, photo-sensitive lighting at CSG1, CSG2 and PRMS (D8-03).

A vent is proposed for all facilities, which replaces the need for a flare and will assist in minimising light pollution and sky glow.

A high-pressure vent stack for emergency and maintenance depressurisation of the process equipment are required at each of the facilities the requirement and operational height of these is discussed in Chapter 4 (Alternatives) and Chapter 5 (Project Description) but will be:

- 80m at CSG1 (D5-021)
- 40m at CSG2 (D5-024)
- 40m high at PRMS (D5-027).

Sensitive material and colour finishes will be used for the external facades of buildings (D8-02). This could include a darker colour scheme such as greys and browns with a matt finish

on buildings and perimeter walls to make the facility less visually prominent and to assist in blending them into the landscape.

Preliminary landscape concept plans have been developed for the facilities and are contained in the ESMMP (see Section 8 of Appendix D).

In the construction phase

General mitigation measures

Prompt and sensitive implementation of the reinstatement measures stated in Section 10.3.4 in connection with the handling, storage and restoration of soil during the construction will mitigate landscape and visual impacts.

Topsoil removed from the facilities (and any excess subsoil) will be stored in designated areas within the site area for potential use in the landscape works (3-01). When camps and lay-down areas are taken out of service, the existing aggregate will used, as approved by the Company, to landscape areas of the site before topsoil is spread, where this is not possible the aggregate with be returned to borrow pits/Company approved disposal areas (1-08). Re-contouring should be sympathetic and in keeping with the surrounding landscape, and as approved by the Company, where this is not precluded by risk to integrity of the pipeline or erosion considerations (9-01). All potential subsoil disposal sites and disposal plans will be subject to an environmental and social review prior to their adoption (9-02).

Before construction personnel and equipment are demobilised, temporary buildings and equipment, tools and any excess material brought on site or generated during the construction and commissioning programme will be removed (D5-093) Reinstatement will be undertaken as early as practicable and in accordance with the Reinstatement Specification (4-09). Temporary works areas will be reinstated to near original condition (as compared to pre-construction survey reports or adjacent areas) (17-05).

The Project will seek to achieve an increasing trend in vegetation re-growth and species diversity (specifically species composition) in reinstated areas with reference to nearby areas undisturbed by Project activities, as recorded by the percent similarity and commonality indices (17-07).

Lights will be shrouded or directed with the aim of reducing off-site light spill at the construction sites, camp and pipe storage areas (8-04).

Pipeline

Any disrupted irrigation or drainage system will be reinstated on completion of construction to a standard at least equal to their original condition (35-08).

Field boundaries will be reinstated to pre-existing condition on completion of construction (3-19) to ensure that the regenerating vegetation blends with the adjacent areas and the pipeline route is not a visible feature in the long term. No side-casting of excess spoil outside the working area will be permitted (9-04).

Facilities

The Landscape Management Plan (Appendix D) includes conceptual landscape plans at CSG1, CSG2 and the PRMS, including earthworks (bunding) and planting proposals that will assist in screening view of the proposed facilities and in integrating them into the local landscape, whilst respecting the local landscape character.

CSG1

At CSG1, locally occurring native trees and shrubs will be planted along field boundaries to the north and east to screen PSG1 and CSG1 facilities from Jandari Road providing sufficient land is available (X4-02).

CSG2

It should be noted that CSG2 is located in a topographical low area, and therefore, to a certain extent, the facility will be partially hidden by the natural surrounding landscape features.

At CSG2, the excess subsoil will be used to create bunding north of the facility (X4-03) Planting of coniferous trees on a bund south of the CSG2 facility will screen the facility from Rekha (X4-05).

Where the CSG2 access road has been cut into the hillsides, some of the excess subsoil and topsoil will be used to blend the road into the landscape if slope stability and drainage allow. The remainder of the material will be removed from site to reinstate borrow pits or disposed of at an agreed location (X4-06). Topsoil from the access road will be stored in allocated areas along the access road and used preferentially for reinstatement of road banks. Surplus topsoil from the CSG2 access road construction will be spread at agreed locations or on municipal land (X3-01). CSG2 access road embankments will be reinstated with an appropriate seed mix (X3-02).

PRMS
At the PRMS, topsoil from the facility will be used to create bunding east and south of the facility (X4-08). Once the land forming at the PRMS has been completed the land will be reinstated for grazing use (X4-09).

In the operational phase

The re-establishment of vegetation will be monitored following reinstatement until it has reached Project near- and long-term re-vegetation targets (17-10). The Company will carry out annual maintenance operations to help maintain the integrity of the landscape planting (8-03). A monitoring plan will be developed to determine the success of re-vegetation and bio-restoration activities, including the appropriateness of species composition (3-14). The existing programme of landscape monitoring of the BTC/SCP Facilities will be extended to include the SCPX ROW, Facilities and temporary sites (OP141).

At CSG1, CSG2 and the PRMS, the Project will maintain the unobtrusive colour scheme (X4-12).

10.4.5 Residual Landscape and Visual Impacts

Pipeline

For the majority of the SCPX pipeline route, the buried pipeline is expected to have negligible residual landscape and visual impacts during construction or its operational life. There will, however, be a persistent visual impact from the aerial and pipeline markers required to identify the route. Although permanent, they are considered to have a low residual impact.

The block valve station (KP28) is small in scale; no specific mitigation measures are considered necessary, as it is collocated with existing facilities. Visual receptors will not view this as a significant change and it will not change the character of the landscape. The pigging station (KP56) is a small compound and will not be significant in the view or change the character of the landscape. The residual landscape and visual impacts from installation of the block valve and pigging station is considered to be of low significance.

Permanent facilities (CSG1, CSG2 and PRMS)

Photomontage visualisations (Photomontages 2.7, 2.10 and 2.17 in Appendix A) have been prepared to illustrate the potential residual visual impacts of the proposed CSG1, CGS2 and PRMS facilities following mitigation 15 years after construction.

As illustrated by the photomontage images the visual impacts are expected to reduce over time as proposed mitigation planting establishes and matures and the effectiveness of the

visual screen improves. In addition, the buildings roofs and facades and other structures will weather and their appearance is expected to soften over time.

For CSG1, the mitigation planting will seek to screen all but the upper portions of the vent stack and exhaust stacks, and is expected to provide the additional benefit of screening all but the taller elements (exhaust stacks) of the existing SCP/BTC facilities. The significance of the residual landscape and visual impacts from CSG1 is considered to be low.

Similarly for CSG2 the earth bunds together with the coniferous planting will effectively screen all but the upper portions of the vent stack and exhaust stacks. The significance of the residual landscape and visual impacts from CSG2 is considered to be medium from visual receptors in Rekha, and low from other visual receptors (Khando and users of the Khando to Rekha road).

The CSG2 access road has been routed to avoid plantations and woodlands and to utilise existing roads where possible to minimise effects on the landscape character of the area. The road will be visible from local villages Nardevani, Aiazmi, Burnasheti, Ozni and Berta. The last 5km of the road is a remote location well away for villages and local visual receptors. The significance of the residual landscape and visual impacts from the CSG2 access road is considered to be low.

For PRMS the earth bunds will screen some of the lower level visual clutter of the existing and proposed facilities. The proposed colour scheme will help the buildings and stacks blend into the background. The significance of the residual landscape and visual impacts from PRMS is considered to be low.

Night-time views of the PRMS and CSG1 are not considered to be of low significance as they will be seen with the lights from the existing facilities. Lights at CSG2 are expected to introduce a noticeable change to the landscape and be visible from receptors in Rheka. Therefore, the residual visual impact is considered to be medium.

10.5 Surface Water Resources

This section discusses potential impacts on surface waters during construction of the SCPX Project and associated mitigation measures to be adopted.

10.5.1 Aspects of SCPX Project that Could Affect Surface Water Resources

The following Project activities in the construction phase of the Project could affect surface water resources in the Project area:

- Extraction of river water for use as hydrotest water
- Extraction of water for construction of CSG1, CSG2 and the PRMS (e.g. concrete batching plants) and for facility commissioning
- Discharge of pipeline hydrotest water into watercourses
- Discharge of domestic waste water from camps into watercourses
- Accidental release of potential contaminants (e.g. fuel, hazardous waste, chemicals)
- Discharge of storm water from the pipeline trench and from the facility construction sites
- Disruption of flow during open-cut crossing of irrigation ditches (KP0–19)
- Disruption of water flow rate during open cut crossing of the Algeti River and other smaller watercourses such as the Aji River and streams crossed by the CSG2 access road
- Riverbank and riverbed disturbance (at Algeti open-cut crossing and other smaller watercourses such as the Aji River and streams crossed by the CSG2 access Road)

- Increased sediment run-off from the ROW, construction camp and pipe storage areas after vegetation and soil stripping, until the area has re-vegetated after reinstatement
- Accidental release of drilling mud during the construction of the Mtkvari HDD or micro-tunnel watercourse crossing
- Use of vehicles in watercourses
- Drainage from the CSG2 access road and facility areas
- Disposal of waste water and surface water drainage from permanent facilities
- Snow and snow clearance.

During the construction and operations phases of the Project, snow will be cleared from the facilities and from the CSG2 access road in winter.

Operation of the facilities has the potential to affect surface water from surface water drainage, wastewater discharges from water treatment facilities and accidental releases of potential contaminants.

10.5.2 Key Sensitivities

In the SCPX Project area, the Algeti, Mtkvari and Ktsia Rivers, their downstream receptors Jandari, Rustavi and Avranlo respectively and the streams crossed by the CSG2 access road whose downstream receptors are Ozni and Edikalisa (near Tsalka Lake) may be sensitive to changes in the quality and flow rate of the river water.

Abstraction of surface water for human consumption is considered to have a greater sensitivity than abstraction for crop irrigation, as the water quality standards are higher for drinking water, so the irrigation channels crossed by the ROW have lower sensitivity. The Algeti and Ktsia Rivers flow from areas that are not considered to be significantly affected by anthropogenic activities. The Algeti and Mtkvari Rivers exceed the EU Freshwater Fish Directive standard (for salmonid and cyprinid waters) with respect to dissolved oxygen, BOD, suspended solids and the Algeti for iron and are therefore considered to have relatively low sensitivity.

Water from the Ktsia is used by local villages for drinking water and is considered to have a high sensitivity. However, it is approximately 2km from the CSG2 site and the nearest village is a further 2km downstream of any likely surface water spring leading from the CSG2 site.

River ecology is sensitive to changes in water flow rate, particularly to activities such as water extraction that lower the water level or river crossing construction that interrupts the water flow. River ecology is also sensitive to changes in the sediment load or BOD, COD and dissolved oxygen levels in the river water.

The distance between the construction activity and surface water receptors will vary depending upon the location that construction is taking place. An increased distance between construction and the receptor will serve to reduce the likelihood of an impact occurring, equally, surface water receptors that are close to the construction activity have a greater potential to be impacted. In terms of sensitivity of downstream receptors, this will be governed by the nature of surface water resource and how it is used. As referenced above for example, where a surface water resource is being abstracted for human consumption, this is considered to have a greater sensitivity than an abstraction for crop irrigation. In addition, where a surface water resource forms an integral part of an ecologically sensitive area or is not affected by anthropogenic activities, this will also be of greater sensitivity than a resource that is located in an urban or heavily cultivated area where the water quality may already be impacted by anthropogenic activities.

10.5.3 Impacts on Surface Water Resources

Changes in water quality

There is a potential for pollution from chemical contaminants at all stages of the SCPX Project. Spillage of fuel, lubrication oil or wastewater may occur at watercourse crossings, along access roads and at facility construction sites and camp/pipe yard locations.

If water discharged into rivers and irrigation channels contains chemicals, the toxicology, biodegradation rate and bioaccumulation potential of the chemicals would determine the extent to which it will affect the river water quality and the freshwater ecosystem or the quality of the irrigation water. The SCPX Project will involve the use or generation of some or all of the following materials that have the potential to contaminate surface waters:

Construction

- Fuels and lubricating oils
- Drilling or tunnelling fluids and cuttings
- Paints and solvents
- Hydrotest chemicals (e.g. biocides, oxygen scavengers and corrosion inhibitors)
- High pH run-off from concrete batching areas
- Leachate from hazardous waste storage areas
- Raw sewage
- Effluent from sewage treatment
- Surface water drainage (with trace oils)
- Effluent from canteen including grease trap operation.

Operation

- Facility cleaning materials
- Fuels and lubricating oils
- Paints and solvents
- Effluent from the oil–water separator
- Treated oily wastewater collected from secondary containment for tanks/key items of plant working on diesel fuel
- Raw sewage
- Effluent from sewage treatment
- Chemical contaminated water from secondary containment around key items of plant working on diesel fuel or around chemical storage
- Firewater (for emergency use only)
- Surface water drainage (with trace oils)
- Effluent from canteen including grease trap operation.

Sediment release

If the water discharged contains high suspended solids or if removal of vegetation and soil increases erosion (see Section 10.3.4) and allows rainfall to wash fine sediments from the site to nearby rivers and streams, it can reduce light levels in the water column and at the channel boundary. The sediment can be deposited on gravel bars in the river, which are often important for fish spawning (which generally occurs in the rivers in the Project area from May to June). This can impact freshwater ecosystems, e.g. by starving fish eggs of oxygenated water supplies.

A number of sediment-generating activities have been identified that may occur during construction, but will vary according to the final techniques selected. Vegetation has to be removed from the working areas, exposing bare soil to rainfall events, overland flow and

freeze-thaw processes. Where there is a significant slope, consequent erosion may deliver fine sediments from the site to nearby rivers and streams, which may provide a migration pathway to downstream receptors over large distances.

Discharges from the CSG2 access road drains (particularly after rainfall or when snow melts) can affect the downstream water quality of the streams and rivers.

High concentrations of suspended solids can make river water unsuitable for use in potable water supplies. In Georgia, many of the rivers and streams already contain high sediment loads (particularly during early summer), thus reducing the significance of additional quantities of sediment introduced during construction.

Operational discharges (wastewater and surface water) have the potential to contaminate surface water through the site drainage system.

Surface water contamination

There is a potential for pollution from chemical contaminants at all stages of the SCPX Project. Spillage of fuel, lubrication oil or wastewater is potentially important at watercourse crossings, along access roads and at camp/pipe yard and facility locations during construction and hydrotesting of the new pipe sections. Contaminants introduced by construction and operational phase plant could migrate downstream to key receptors such as the Mtkvari River, Algeti River, the streams crossed by the CSG2 access road or wetlands adjacent to CSG2. Migration to these key receptors could take place very quickly, in a matter of a few hours in some cases.

During the tunnelling or drilling of the Mtkvari River there is the potential that mud used in the tunnelling or drilling process can escape via fissures in the geology and flow into rivers (causing discolouration and increase in fine sediment) or collect on the surface of the riverbanks.

The likelihood of a major oil spill is considered unlikely for this gas pipeline project. It is possible that a loss of fuel oil used during construction could reach the surface water system could compromise sensitive habitats, drinking water supplies, industrial water supplies and settlements. The largest credible spill scenario would be a spill involving a fuel tanker operating outside a bunded area. The spill would be limited to the tankers capacity (approximately 10–15m^3).

Abstraction of water

Flow quantity is often as important as water quality in rivers. Interruption of river flows has the potential to adversely impact ecological sustainability, fisheries, water abstractions by downstream users and the dilution of downstream discharges.

The Mtkvari and Algeti Rivers flow rates may be affected by water abstraction. Approximately 83,000m^3 of water will be needed to fill the SCPX pipeline loop for hydrotesting and it is likely that the hydrotest water will be extracted from these rivers.

The Algeti and Aji River flow rates, and several smaller streams could be affected by temporary damming or diversion to reduce sediment release and to create a drier, safer working environment during construction of the open-cut river crossing.

Discharges from the CSG2 access road drains (particularly after rainfall or when snow melts) can affect the downstream flow rate with the potential for flash floods downstream affecting local dwellings or changing channel morphology.

Many PACs consider the quantity and quality of the existing water supply to be unsatisfactory and are sensitive to changes that would reduce the quantity of water available for domestic use or for irrigation.

Flooding

The flat land around CSG1 drains to irrigation and drainage channels. The channels and the fields are subject to periodic flooding if the channels are blocked to flood adjacent fields to irrigate crops or in any occasional periods of heavy rainfall when the channels may overflow. Temporary blockage of the channels to install the pipeline could result in flooding fields, affecting the livelihoods of farmers. The floodwaters could gather sediment and contaminants that would affect the water quality when the blockage is removed.

Impact summary and assessment of significance

Table 10-9 and Table 10-10 provide an assessment of the significance of surface water impacts before and after implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 10-9: Potential Impacts on Surface Waters

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A10	Disposal of trench-water and hydrotest water	Surface water contamination by sediment or chemicals	C3 Medium	3-17, 3-21, 3-24, 3-30, 10-02, 10-03, 10-04,10-06, 10-08,10-09, 10-10, 10-11, 10-12, 10-14, 10-15, 10-16, 10-18, 10-19 10-21, 10-22	C2 Low
		Artisanal fish catch reduced by levels of sediment during open-cut crossing	C2 Low		C2 Low
A11	Impeded flow of river or channel	Harm to freshwater ecosystem.	C3 Medium	11-01 to 11-05	C2 Low
		Artisanal fish catch reduced by changes to water flows during open-cut crossing	C2 Low		C2 Low
		Reduced flow may restrict use by local people	D3 Medium	11-02, 11-03, 11-01, 10-14	D2 Medium
A12	Use of water from river or channel	Reduced flow may restrict use by local population	C3 Medium	D5-078, 10-09, 15-02, 15-03, 11-01	C1 Low
A13	Flooding caused by impeded river, irrigation channel flows	Blockage of irrigation or land drainage channels affects downstream users and freshwater ecosystem	C3 Medium	13-01 to 13-03, D17-04, 16-01, 15-03, 11-01, 11-02, 11-03	C2 Low

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A3	Soil erosion following removal of vegetation and/or disturbance of ground	Erosion of river/channel banks, scour, sediment contamination of surface waters	C3 Medium	3-21, 3-23, 3-03, 3-15, 3-28, 4-07, 4-09, 4-12, 10-12, 10-16, 10-18, 10-19, OP131, OP143	C2 Low
A7	Release of hazardous materials (e.g. fuels, lubrication fluids, oils, paints, diesel, concrete etc.)	Contamination of water used for irrigation (KP0–12) and water supply. (Ktsia, Mtkvari, Algeti)	C4 Medium	6-03, 6-04, 10-01, 6-05, 6-06, 6-07, 6-08, 6-09, 6-10, 24-07, 11-05, 6-11, 6-12, 7-11, OP-04	C4 Medium
A7	Production and disposal of solid & liquid waste,	Contamination of water used for irrigation and water supply	C4 Medium	D5-028, D5-029, D5-030, 6-03, 6-04, 10-01, 6-05, 6-06, 6-08, 7-10, 7-13, 24-07, 11-05, 3-23, 31-05, 6-11, 6-12, 6-20, 6-21, 6-24, 6-26, 7-01, 7-04, 7-08, 7-12, 7-14, 7-15, OP-04, OP41, OP42, OP43	C2 Low
A14	Disposal of black and grey water	Surface water contamination used for irrigation and water supply	C4 Medium	D5-106, 14-02, 14-04, 14-06, 14-08, 14-09, 31-05	C2 Low

* Assessed using Tables 3-6 and 3-7

Table 10-10: Potential Impacts on Surface Waters at Sensitive Locations

Location	Issue	Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
KP0-12 Channels	Surface water	Increased levels of sediment by open-cut crossing technique	C2 Low	10-19, 10-02, 10-03, 10-04, 11-01, 11-02	C1 Low
		Impeded flow of channel disrupting downstream users	C3 Medium	X5-06	C1 Low
Algeti River	Surface water	Downstream receptors (may be affected by increased flows and Subsequent increased levels of sediment during open-cut crossing	C2 Low	11-01, 11-02, 15-03, 10-2, 10-09, 10-14, 10-15, 10-16, 10-18, X5-01, X5-04	C2 Low
Ktsia River	Surface water discharge to springs	Affect water quality of downstream receptors (Avranlo, Berta) may be affected.	C1 Low	D5-032, D6-04	C1 Low

Location	Issue	Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
Mtkvari River and channel at KP12	Mud breakout from micro-tunnelling or HDD	Increased sediment in river affecting downstream users (Rustavi) and aquatic ecology	C3 Medium	6-26, 9-03, X5-02, X5-03, X5-01, X5-07, 10-16	C3 Medium
CSG2 access road streams	Water discharge from surface water and road drains	Downstream receptors (Kizilkilisa, Ozni, Edikalisa) may be affected. Increased levels of sediment, increased flow rate may cause flooding or changes to channel morphology	D4 High	D5-032, D6-03, D36-01, X5-08, 10-12, 10-16, 10-18, X5-05	D1 Low
CSG2	Surface and waste water discharge	Pollution of surface water in Ktsia affecting downstream users (Avranlo and Berta)	D3 Medium	D5-032, D6-03, D5-078, 10-09, D5-106, 15-02 D14-01, 7-10, 7-13, OP02, OP03, OP40, OP04, OP05	D1 Low
CSG1	Surface and waste water discharge	Pollution of surface water in irrigation channels KP1-KP12	C3 Medium	D6-01, D6-04, D5-106, D14-01, 7-10, OP02, OP03, 7-13, OP05, OP04	C2 Low
PRMS	Surface and waste water discharge	Pollution of surface water currently used for A80 site discharge.	C3 Medium	D6-01, 6-04, D5-078, D5-106, D14-01, 7-10, OP02, OP03, 7-13, OP05, OP04	C2 Low

* Assessed using Tables 3-6 and 3-7

10.5.4 Mitigation for Surface Water Impacts

The impact avoidance and mitigation measures summarised below will be applied to activities that could impact the surface water.

At the design stage

The camps will discharge domestic waste water treated by a sewage treatment package designed to meet the Project Standards and permit requirements (D5-106). The facilities will be designed with treatment units for black and grey water. Treated water from the sewage treatment units will be discharged to ground in a controlled manner via a soakaway or to surface water in accordance with the Project Standards (D14-01).

Pipeline

Watercourse crossing methods will be developed with the aim of minimising the mobilisation of sediments (11-05).

The Mtkvari River crossing will be constructed by micro-tunnelling or horizontal directional drilling under the river (D17-04). This is designed to reduce the generation of sediments compared with open-cut techniques, thus reducing potential impacts on surface water.

The Mtkvari River crossing at KP30 will be non open-cut (micro-tunnel or HDD) and will use the existing/abandoned launch pit on east bank if practicable (X5-02).

CSG1 and PRMS

Waste water treatment systems will be integrated with the existing facilities at CSG1 and the PRMS (D6-01).

CSG2 and access road
The design of the waste water system at CSG2 is still being developed, although the options currently being assessed include a rotating disc (BioDisc®) water treatment plant (or similar) with discharge of treated effluent into a surface water or alternatively via a soakaway (D5-032). Additional tertiary treatment shall be investigated at CSG2, including reed beds, to identify a solution suitable for the climatic conditions (D6-04).

A hydrology study will be undertaken during the detailed design of the CSG2 site and access road to determine catchment areas, flow rates and water quality in the stream crossings and wetland areas (D6-03). Drains will be installed on the uphill side of the CSG2 Access Road, pass through culverts under the road and discharge via holding ponds or other energy reduction techniques into local streams (D36-01).

Hydrotest
If water is sourced from rivers (or channels) no more than 10% of the water flow will be extracted at any time (D5-078). This aims to ensure that water flows downstream are maintained for other users and natural ecosystems.

Hydrotest water will be re-used between sections, where practical, to minimise the volume required (10-09).

In the construction phase

Water quality
The Mtkvari River crossing will be constructed by micro-tunnelling or horizontal directional drilling under the river. This will minimise disturbance of the river ecosystem and disturbance of downstream users.

Muds used will be water based (9-03) for drilling/tunnelling under the Mtkvari. Drilling and tunnelling mud will be stored in impermeable, lined bunded areas or tanks (6-26). The contractor will prepare a plan to respond to an outbreak of mud including clean up and remediation for outbreak on land and liaison with downstream users in the event of outbreak in the water (X5-03).

At the Algeti River, the crossing trench will be backfilled with the excavated material and, where existent, the watercourse's armour will be reinstated as soon as possible following pipeline installation (X5-04).

The measures described in Section 10.3.4 to reduce the potential for soil contamination and the procedures to be undertaken should contamination occur, will also mitigate the potential impacts associated with surface water contamination (for example, commitments 6-03 to 6-05, 6-11, 6-12 and 7-11 to 7-12, 7-14 and 7-15).

In addition, the Pollution Prevention Plan will include the following measures to reduce the risk of surface water contamination:

- Concrete batching plant (if required) will be sited at least 50m away from sensitive receptors such as watercourses; wash pits to be lined with an impermeable liner (10-01)
- Treated waste water will be used for damping down road surfaces to mitigate dust generation (24-07)
- Watercourse crossing methods will be developed with the aim of minimising the mobilisation of sediments (11-05)
- At watercourses bank and bed material will be stored separately away from the active channels and will not be placed where flow or drainage will be obstructed (3-23)
- A risk assessment will be undertaken when considering waste water discharge options and locations (31-05). This risk assessment will also account for potential

human health effects including an evaluation of all relevant exposure pathways (i.e. watering crops, drinking water)
- Domestic sewage from camps and pioneer camps will be stored and transported to water treatment works or treated through a dedicated site sewage water treatment plant (14-02) before discharge to ground or surface water
- Waste water will be reduced by efficient use of raw water and the implementation of water management schemes that require water to be reused, whenever practicable, prior to treatment and disposal (14-04)
- All wastewater discharges will be in compliance with the Project Environmental Standards (14-06)
- Periodic analysis will be undertaken of controlled stormwater, sanitary and industrial discharges and any receiving surface water upstream and downstream of the discharge point (14-08)
- The applicable discharge permits will be obtained for any new planned liquid discharges, prior to the discharge commencing (14-09)
- Relevant training will be provided to those with responsibilities for monitoring of effluent discharges and emissions at the construction camps such as effluent sample taking and chain of custody (7-13).

To avoid contamination from discharges of trench water, construction operations will take the following measures:

- Measures to minimise scour and reduce sediment load will be implemented at locations where hydrotest water or other pumped water (including trenchwater) is discharged to surface watercourses or to land (e.g. controlled rate of discharge and deployment of geotextile mats or other physical erosion prevention measures) (3-21)
- The direct discharge of trench water to watercourses will be avoided, except where approved by the Company (10-02)
- The locations for discharge of hydrotest water and where possible trench water, will be identified in the contractor's Pollution Prevention Implementation Plan (10-03)
- If discharge of trench water to a watercourse is unavoidable, discharge will be through a filtering medium (10-04)
- At the slopes east of the Mtkvari between KP27 and KP29 header drains or dewatering should be considered where large quantities of water are likely to enter the ROW (X5-07)
- Where CSG2 access road crosses hill slopes and springs header drains or dewatering should be considered where large quantities of water are likely to enter the working areas (X5-08).

The following measures will be taken to avoid contamination from discharges of hydrotest water:

- Before hydrotesting, the Contractor will prepare, and submit for Company approval, a hydrotest plan (10-06)
- A risk assessment will be undertaken before any chemical additives are used in hydrotest water(10-08)
- The direct discharge of hydrotest water to watercourses and soakaways will be subject to the results of the chemical risk assessment. The use of evaporation basins will be considered subject to the availability of land and an environmental and social assessment (10-21)
- Water (including hydrotest water) will be tested before discharge and treated to meet the Project Environmental Standards (10-10)
- The hydrotest water will be treated using diffusers to entrain oxygen in a break tank, and filtration will be used to minimise suspended solids, prior to discharge. Flow rate will be controlled to reduce the risk of soil erosion and disturbance to riverbed sediment (10-11).

Sediment release

The following measures will be used to help avoid significantly increasing sediment contamination from discharges of water from working areas including trench water and other open excavations as outlined below:

- Sediment control fencing, drainage channels & trench barriers will be installed where appropriate (10-12)
- Watercourse banks disturbed by Project crossings, will be restored to near original condition, which will be assessed individually for each watercourse and defined in the Contractor's Reinstatement Implementation Plan. Any deviations (e.g. because hard reinforcement is required for erosion control) shall be subject to Company approval (10-14)
- Sediment reduction measures will be implemented including, but not limited to, discharge of pumped water via break tanks or sediment mats (10-15)
- Daily visual monitoring of turbidity will be undertaken at river crossings while works are being undertaken at that river. This will be supplemented as necessary by probe monitoring (10-16).

Only essential construction vehicles (as approved by the Company) will be allowed to enter rivers or streams and only with prior examination of the vehicles for fuel/lubricant leaks. Generally, the construction traffic will cross watercourses via a flume/culvert (piped bridge), which will be sized so as not to restrict the flow in the watercourse and allow fish and other aquatic organisms to pass through (10-18). This applies particularly during the crossing construction of the Algeti River and the streams crossed by the CSG2 access road.

Washing of Project plant and vehicles in watercourses will not be undertaken (10-22).

Protection measures will be put in place to prevent any water used for dust suppression from causing silt problems for nearby wetlands or watercourses (10-19).

Water quality and flow rate testing will be undertaken upstream and downstream of crossings on the access road to CSG2 prior to, during and after construction (X5-05).

Flow rates and flooding

River flow will be assessed before and during abstraction; abstraction rates will be set taking into account information that the Contractor is able to acquire about downstream users (15-03).

Construction of the surface water crossings will seek to ensure minimal impacts from interrupting river flow by identifying downstream users and determining their river water supply needs (11-01). Construction design of river and stream crossings will seek to ensure minimal interruption to flow by using measures such as pumping, channel diversions and fluming (11-02). In addition the Project will minimise effects by using the following measures:

- If temporary damming is required, a pre-construction engineering, social and environmental review will be undertaken with the aim of planning the work to minimising the duration of the flow interruption and determining the need for pump around to maintain flows (11-03)
- Any temporary dams in watercourses to be removed as soon as pipe installation and reinstatement at that crossing is complete (11-04)
- Water flow will be maintained at Irrigation channels that will be open-cut at KP00–11 (X5-06).

Water flow in the Mtkvari and Algeti Rivers will be assessed before and during abstraction of hydrotest water (X5-01).

The construction contractor will monitor weather forecasts and avoid creating temporary dams in watercourses if flooding is likely (13-01), which will reduce the likelihood of flooding in the flat land between KP00 and KP19 that is liable to periodic flooding in the event of heavy rainfall. Gaps will be left in soil stacks at strategic locations to allow water through (13-02). Any flood defence banks breached by the pipeline will be replaced during reinstatement (13-03).

The land drainage system will be reinstated to achieve pre-existing functionality (16-01).

Washout and scour
To avoid scour from discharges to rivers and channels, during construction the following measures will be implemented:

- Measures to minimise scour and reduce sediment load will be implemented at locations where hydrotest water or other pumped water (including trenchwater) is discharged to surface watercourses or to land (e.g. controlled rate of discharge and deployment of geotextile mats or other physical erosion prevention measures) (3-21)
- At locations where trench water or hydrotest water or other pumped water discharges causes scour or soil erosion, eroded areas will be reinstated (3-24)
- When discharge velocities have the potential to create erosion, energy dissipaters will be used to establish sheet flow. Trenches will be dewatered in such a manner that no heavily silt-laden water flows into any wetland or water body (3-30).

Operation

Pipeline
ROW patrols will monitor river crossing to provide assurance of the integrity of any river protection works and river banks. This will include a visual inspection for river bank erosion or changes to channel morphology (OP131). An expert assessment of burial depths, set back measurements and pipeline protection works will be carried out at major river crossings annually (depending on the river characteristics and crossing technique) and after flood events exceeding a 1:100-year return period (OP143)**.**

Facilities
Surface run-off from un-contained catchment areas within the facility site areas (e.g. roadways and other surfaced areas) will flow into the storm water drainage which will be discharged off-site via a weir, to surface or ground (OP04).

At the facilities, fixed, external equipment containing oil and the water bath heaters will be bunded locally and bunds will be manually discharged to the storm water drainage system if clean. Any visible contamination will be recovered prior to discharge or the oily water will be removed for treatment at an oily water separator (OP05).

A monitoring programme will be developed for sanitary and industrial discharges, which will be monitored at the point of discharge to confirm compliance with the Project Standards. Monitoring will be carried out monthly for the first year of operation, after which the frequency and suite of determinants will be reviewed and revised dependent on the first year's results (OP41). The applicable discharge permits will be obtained for any new planned liquid discharges, prior to the discharge commencing (14-09).

An ambient surface water monitoring programme will be developed during operations for waters that receive discharges from the facilities. Monitoring will be carried out monthly for the first year of operation upstream and downstream of the discharge point, after which the frequency and suite of determinants will be reviewed and revised dependent on the first year's results (OP43).

All new and existing water abstractions for use by the Project will be subject to an environmental and social assessment to assess potential impacts; decisions on the acceptability of the source and abstraction rates will be based on the results of the review, in accordance with the abstraction permit (15-02).

Permanent fuel and chemical storage areas
The following design features will be in place at each of the facilities to help avoid the release of fuels and chemicals into site wastewater:

- Diesel storage tanks at CSG2 will be located in suitably sized bunded areas that are designed to be impervious to water and fuel. The bund volume will be designed to no less than 110% of the tank volume. Loading and off-loading connections are located over secondary containment (7-10)
- At CSG2 rainwater from the diesel storage tank bund will be manually drained and routed to the storm water drainage system via an oily water separator (OP02)
- After visual inspection and sampling of water (if required, to determine it meets the Project Standards), the oily water separator water will be discharged directly into the environment (OP03)
- Hazardous chemicals will be securely stored on site in special containers in a designated storage area (7-11).

Regular inspections and maintenance will be carried out of secondary containment areas and emissions control techniques at Facilities to confirm that they are functioning effectively (7-12).

Training
Information will be incorporated into the site induction process and will outline the role of personnel in the management of waste and emissions from site and spill response procedures (7-14).

Site induction training will be supplemented by regular 'toolbox' talks with personnel and technicians if inspections or audits highlight failings in waste management (7-15). In addition to the site induction, more detailed emissions management training will be provided for managers and technicians who will be involved in site operations (OP46). Relevant training will be provided to those with responsibilities for monitoring of effluent discharges and emissions at the Facilities such as effluent sample taking and chain of custody (7-13).

Water quality testing will be undertaken annually downstream of the CSG2 access road crossing for a period of five years post construction or until there are no demonstrable changes, whichever is the sooner (OP40). Monitoring and maintenance of the water treatment facilities will be integrated with the existing SCP Georgia emission management procedures (OP42).

10.5.5 Residual Impacts on Surface Water Resources

If the proposed mitigation measures are implemented, the residual impacts on surface waters can be summarised as follows:

- The discharge of trench water and hydrotest water is expected to have a residual impact of low significance
- Impeding flow in the Algeti and Aji Rivers is expected to be of low significance
- Temporary disturbance to the flow in irrigation channels KP00–12 may affect landowners who use the water for agricultural purposes; however, with mitigation measures to maintain the flow the residual significance is expected to be low
- Flow rates of surface water drainage into the streams crossed by the CSG2 access road will be controlled, the effects of the road on the existing streams is expected to be of low significance

- Discharges from surface and waste water systems at CSG1 and PRMS will be will be monitored in accordance with the Project Standards. The effect of the additional flows from the existing water discharge points is expected to be of low significance
- Discharges from surface and waste water systems at CSG2 will be monitored in accordance with the Project Standards; the effects of discharges on surface water flow and quality are expected to be low
- Soil erosion following removal of vegetation may cause elevated sediment in streams and lead to loss of soil structure. The residual impacts of this are expected to be low
- Accidental events such as mud breakout and spillage of hazardous materials are most likely to have a widespread and significant effect when it is released into watercourses. The assessment for residual impact is considered to be medium.

10.6 Groundwater Resources

This section discusses potential impacts on groundwater during construction and operation of the SCPX Project and associated mitigation measures to be adopted.

10.6.1 Aspects of SCPX Project that Could Affect Groundwater Resources

The following aspects of construction and operation have the potential to affect groundwater:

Effects from construction

- The trench of the pipeline loop could act as a conduit affecting groundwater flows
- The presence of concrete batch plants and pouring concrete at facilities could contaminate the groundwater with high pH fluids if not properly managed
- Groundwater abstraction to supply fresh water for construction camps
- Discharge of domestic waste water from camps into watercourses
- Accidental release of potential contaminants (e.g. fuel, hazardous waste, chemicals)
- Possible contamination of groundwater by hydrotest chemicals (if used)
- Production and disposal of solid and liquid waste
- Contamination (due to increase in suspended solid content) of groundwater by drilling fluids or leaching of drilling cuttings if wells are drilled for abstraction at construction camps
- Contamination caused by break-out of drilling mud into aquifers during drilling of non-open-cut crossings.

Effects from operations

- Disruption or impedance of groundwater flows in shallow groundwater areas due to the presence of the pipeline in the ground
- Groundwater abstraction for operating the facilities
- Hard surfacing for facility areas affecting groundwater water recharge
- Disposal of waste water from permanent facilities.

10.6.2 Key Sensitivities

The groundwater at CSG1 and along the pipeline loop is shallow and is not protected by any impermeable geological formation, so the quality of the groundwater can be affected by discharges of wastewater or leachate from stored materials and waste. This shallow groundwater resource is generally restricted to use for agricultural activities. Shallow groundwater at CSG2 is used for potable purposes and has a high permeability and high quality potable properties and could be affected by the potential contaminants described above. The groundwater at PRMS is considerably deeper (80m) and is therefore less likely to be affected by construction or operational effects.

Abstraction of water during the construction and operational phases of the SCPX Project may affect the groundwater level and the availability of water for other users. Many PACs consider the quantity and quality of the existing water supply to be unsatisfactory and are sensitive to changes that would reduce the quantity of water available for domestic use. About 10% of residents in project-affected communities (PAC) use water drawn from wells.

10.6.3 Impacts on Groundwater

Groundwater quality

Contamination of groundwater can make water drawn from wells unsuitable for use as potable water or irrigation water. The important factors when determining the magnitude or likelihood of an impact on groundwater are the:

- Nature and quality of the spill, discharge or leak
- Type and thickness of the overburden (including porosity and permeability)
- Depth of the water table
- Rock type
- Aquifer thickness
- Attenuation properties of the aquifer (i.e. the ability of the aquifer to dilute and disperse any spill).

Construction of the SCPX Project will involve the use or generation of materials that have the potential to contaminate groundwater. These are referenced in Section 10.5.3.

The areas within the SCPX Project footprint considered most likely to be impacted are those where the aquifer is relatively shallow, overlain by a thin layer of porous or permeable sediments (i.e. where groundwater vulnerability[1] is high). The significance of the impact will be, in part, determined by whether or not the groundwater is used for potable and irrigation purposes. The sensitivity of the groundwater has been detailed in Section 10.6.2, and this illustrates that the area of highest sensitivity is within the CSG2 location due to groundwater vulnerability and its use as a potable water supply.

Abstraction

Abstraction of groundwater to supply construction camps or the facilities temporarily depresses the water table in the vicinity of the well. The extent of the radius of influence depends on the transmissivity and storage properties of the aquifer and on the recharge to the aquifer. Drawdown may have an adverse effect on the yield of nearby boreholes, wells, springs and karizes, at least until abstraction ceases. Poorer sections of the community that rely on such water sources are especially vulnerable if lowering of the groundwater levels affects their water supply. Wetland ecosystems are harmed if groundwater levels fall low enough for the soil to dry out.

If excavations (e.g. the pipeline trench) intercept the water table, it may be necessary to install a dewatering system to lower the water table and provide a drier and therefore safer working environment for construction. Such systems typically comprise a series of small well-points (perforated tubes) inserted into the ground around the works area and connected to a vacuum pump. The pumps draw the water out of the ground and thereby lead to a temporary lowering of water table. This effect is restricted to a localised area and the water table returns to its normal level once the pumps are switched off.

New boreholes will be drilled to supply water during the construction and operational phase. The quantities of water required are provided in Chapter 5.

[1] Groundwater vulnerability is defined as the tendency and likelihood for general contaminants to reach the water table after introduction at the ground surface.

Groundwater flow

The backfilled material in the trench is likely to have a higher permeability than the surrounding undisturbed material. Where the water table is shallower than the bottom of the trench, or following heavy rains, sections of the trench that have a high topographical gradient may channel rainwater and act as a 'rapid flow' conduit for groundwater and rainwater. This may lower groundwater levels above the trench, wash backfill material out of the trench and cause waterlogging or springs to form where the water leaves the trench. During operation, the presence of the pipeline in the trench may impede groundwater flows in areas where the water table is shallow, which could cause waterlogging up flow direction and cause areas to dry out down flow direction.

Impact summary and assessment of significance

Table 10-11 provides an assessment of the significance of potential impacts on groundwater resources before and after implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 10-11: Potential Impacts on Groundwater

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A14	Disposal of black and grey water	Groundwater contamination	C3 Medium	D14-01, 7-13, 14-02, 14-04, 14-06, 14-08, 14-09, 31-05, OP41	C1 Low
A15	Abstraction of groundwater	Reduced water quality or quantity from established springs, wells etc.	C2 Low	15-01, 15-02, 15-04, 15-05, 15-07, 15-09, X6-01, X6-02, X6-03, OP47	C1 Low
		Reduced availability of such as springs for local users	D2 Low		D1 Low
A16	Altered drainage pattern	Trench can act as conduit for groundwater, draining higher areas and flooding lower areas	C2 Low	2-05, 3-07	C1 Low
A6	Disturbance, treatment and disposal of known/unknown contaminated land	Mobilisation of contaminants with associated risk of polluting groundwater	C3 Medium	6-09, 6-11	C Beneficial
A7	Production and disposal of solid and liquid waste, release of hazardous materials	Potential for groundwater contamination if disposal uncontrolled or from accidental spillages	C2 Low	14-03, D5-029, D5-030, OP47 Also refer to Section 10.3.4 and 10.5.4	C1 Low

* Assessed using Tables 3-8 and 3-9

10.6.4 Mitigation of Impacts on Groundwater

The impact avoidance and mitigation measures summarised below will be applied to planned activities that could contaminate groundwater, abstract groundwater or affect the flow of groundwater.

At the design stage

The facilities will be designed with treatment units for black and grey water. Treated water from the sewage treatment units will be discharged to ground in a controlled manner via a soakaway or to surface water in accordance with the Project Standards (D14-01). The final design is yet to be completed.

All wastes from the SCPX Project will be managed with the aim of minimising:

a) Impacts to the natural environment
b) Health hazards to personnel.

Where appropriate waste materials will be reused or recycled, with disposal to landfill as a last resort. In this case, inert and non-hazardous waste will be disposed of to the licensed BP operated landfill site near Rustavi (D5-029) Hazardous waste will be forwarded to a waste disposal contractor licensed to receive and treat hazardous waste (D5-030).

In the construction phase

Groundwater quality

General mitigations for impacts on groundwater quality are outlined in Section 10.3, Soils and Ground Conditions and Section 10.5.4 Surface Water Resources, as they are also applicable to soil and surface water contamination. These mitigation measures include for example

- the storage of hazardous materials will be restricted to designated impermeable hazardous materials storage areas located at least 50m from any surface water course or seasonal water channel (6-03)
- the requirements for the establishment of hazardous materials storage areas (e.g. bunding, impermeable surfaces, secure drainage, limited access, labelling) will be identified in the Contractor's Pollution Prevention Implementation Plan (6-04)
- domestic sewage from camps and pioneer camps will be stored and transported to water treatment works or treated through a dedicated site sewage water treatment plant (14-02).

These general mitigations therefore not discussed further in this section.

However, the following measures, of particular relevance to groundwater protection, are highlighted below:

- Relevant personnel will be trained in safe use and handling of hazardous materials (6-09) and in emergency use of spill kits and disposal practices (6-11)
- A risk assessment will be undertaken when considering waste water discharge options and locations (31-05). This risk assessment will also account for potential human health effects including an evaluation of all relevant exposure pathways (i.e. watering crops, drinking water)
- In areas of wetland and areas where the groundwater supplies wells for irrigation or potable use, the storage and use of hazardous materials will be carefully controlled (14-03)
- Concrete batching plant (if required) will be sited at least 50m away from sensitive receptors such as watercourses; wash pits to be lined with an impermeable liner (10-01).

In relation to drilling muds:

- Muds used will be water based (9-03) for drilling/tunnelling under the Mtkvari
- The river crossing contractor will prepare a plan to respond to an outbreak of drilling mud if this occurs during a non-open-cut crossing, including clean up and

remediation for outbreak on land and liaison with downstream users in the event of outbreak in the water (X5-03).

At CSG1 and the PRMS, where existing boreholes will be used, the water will be sampled and analysed to monitor contamination (X6-01). Groundwater quality at CSG2 will be monitored during construction using the installed monitoring wells (X6-03).

Groundwater abstraction
All new and existing water abstractions for use by the Project will be subject to an environmental and social assessment to assess potential impacts; decisions on the acceptability of the source, and appropriate abstraction rates will be based on the results of the review in accordance with the abstraction permit (15-02). The abstraction borehole, when completed, will be test pumped and a sustainable yield will be determined together with aquifer characteristics such as hydraulic conductivity and radius of influence (15-04). Water features such as abstractions (boreholes, wells, springs) or environmental features (wetlands, springs, streams or surface water features in continuity with groundwater) will be identified within the likely radius of influence of the abstraction point (15-05).

Water conservation initiatives will be undertaken at the construction camps (15-07) to reduce the quantities of water used. If groundwater is extracted for Project use, from either new or existing boreholes at temporary facilities, the water quality and sustainability will be monitored periodically to confirm that the supply meets Project standards and does not impact adversely on other known users (15-09).

Groundwater flows
Trench breakers will be installed where downhill flow within the trench may lead to erosion (3-07). Back-fill will be adequately (but not excessively) compacted to prevent future settlement (2-05). This will seek to prevent the backfilled pipeline becoming a drainage conduit.

In the operational phase

The trench breakers installed in the pipe trench during construction are intended to prevent the pipeline acting as a conduit for groundwater.

The facilities will be supplied with water from either existing abstraction wells or new wells and will be subject to a sustainability assessment (X6-02).

Groundwater quality monitoring will be carried out post-construction and prior to operation of the facilities and subsequent to any unplanned events which are assessed as having the potential to impact groundwater quality (OP47).

With regard to wastewater discharges at the facilities:

- The applicable discharge permits will be obtained for any new planned liquid discharges, prior to the discharge commencing (14-09)
- All wastewater discharges will be undertaken in compliance with the Project Environmental Standards (14-06)
- A monitoring programme will be developed for sanitary and industrial discharges, which will be monitored at the point of discharge to confirm compliance with the Project Standards. Monitoring will be carried out monthly for the first year of operation, after which the frequency and suite of determinants will be reviewed and revised dependent on the on the first year's results (OP41).

Relevant training will be provided to those with responsibilities for monitoring of effluent discharges and emissions such as effluent sample taking and chain of custody (7-13).

10.6.5 Residual Impacts on Groundwater

If the proposed mitigation measures are implemented, the residual impacts on groundwater are considered to be low.

10.7 Ecology

This section discusses potential impacts on flora and fauna during construction and operation of the SCPX Project and the associated mitigation measures to be adopted.

10.7.1 Aspects of SCPX Project that Could Affect Ecology

The following planned Project activities could affect habitats and disturb fauna in the Project area:

- Clearance of trees and vegetation from the camps, equipment lay-down areas, access roads, ROW and facility sites
- Construction of any necessary borrow pits
- Removal of topsoil and subsoil from access roads, ROW and facility sites
- Pipe stringing
- Trench excavation
- Storage of soil from ROW, trench and facility sites
- Disposal of surplus soil from the pipeline trench
- Use of vehicles on the ROW and at the facility sites
- Blasting and piling at CSG2 and the PRMS
- Use of equipment that generates noise on the ROW and at the facility sites (e.g. compressors, generators, turbines)
- Use of temporary or permanent lighting systems on the ROW and at the facility sites
- Disposal of solid and liquid wastes
- Abstraction of water from streams and rivers for hydrotesting
- Disposal of trench water and hydrostatic test water
- Construction of river crossings
- Laying a ground cable from the micro-tunnelling pit to the edge of the Mtkvari River to track the micro tunnelling device
- Permanent removal of habitat for facilities
- Accidental spills of chemicals and fuel.

Activities during operation of the pipeline that may have ecological impact are:

- Patrolling of the pipeline by security personnel, if this impacts on reinstatement
- Lighting at the facilities and pigging station and block valve.

10.7.2 Key Sensitivities

Habitats are sensitive to changes in the types of vegetation present and to severance, which divides habitats into compartments. The most sensitive habitats for each of the sites are described below. Plant and animal species that are considered to have conservation value, primarily because they are vulnerable, rare or endemic to the Caucasus region are also described below. They may have protection status if their populations are sensitive to disturbance.

None of the habitats visited as part of the general phase 1 habitat survey for the pipeline route (excluding the specialised riparian survey) are considered to be of high ecological value. In addition, neither of the plant species, *Iris iberica* and *Tulipa biebersteiniana* which

were the subject of SCP monitoring surveys were recorded, nor were any habitats with the potential to support these species. All habitats crossed are relatively species-poor, subject to anthropogenic influence and are no more/less valuable than the other habitats outside of the pipeline ROW. Aspects to note along the pipeline include:

- Irrigation channels between KP0 and KP12, which are used by a diverse assemblage of amphibians (possibly for breeding) that are commonly occurring and reptiles (such as the rare four-lined snake; Mediterranean tortoise (a Georgian Red List species) and the European marsh turtle, which is the subject of SCP monitoring surveys)
- A Brandt's hamster (IUCN Red List Near Threatened and Georgian Red List), which was recorded near KP2 during the faunal surveys
- The channel at KP12, which is known to support a diverse assemblage of reptiles and amphibians (including the European marsh turtle, which was the subject of SCP monitoring surveys)
- Mediterranean tortoise (a Georgian Red List species and one considered 'Vulnerable by IUCN), which is known to inhabit the eastern banks of the Algeti and Mtkvari
- Smooth-leaved elm (Georgian Red List species) on the banks of both the Mtkvari and Algeti Rivers
- Barbel Chanari, the only fish species to be classified as 'Vulnerable' by the IUCN, which could be present in the Mtkvari and is usually caught in 'average' numbers. This indicates (albeit qualitatively) a relatively healthy fish population in this region of the Mtkvari
- Carp (an IUCN vulnerable fish species) which inhabits the Algeti River
- The boundary features of the proposed CSG1 site (such as the irrigation channel in the south-west corner of the site and the windbreak), which are more sensitive than the actual site itself that comprises agricultural land of low sensitivity as a habitat. The irrigation channel supports commonly occurring amphibians and the windbreak has features (e.g. split bark) that could support roosting bats.

The key ecological sensitivities at CSG2 are:

- Populations of the CITES-listed marsh orchid in discrete areas within the site
- The pine plantation abutting the south-west corner of the site, which is used by a number of breeding birds
- Several breeding bird species, including corncrake (which is considered by local surveyors to be in decline and which is likely to inhabit and breed in wetland areas).

The key ecological sensitivities at the CSG2 access road are:

- The pine plantation, which is used by several breeding birds (owing to the scarcity of similar habitats in the surrounding area)
- The wetlands, which support commonly-occurring amphibians
- White stork (a Georgian Red List species) nesting on abandoned wooden power poles in Nardevani
- Several breeding bird species, including corncrake (which is considered by local surveyors to be in decline and which is likely to inhabit and breed in wetland areas).

Ecological sensitivities at the PRMS include six endemic plant species that grow on the site (mainly around the boundary of the survey area). However, despite being endemic, these species are common in Georgia.

Plant species are sensitive to changes in climatic conditions and soil conditions that may cause habitat destruction, fragmentation or even loss. Animal species may be harmed directly (e.g. by vehicle impact or by exposure to chemicals or dust) or disturbed by activities that remove their food or destroy their underground burrows and nests (e.g. soil removal, soil compaction by vehicles, removal of vegetation). Noise and presence of people can also frighten or startle fauna.

Plants and animals may be put under survival pressure by the introduction of alien competitive species.

10.7.3 Impacts on Ecological Resources

Design

The facilities and Pipeline AGIs will cause a permanent change to approximately 45ha of habitat (excluding the vent area, the majority of which is planned to retain as the natural ground cover), comprising wet and moist meadow (CSG1), subalpine and wet subalpine meadow (CSG2 and CSG2 access road) and a combination of steppes, xeric grassland, scrub and agricultural land (PRMS). The facilities have been located adjacent to and integrated with existing facilities where possible to minimise habitat severance and the development footprint.

Construction

Habitats and plant species

Clearing vegetation and soil, and spreading or piling soil over vegetated areas, will cause both temporary and permanent habitat loss. Poor soil handling, soil erosion, soil compaction and poor disposal of surplus sub-soil could all reduce soil fertility, soil depth and soil structure which could, in turn, impact on the ability of the vegetation to recover naturally after the topsoil has been replaced.

Pollution of soil and groundwater by discharging wastewater and waste can cause mortality of vegetation.

On the ROW and at construction camps and equipment lay-down areas, clearing vegetation and soil will cause temporary loss of the natural habitat to approximately 287ha of land In addition, there will be a small loss of habitat where new temporary access roads are created or existing roads widened. The camps and laydown areas are located on areas of similar habitat to CSG1, CSG2 and the PRMS. Two options exist for the location of the PRMS construction camp location, with the final location to be determined prior to construction following a multi-disciplinary assessment, including the results of a seasonal ecological survey. The pipeline camp is located approximately 5km from the pipeline ROW in similar habitat and the pipe storage area is located on a brownfield site in Rustavi. The pipeline camp will be subject to a pre-construction ecological survey to inform any additional mitigation measures.

Potential impacts on habitats associated with this temporary habitat loss include localised reduction of biodiversity, habitat severance and an increase in edge-effects such as dominance by ruderal plant species.

The permanent footprint for the pigging station will be 0.3ha and the block valve 0.1ha of grassland habitat. The block valves and pigging station will be surfaced with gravel. This will constitute a new habitat that certain species may exploit.

A line of riparian scrub may need to be cut back to lay a cable from the micro-tunnelling pit to the edge of the Mtkvari River.

ROW clearance in the riparian woodland by the Algeti River will cause loss of several (approximately 9 mature individuals, plus approximately 200 saplings) of the protected (Georgian Red List) smooth-leaved elm (*Ulmus minor*) trees and cause temporary severance of the habitat The smooth-leaved elm sends out suckers and can regenerate

after felling as long as the roots are not removed. This species is therefore likely to re-establish well along the margins of the ROW, but would not be allowed to grow directly over, or close to, the new pipeline because its roots can damage pipe coating. Removal of mature trees could mean further fragmentation of remnant forest habitat.

Most of the ecological impacts resulting from pipeline construction will only be impacted on a temporary basis, provided all disturbed areas are reinstated quickly and effectively. The planned reinstatement work aims to correct the temporary habitat loss and severance, but its success depends on retention of topsoil containing seeds, bulbs and other propagules of native flora from the ROW, retaining the soil structure and nutrients during topsoil storage and avoidance of soil compaction (see Section 10.3.3).

The CSG1 site is agricultural land and surveys have identified few ecological sensitivities within the site, but have noted that the boundary features including a wind break and an irrigation channel have the potential for greater species diversity. The permanent loss of natural habitat will be approximately 20ha of land.

At the CSG2 facility and the CSG2 access road, clearing vegetation and soil will cause permanent loss of natural habitat of about 21ha of land. At CSG2, approximately 13ha of a meadow habitat that supports the CITES-listed marsh orchid (*Dactylorhiza urvilleana*) will be lost. However, this plant is considered to be very widespread in Georgia, and loss of part of this meadow would not influence species survival. The access road will occupy an area of 8ha.

At the PRMS, approximately 5ha of a mixture of agricultural land, scrub steppe and xeric grassland that supports endemic plant species will be lost. The plant species in question are widespread in Georgia and are not considered to be threatened, so loss of small areas of the habitat that supports them will not have a significant impact on species survival.

Introduction of competitive species or diseases
There is also the potential for non-native species imported on construction plant/vehicles and in seed mixes (if present) to establish leading to secondary impacts on habitats. If competitive alien/invasive species and diseases are introduced to the ROW or the facility construction sites, the newly introduced species could out-compete the native flora or cause the spread of plant (and animal) diseases.

Fauna
The periods when fauna will be most affected by disturbance are when they are hibernating or breeding. Most animal species are particularly vulnerable during the breeding season (April to July) and hibernating season (October to March). The precise timing of these behaviours is highly dependent on seasonal weather variation.

Clearance of CSG1 and its construction camp areas may begin while some species will be hibernating, but few, if any, will be breeding. Noise and vibration from vehicles, construction work and the construction camp will alert animals to dangers. Earth-moving equipment may destroy burrows, nests and breeding sites and vehicles on the access roads could run over slow-moving animals.

Noise from plant and machinery during construction could result in disturbance of wildlife. It is likely that large mammals and birds will temporarily move away from the construction area. When young animals are in the burrows, and eggs or chicks are in the nests, they could also be destroyed, although no nesting birds were identified on site during surveys in 2011. The significance of such disturbance depends on the seasonal behaviour patterns (e.g. hibernating, nesting) and life cycle sensitivities (e.g. breeding) of individual species and existing background noise levels, local topography and the duration and intensity of noise. Any disturbance caused by construction activities during the breeding season could lead to a reduction in breeding success of the species concerned. The construction area for CGS2 is a relatively small part of an extensive habitat and is unlikely to constitute a significant change in habitat for breeding populations. CSG2 also contains areas of wetland habitat.

Loss of the wetland habitat could affect the animal and bird species that use it. Where the CSG2 access road passes through patches of wetland it can cause permanent loss or severance of habitats that support the corncrake (*Crex crex*) which is considered vulnerable by local ecologists.

A white stork (GRL species) nests in the village of Nardevani (breeding between April to May each year) approximately 1km from the route of the access road; at this distance it is considered that the breeding birds are unlikely to be affected by construction or operation of the new access road.

At the Algeti and Mtkvari Rivers, the ROW passes through areas where the protected (GRL) species Mediterranean spur-thighed tortoise (*Testudo graeca*) has been observed. There is a risk that open-cut crossing construction activities at the Algeti or clearance of vegetation and soil by the Mtkvari River could harm individuals of this species or restrict its breeding sites and foraging areas.

Clearance of the ROW, particularly in more vegetated areas, may present a temporary barrier to movement for small mammals, amphibians and reptiles. The construction of soil storage piles, pipeline stringing and the opening of trenches could form a barrier to the movement of larger mammals. Trenches and other excavations involve a risk that individual animals may fall in, be injured by the fall or not be able to escape from the hole.

Accidental spills of chemicals, oils or fuels could have impacts on terrestrial fauna, the most likely of which are direct mortality through exposure to toxic compounds or bioaccumulation of toxic compounds through the food chain. The scale and significance of the impact would be dependent on the type and amount of any particular material spilled, as well as its location i.e. spills within a construction compound are unlikely to have significant ecological effects, but spills of large amounts of a chemical or oil in natural habitat could lead to a larger ecological impact. In consideration of the quantities and types of materials used during construction, any spill is likely to be quite localised. The direct impacts of mortality would only be likely to affect a very small number of animals (e.g. if the spilled material made direct contact with a sensitive species). The risk of bioaccumulation would only occur if the spill was left untreated and became ingested by a large number of prey species. These impacts are therefore only likely to be high if a spill involved large amounts of toxic material being introduced into a natural environment and being left untreated.

Uncontrolled disposal of solid wastes can have localised impacts on terrestrial fauna. In the case of largely inert solids such as excavated materials, this could have a small impact on terrestrial fauna if they are stored or disposed of into natural habitats. Solid wastes produced from construction camps (e.g. litter and similar materials) can cause mortality of animals if they become trapped in containers (e.g. plastic bottles). These impacts are likely to be small and localised.

Dust from construction works or from soil storage piles can adversely affect the respiration of animals.

Fish

One major river, the Algeti, and a number of smaller watercourses will be crossed using open-cut crossing methods. Open-cut crossing methods have the potential to impact on river ecology during the construction phase. The scale and duration of the impact will depend on the size of the watercourse, the habitat types present, the timing of works and the precise methods employed.

The main potential impacts on fish from construction of pipeline river crossings include:

- Creating a (temporary or permanent) barrier to the movement of fish and other wildlife
- Loss of fish eggs and other benthic fauna at the crossing point

- Degradation of fish spawning habitat at and downstream of the crossing point
- Sediment release leading to lethal or sub-lethal effects on fish and other aquatic organisms.

Open-cut pipeline crossings of rivers can potentially create a temporary barrier to fish movement during construction, and also have the potential to create a long-term barrier to fish movement after construction. Some fish migrate from rivers to the sea, whilst other species migrate up and down the freshwater sections of rivers throughout their lifetime, moving from fast-flowing headwaters to calm downstream waters. Poorly installed pipelines and other crossing structures (such as hard bed reinforcement to combat erosion and temporary flume pipe crossings/bridges installed to allow construction plant and machinery to cross over the river without entering the watercourse) can create barriers to these natural movements. This can result in the isolation of meta-populations up and downstream of the crossing point, reduced breeding success or loss of migratory species from sections of the river.

The peak fish-spawning activities typically occur between May and June, spawning activity can begin slightly earlier (depending on seasonality) and is likely to tail off towards the end of the season (July), as water levels drop and the rivers begin to dry up. Therefore, the period between May and June represents the most sensitive period for construction of open-cut river crossings in relation to spawning fish. Large amounts of sediment released into the river at this time could have a large impact on fish populations. Excavating a crossing trench through potential spawning habitat during the spawning season could lead to the direct loss of fish eggs or young. If there is spawning habitat downstream of the crossing then sediment released during trenching or backfilling could smother fish eggs and other benthic fauna.

Sediment released outside of the spawning season could also have impacts on spawning fish. Fish eggs are typically released into the water stream or laid over gravel beds, and the structure of the sediment, along with water quality, is an important factor in determining the suitability of a river for successful spawning. Sediment released into a river can reduce the suitability of habitat for fish spawning by reducing the three-dimensional complexity of the bed (e.g. covering gravels in a fine layer of silt). The impact of this on spawning fish is likely to be smaller in magnitude than a release of sediment during the spawning season, as over time silt is washed away and the spawning habitat recovers. Some examinations of the impacts of pipeline crossings on fish spawning habitat have shown that this can occur within one year or less[2].

Sediment released during trenching or backfilling can also lead to sub-lethal and lethal effects on fish and other aquatic organisms, as well as spawning fish and their habitat. Sub-lethal effects of increased levels of suspended sediment on fish include reduction in prey availability (due to smothering of benthic invertebrates), reduced ability to hunt for prey or avoid predators (due to lower visibility) and effects on health such as clogging of gills. Sub-lethal effects typically occur in the range of tens to hundreds of mg/l, and lethal effects typically occur in the range of hundreds to hundreds of thousands of mg/l. However, the rivers crossed by the proposed route naturally have quite high levels of suspended sediment, particularly during periods of high flow (May and June) where levels of suspended solids greater than 2000mg/l were recorded in the Mtkvari and Algeti during the 2011 field surveys. Fish living in rivers with high variability in suspended sediment levels are typically well adapted to short-term variations (i.e. increases over a few days), so to have an impact on fish and other aquatic organisms, suspended sediment would have to be raised above these levels or continue for a prolonged period.

[2] Reid, S.M., Stoklosar, S., Metikosh, S. and Evans, J. (2002). Effectiveness of Isolated Pipeline Crossing Techniques to Mitigate Sediment Impacts on Brook Trout Streams. *Water Qual. Res. J. Canada,* 2002, Volume 37, No. 2, 473–488.

According to a review by Reid and Anderson[3] of pipeline crossings of seven rivers in the United States, suspended sediment levels downstream of crossings ranged between 503mg/l and 2,960mg/l (mean = 1,326mg/l). There was a large range in the data and the concentrations were highly dependent on the distance of the measurements downstream from the crossing.

The increase in suspended sediment resulting from pipeline crossings is highly dependent on the techniques used. For example Reid et al (2002)[4] monitored total suspended sediment downstream of isolated crossings (using dam and pump and flume techniques) and found that, aside from installing and removing the isolation structures, suspended sediment levels downstream of the crossing were at least seven times lower than open-cut crossings of similar sized watercourses.

Open-cut crossings are typically completed over a course of a few days, so any increased levels in suspended sediments would only be short term. As a proportion of the total and average movement of sediment in these rivers, the amount of sediment mobilised by construction is likely to be small and short term. These estimates are subject to a large number of un-calculated variables and should be treated with caution and consideration of the variables discussed here in regard to timing of animals' behaviour and the behaviour of sediments released into flowing water. They do however provide a guide to the likely scale of any impact, such that the potential impacts on fish and aquatic organisms from release of suspended sediment are likely to be small unless the levels released are many times greater than the background levels, coincide with the fish spawning season and are distributed into fish spawning habitat.

It is possible that additional sediment could enter watercourses due to run-off from the ROW (which may be more vulnerable to wind and water soil erosion following topsoil removal during construction and following topsoil replacement, when the vegetation has yet to recover). The total potential amount of sediment that could enter the watercourses from this source is considered likely to be small in comparison with the natural levels of sediment borne in the water, particularly during the periods of high flow. This potential impact will be mitigated in the long term by the process of biorestoration of the ROW and the other control measures in place to avoid surface soil erosion. In consideration of the scale of potential effect and the high levels of natural suspended sediment this impact is therefore only likely to be small and short-term and would not be expected to have a significant effect on aquatic organisms such as fish.

Abstraction of water from rivers, for example for hydrostatic testing, and discharge of water (such as hydrostatic test water and water from trenches) to rivers has potential direct effects on aquatic biota (particularly fauna) and potential effects on water quality leading to secondary effects on aquatic biota. During abstraction there would potentially be a risk of picking up aquatic biota such as fish and temporarily or permanently removing them from the water. There is an increased risk to fish populations if water abstraction is carried out during the spawning period when very young fish could be extracted in large numbers. If trench water and hydrotest water is discharged to watercourses there could be a potential impact from increased suspended sediment levels (through scour or soil erosion). The potential effects of this are discussed above in relation to potential impacts of open-cut river crossings.

During non-open-cut river crossings there is a risk of drilling mud break-out. Drilling muds will be water based and the primary risk from mud outbreak is an increase in suspended sediment in the water column that could, in turn, have secondary impacts on fish. As

[3] Reid S.M. and Anderson P.G. (1998). Suspended Sediment and Turbidity Restrictions Associated with Instream Construction Activities in the United States: An Assessment of Biological Relevance. *Proceedings of the International Pipeline Conference, American Society of Mechanical Engineers,* Calgary, Alberta, June 10-14, 1998, pp. 1035-1040.

[4] Reid, S.M., Stoklosar, S., Metikosh, S. and Evans, J. (2002). Effectiveness of Isolated Pipeline Crossing Techniques to Mitigate Sediment Impacts on Brook Trout Streams. *Water Qual. Res. J. Canada*, 2002, Volume 37, No. 2, 473–488.

discussed above, the potential ecological impacts of this are likely to be small in consideration of the high natural levels of suspended sediments in the rivers. Should break-out occur, an appropriate response plan will be implemented.

Operation phase

Small maintenance and inspection activities along the pipeline ROW may re-disturb vegetation. In particular, driving along the ROW after reinstatement (on un-surfaced routes) can prevent the recovery of vegetation and lead to permanent habitat loss, degradation and fragmentation. However, BTC/SCP operations staff are only permitted to drive along the ROW in an emergency.

Areas around the facilities and the construction camps and lay-down areas will be reinstated and will become available for wildlife once more. The permanent loss of land for the SCPX Project is estimated at approximately 125ha in total, of which approximately 80ha will remain as natural vegetation (facility vent areas).

Lighting and daily security movements outside the facility fence lines are unlikely to cause undue disturbance to wildlife if restricted to roadways. The wall surrounding the site will screen fauna from views of people within the site.

Access within the vent area will be possible for some types of fauna.

Impact summary and assessment of significance

Table 10-12 provides an assessment of the significance of potential impacts on ecological receptors before and after implementation of the proposed mitigation measures that are discussed in the rest of this section. An assessment for particularly sensitive receptors is provided in Table 10-13.

Table 10-12: Potential Impacts on Ecological Receptors

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A17	Loss of habitat	Reduced biodiversity	B2 Low	2-02, 3-14, 3-19, 4-09, 9-02, 10-14, 11-05 17-05, 17-07, 17-08, 17-10, 17-11, 17-14, 17-18, 19-10, 30-23, 32-03, D5-045, D17-09, OP61, OP51, OP52	B1 Low
		Modified habitat structure			
		Loss of breeding and foraging areas			
		Habitat severance			
A18	Introduction of competitive plant species or diseases	Poor re-colonisation by local flora following reinstatement	B2 Low	18-01, 18-02, 18-05	B1 Low
		Modified habitats due to non-native species establishment	B4 Medium	18-01, 18-02, 18-05	B2 Low
A19	Disturbance or harm to wildlife	Reduced breeding potential and population	B2 Low	D5-045, D5-046, 2-02, 3-14, 9-02, 9-03, 19-03, 19-04, 19-05, 19-06, 19-07, 19-08, 19-10, 21-04, 28-11, X7-08	B1 Low
		Changed behaviour	B2 Low		B1 Low
		Increased predation	B2 Low		B1 Low
		Injury or death	B2 Low		B1 Low
A20	Impeded movement of wild animals, domestic herds and people due to open trench, pipe string	Disruption of animals movements affecting their ability to forage	B2 Low	20-01, 32-08	B1 Low

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
	or spoil storage mounds				
A21	Open excavations (including open trench)	Injury to fauna from falling into excavations	B2 Low	21-01, 21-02, 21-04	B1 Low
A2	Soil compaction	Impaired re-establishment of vegetation after construction	B2 Low	2-01, 2-02, 2-03, 2-07, 3-15, 4-06 Also refer to Section 10.3.4	B1 Low
A3	Soil erosion and sediment run-off following removal of vegetation and/or disturbance of ground	Reduced primary productivity in watercourses, smothering of invertebrates, lethal or sub-lethal effects on fish, degradation of spawning habitat	B3 Low	3-03, 3-07, 3-08, 3-09, 3-15, 3-23, 3-26, 3-28, 4-07, 4-08, 4-09, 4-12, 4-13, 10-11, 10-12, 10-16, 10-18, 10-19, 17-07, OP143, OP131, OP136	B1 Low
		Impaired recovery of natural vegetation due to erosion by wind or water	B3 Low		B1 Low
A4	Loss of soil structure, fertility and seed bank	Poor recolonisation due to anaerobic conditions in stored soil, reduced fertility and loss of entrained seeds	B2 Low	4-05, 4-04, 3-01, 3-11 Also refer to Section 10.3.4	B1 Low
A7	Disposal of solid and liquid waste, release of hazardous materials	Stress or mortality of flora and fauna due to drilling mud break out or spills of waste or hazardous materials into watercourses	B2 Low	4-14, 6-04 to 6-14, 6-20, 6-21, 6-16, 6-18, 19-08, 7-10, 7-11, 7-12, 7-14, 10-01, 10-22 Also refer to Section 10.3.4	B1 Low
A9	Disposal of surplus subsoil	Smothering of native flora and fauna	B2 Low	1-11, 1-12, 9-02, 9-01, D5-093, 4-09, X4-06, 9-04 Also refer to Section 10.3.4	B1 Low
A10	Disposal of surplus trench and hydrotest water	Smothering of invertebrates by sediment and mortality of fish	B3 Low	10-02, 10-03, 10-04,10-06, 10-08,10-09, 10-10, 10-11, 10-12, 10-14, 10-15, 10-16, 10-19 10-21 Also refer to Section 10.5.4	B1 Low
A11	Impeded flow river or channel	Loss of aquatic and water-margin habitats, restriction of fish movement and reduced reproductive success, impaired movement and reduced habitat suitability for other aquatic organisms	B3 Low	10-18, 11-01, 11-02, 11-03, 11-04, D5-079	B1 Low
A12	Use of water from river or channel	Loss of aquatic and water-margin habitats, restriction of fish movement and reduced reproductive	B3 Low	10-04, 10-09, 15-02, 15-03, D5-079, D5-078 Also refer to Section 10.5.4	B1 Low

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
		success, impaired movement and reduced habitat suitability for other aquatic organisms			
A24	Dust generation, particularly from vehicle movements and storage of excavated materials	Respiratory problems for animals	B2 Low	2-02, 19-07, 24-01 to 24-02, 24-05, 24-06, 23-05, 23-06, 28-11, OP13, OP23	B1 Low
A25	Noise emissions from vehicle movements, construction operations and construction camp	Disturbance affecting breeding and/or behaviour	B2 Low	25-01 to 25-05 25-09, 25-11	B1 Low

* Assessed using Tables 3-10 and 3-11

Table 10-13: Potential Impacts on Sensitive Receptors

Location	Sensitive Receptor	Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
KP0	Wetland fauna	Disturbance of wetland fauna	B3 Low	X7-01, 19-10	B2 Low
KP7–10	Amphibians	Damage to reed bed habitat supporting amphibians	B3 Low	X5-06, 19-10	B2 Low
KP12	Fauna in channel	Disturbance of fauna inhabiting irrigation channel	C3 Low	D5-009, X5-06, X7-15	C2 Low
Mtkvari	Individuals of the smooth-leaved elm	Removal of smooth-leaved Elm (GRL species)	D3 Medium	D17-04, X5-02, D5-045, 17-08, X7-09, X7-03, 3-14, 17-11, 17-15, OP51, OP52	D1 Low
Mtkvari	Aquatic ecosystem	Disturbance of aquatic ecosystems in season of high sensitivity (spawning *c.* May-June)	D3 Medium	D17-04, D5-079, X5-01, X5-02, X5-03 Also refer to Table 10-10	D2 Medium
Mtkvari	Mediterranean spur-thighed tortoise	Injury, restriction of movement, breeding, foraging	D2 Medium	X5-02, D17-04, 21-04, 19-03, 19-06	D1 Low
KP50–51	Reed bed habitat	Damage to reed bed habitat supporting amphibians	B3 Low	10-14, 19-10	B3 Low
KP3, 54-55	Trees used for bat roosts	Loss of habitat (roosts) for bats	C3 Medium	D5-045, D5-054, 19-06, X7-12, X7-13, 17-08, X7-06, X7-07, 17-10, 3-14, 17-11, OP51, OP52	C2 Low

Location	Sensitive Receptor	Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
Algeti	Individuals of the smooth-leaved elm	Removal of smooth-leaved elm (GRL species)	D3 Medium	D5-054, D5-079, X7-17, X7-02, X7-06, X7-07, 3-14, 17-10, 17-11, 17-08, 17-15, OP51, OP52	D2 Medium
Algeti	Aquatic ecosystem	Disturbance of aquatic ecosystems in season of high sensitivity (spawning *c.* May-June)	D3 Medium	D5-079, X5-01, X7-11 Also refer to Table 10-10	D1 Low
Algeti	Mediterranean spur-thighed tortoise	Injury, restriction of movement, breeding, foraging	D2 Medium	19-06, 21-04, 19-03	D1 Low
CSG2	Subalpine and wet subalpine meadow habitat supporting the CITES listed marsh orchid	Loss of 12ha meadow habitat supporting the marsh orchid	D3 Medium	X7-18, X7-10	D2 Medium
CSG2	Wetland habitat	Disturbance of wetland habitat, loss of habitat supporting amphibians	B3 Low	17-10, 19-06, D17-01, X7-16, X7-10	B2 Low
CSG2 and CSG2 Access Road	Corncrake in wetland	Loss of wetland patches supporting corncrake breeding and feeding areas	C3 Medium	D17-02, D17-08, 19-06, X7-14	C3 Medium
CSG2 Access Road	Pine plantation	Removal of trees from pine plantation	A3 Low	D17-02, X4-07, 17-10, 17-08	A1 Low
CSG2 Access Road	Stork nesting near Nardevani	Disturbance of breeding birds and migrating birds	D1 Low	19-06, X7-14	D1 Low

* Assessed using Tables 3-10 and 3-11

10.7.4 Mitigation of Ecological Impacts

The impact avoidance and mitigation measures summarised below will be applied to activities that could affect habitats and species.

At the design stage

The Mtkvari River crossing will be constructed by micro-tunnelling or horizontal directional drilling under the river (D17-04), which will reduce impacts on riparian habitat compared with open-cut techniques. The large irrigation channel, drainage ditch and road at KP12 will form part of a single trenchless crossing (D5-009), which will minimise potential effects on the channel ecology.

Where the ROW passes through riparian woodland by the Algeti River crossing, the SCPX ROW will be a reduced working width, and topsoil will be removed from the ROW to a storage area (D5-054).

Construction of CSG2 facility and lay-down areas will avoid building on the larger area of wetland at the site (D17-01). The inert surface area of the vent exclusion zone at the facilities (CSG1, CSG2 and PRMS) will be reduced to that required for safety purposes, thereby reducing the amount of habitat removed (D17-09).

The CSG2 access road route has been selected to follow existing roads and tracks and to avoid plantations, wetlands and cultural heritage sites as far as practicable (D17-02). During detailed design, the CSG2 access route has been adjusted to avoid the majority of the wetland area near Kuschi and to route the permanent and temporary footprint away from the area of active Corncrake habitat between Kuschi and Berta villages (D17-08). Routing the road through existing gaps in the pine plantations reduces the need to fell trees. The location of the PRMS construction camp will be selected based on a multidisciplinary evaluation of the potential options considering H&S, social, technical and environmental criteria. This evaluation will consider the results of pre-construction ecological surveys which will be undertaken at the potential locations in Spring (D5-046).

In the construction phase

Loss of habitat
Vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency) (2-02) to reduce unnecessary impacts to habitat.

Existing third-party services and sensitive receptors that need to be avoided during construction (e.g. cultural heritage sites, or specific trees that are to be retained) will be marked (D5-045). A record will be made of the condition of access roads, construction camps, laydown areas and rail offloading areas and any special features along the pipeline ROW before construction to inform the reinstatement work (17-14). A pre-construction survey between April and July inclusive will be undertaken at the pipeline camp location, of the plants and animals present on site to identify any need for site-specific mitigation measures (17-18).

A method statement will be produced and agreed prior to construction of the pipeline through the wetland at KP0–0.5 with the aim of reducing damage to the wetland during construction by use of bogmats or an alternative as approved by the Company (X7-01). Watercourse banks disturbed by Project crossings will be restored to near original condition, which will be assessed individually for each watercourse and defined in the Contractor's Reinstatement Implementation Plan. Any deviations (e.g. because hard reinforcement is required for erosion control) shall be subject to Company approval (10-14). At the Algeti River crossing, individuals of the smooth-leaved elm shall be marked prior to construction and shall be avoided where deemed practicable by the Company during the setting out of the ROW (X7-17).

At the Mtkvari crossing, the scrub will be cut back and coppiced to accommodate the guide cable for the micro-tunnel machine. Plant roots will remain undisturbed as far as practical (X7-09). If Georgian Red List tree species cannot be avoided by coppicing on the banks of the Mtkvari River, compensation planting will be undertaken to off-set the essential removal of trees (X7-03). The Mtkvari River at KP30 will be non-open-cut (micro-tunnel or HDD) and use existing/abandoned launch pit on east bank if practicable (X5-02).

An inventory will be made of all trees felled during the Project construction phase, including Red Data Book species, in accordance with the requirements of national legislation (17-15).

Marsh orchids within the temporary and permanent footprint at CSG2 will be surveyed, identified and translocated prior to construction. A proportion of the plants will be moved to similar habitat in unaffected areas (X7-18).

Where the CSG2 access road is routed through pine plantations, felled trees will be preferentially left within the existing plantation to rot and provide habitat for fungal and invertebrate species, pending agreement with the landowner (X4-07).

At CSG2 the large wetland area to the east of the facility are will be fenced with protective barriers to protect it from construction activities whilst allowing access for livestock (X7-16).

Introduction of competitive plant species or diseases
No species that are considered likely to out-compete the indigenous plant species will be used in seed mixes (18-01). No invasive species will be used in seed mixes for erosion control or bio-restoration (18-02). The Contractor shall inspect and wash all plant and equipment prior to shipping to the country of use with the aim of ensuring, as far as it is free from soil and plant material (18-05).

Disturbance and harm to wildlife
No hunting, fishing or unauthorised gathering of products (including plants and cultural heritage artefacts) by the workforce will be permitted within the Project footprint (19-05). Environmental and social issues will be included in workforce and visitor induction training (28-11) and wildlife sensitivity to disturbance will be included in workforce training (19-06). All drivers will undergo safety and environmental and social awareness training; driving performance will be assessed and monitored with additional training provided if necessary (19-07). Muds used will be water based (9-03) for drilling/tunnelling under the Mtkvari. The Company will prepare Site Specific Ecological Management Plans for priority areas. Contractor will incorporate the requirements of these plans into site-specific method statements (19-10).

Ornithological surveys will be carried out at CSG2 and at wetland areas along the CSG2 access road in the breeding season (May–June) and in the migration season (September) before and during construction work to identify bird species using the area and the effect of construction (X7-14).

Impeded movement of wild animals
To minimise the risk of harm to wildlife and livestock, the length of the continuous open trench (including trench with pipe installed but not backfilled and a void space greater than 1m) will not exceed 10km per spread and the maximum length of the open trench will not exceed 15km per spread (21-01). Each section of open pipeline trench will have sloped ends or other mechanisms to aid egress from the trench (21-02). The trench will be checked regularly for wildlife (particularly in sensitive locations), e.g. where tortoises are found (KP29–31 and KP54–55) and where the four-lined snake may be present (KP0-12) (21-04).

Animals may seek shelter within pipe sections; welded pipe sections will be capped to prevent entry (19-04). Gaps will be left in soil stacks at strategic locations to allow passage of animals and people where the Project considers it safe to do so (20-01).

Soil compaction
Section 10.3 (Soils) describes measures that will minimise soil compaction and loss of fertility, which could affect bio restoration and loss of entrained seed.

Disposal of solid and liquid wastes
Construction contractors will be required to manage the storage and disposal of food and organic wastes to avoid attracting vermin (19-08).

Where benching is required, surplus subsoil will be stored on the ROW or, if disposal is necessary, it will be transported to an approved disposal site and/or approved borrow pits (1-11). Section 10.5 and 10.6 (Surface Water and Groundwater) describes further measures that will minimise mortality of flora and fauna as a result of waste and spoil disposal.

Use of water
The sediment control measures described in Section 10.5.4 will reduce adverse impacts on aquatic fauna in the Algeti River.

The irrigation channel at KP12 will be crossed using a trenchless method thus avoiding disturbance to flora and fauna (X7-15).

Before extracting water the Project will consider the presence of any IUCN/Georgian Red List fish species particularly during fish spawning season (which normally occurs within the period May to June) and the mitigations such as 10mm fish screens will be determined by a site assessment and approval by the Company (D5-079).

Section 10.5.4 (Surface Water) describes measures that will minimise harm to aquatic organisms from activities that affect river water quality and flow rates.

Dust
Section 10.8.4 (Air) describes measures to minimise the respiratory impairment of wildlife by exposure to dust.

Aquatic flora and fauna
The Algeti River crossing will be constructed outside of the fish-spawning season, which is May to June (X7-11). Section 10.5.4 (Surface Water) describes measures that will minimise harm to aquatic organisms from activities that affect surface water levels.

Disturbance of terrestrial fauna
Pre-construction ecological surveys will be carried out at dusk/night in June–July to record details of bats at KP2–12 and KP54–55. Trees identified as bat roosts will be marked for avoidance. Where removal is unavoidable, the bats will be prevented from re-entering their roosts by blocking roost entry points at night prior to construction (X7-12 and X7-13).

If *Testudo graeca* (spur-thighed tortoise) is found within the work site, individuals will be moved to within a safe distance (50m+) from the works by the Project ecologist. Any eggs or hatchlings will be placed in a box of sand and transferred by the Project ecologist to suitable nearby habitat where a nest will be created (19-03).

Reinstatement

Temporary works areas will be reinstated to near original condition (as compared to preconstruction survey reports or adjacent areas) (17-05). Reinstatement will be undertaken as early as practicable and in accordance with the Reinstatement Specification (4-09). Re-contouring should be sympathetic and in keeping with the surrounding landscape, and as approved by the Project, where this is not precluded by risk to integrity of the pipeline or erosion considerations (9-01). All potential subsoil disposal sites and disposal plans will be subject to an environmental and social review prior to their adoption (9-02).

The re-establishment of vegetation will be monitored following reinstatement until it has reached Project near- and long-term re-vegetation targets (17-10). The Project will seek to achieve an increasing trend in vegetation re-growth and species diversity (specifically species composition) in reinstated areas with reference to nearby areas undisturbed by Project activities, as recorded by the percent similarity and commonality indices (17-07). The ROW slopes at KP27 and KP29 that have a high erosion risk will be reseeded using hay and an appropriate seed mix (X7-08). A monitoring plan will be developed to determine the success of bio-restoration activities, including the appropriateness of species composition (3-14).

Compensation planting will be undertaken based on the number of trees to be removed A re-planting ratio will be developed which will be species and region specific (17-08). Compensation planting of trees could be achieved by fringe planting at the edge of existing forest blocks to increase the continuous area of forest (Figure 10-3). In order to minimise the edge/core ratio such edge planting should be done as small blocks rather than linear areas.

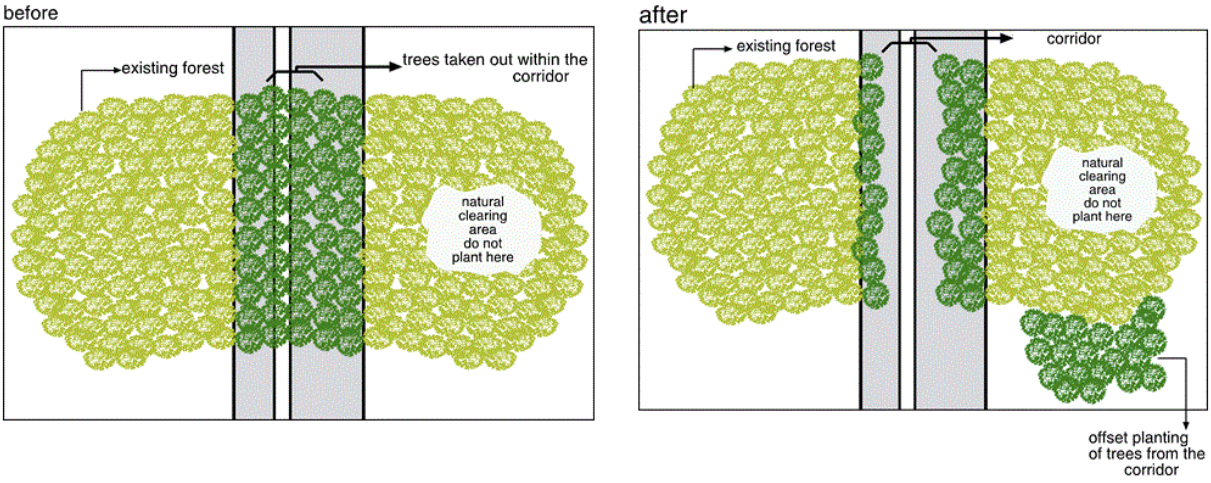

Figure 10-3: Fringe Planting at the Edge of Existing Forest Blocks

Where trees are removed on the banks of the Algeti River, compensation planting will be undertaken to off-set the essential removal of trees (X7-02). A preliminary offset planting scheme has been developed for the Smooth Leaved Elm (GRL) species removed at the Algeti River crossing. Current estimates suggest that an area of approximately 1000m^2 of riparian forest containing Smooth-Leaved Elm (9 mature individuals), will be removed during pipeline construction. It is therefore proposed to plant an equivalent area with a mixture of Smooth-Leaved Elm and White Poplar species (*Populus cansecens)*. White Poplar is a typical riparian species and occurs in the habitat within and close to the construction RoW and is expected to aid Elm survivability.

To facilitate the re-establishment of smooth-leaved elm populations by the Algeti River, seeds will be collected from mature tree specimens in nearby habitat and saplings will be produced from the collected seeds at recognised nursery (X7-06). Translocation of the existing individuals is not considered feasible due to their poor existing condition and the species high sensitivity to root disturbance.

After construction has been completed, seed-grown plants of 50cm or more in height will be planted in areas of the Algeti riparian woodland, where populations of smooth-leaved elm occurred prior to clearance (subject to planting restriction zones), suitable protection will be provided to protect them from grazing (X7-07). The proposed planting area is an existing gap between two more extensive riparian forest patches, which when established, will likely form an ecological corridor. Based on existing forestry practices in Georgia approximately 700 individual Smooth-Leaved Elm, interspersed with White Poplars are expected to be planted (Figure 10-4).

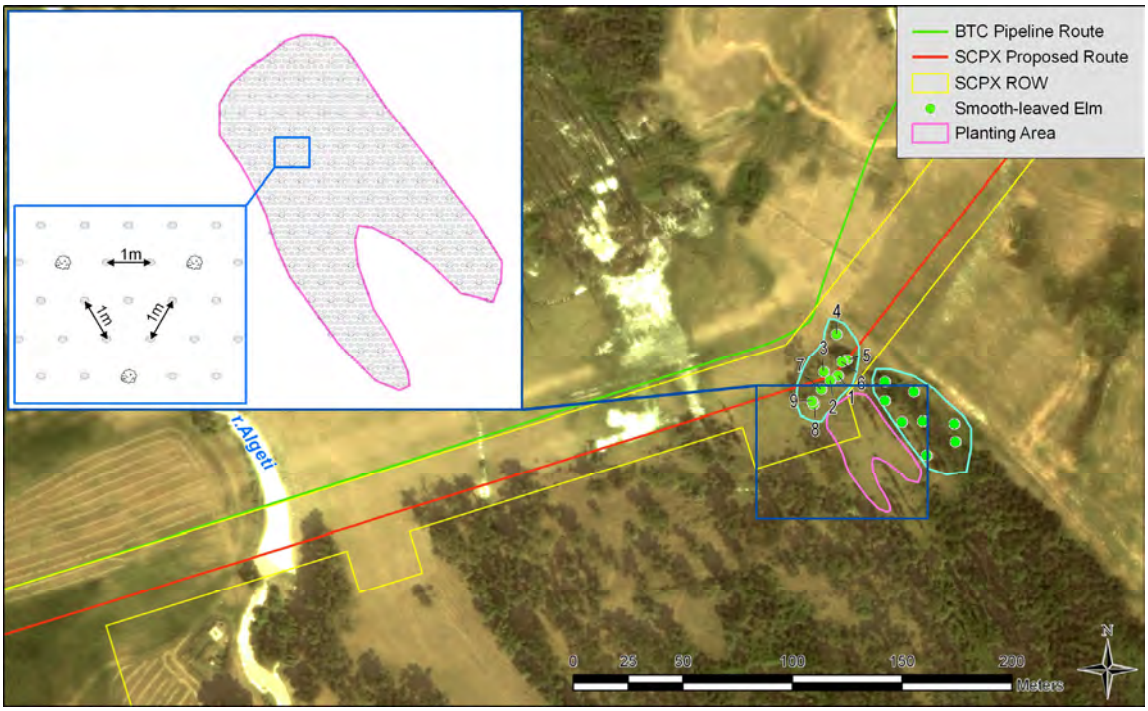

Figure 10-4: Example of Preliminary Tree Offset Planting Plan near the River Algeti

At CSG2, tree planting to screen the visual impact will avoid planting on the seasonal wetland areas (X7-10).

In the operational phase

The re-establishment of vegetation will be monitored following reinstatement until it has reached Project near- and long-term re-vegetation targets (17-10). These habitat-specific vegetative cover targets have been developed based on experience of re-vegetation during BTC and SCP. A monitoring plan will be developed to determine the success of bio-restoration activities, including the appropriateness of species composition (3-14).

Follow-up monitoring to record survival of planted or re-planted trees for off-setting purposes will be undertaken until sustainable growth is achieved (OP51). The Project will carry out annual maintenance operations until any new tree planting for off-setting purposes has established (OP52).

Corrective measures will be implemented if establishment of vegetation is not successful or if, following survey and data analysis, the species composition is considered by a Project ecologist to be unsuitable for the area (17-11).

When patrolling the pipeline, the Project will use horse patrols wherever practicable, minimising vehicular access except where necessary for maintenance purposes (OP61).

10.7.5 Residual Impacts on Ecology

When the proposed mitigation measures are implemented, the residual impacts on ecology can be summarised as follows:

- The pipeline route crosses habitats which are generally of low sensitivity and support few sensitive species. The residual impacts are therefore considered to be of low significance. Particularly sensitive species are encountered at the Mtkvari and Algeti River crossings, where individuals of the smooth-leaved elm will need to

be removed during construction. This residual impact is considered to be of medium significance

- The CSG1 site is agricultural land. Surveys have identified few ecological sensitivities within the site and construction is unlikely to affect the more sensitive habitats in the irrigation channel and windbreak that border the site. Overall, these changes are expected to be of low significance
- CSG2 and its access road are in subalpine meadow and will displace individual animals to the surrounding area, without affecting species populations. Construction activity will avoid the larger wetland area near the site. The permanent facility footprint will remove a relatively large area of habitat that supports the CITES-listed marsh orchid. The CSG2 Access road has been routed to avoid areas of known corncrake habitat however some areas of potential habitat will be lost permanently due to the presence of the road. These changes are assessed to be of medium significance
- The PRMS is in a setting of scrub and agricultural land, which supports endemic species which are relatively common within Georgia. Individual animals will be displaced to the surrounding area without affecting species populations. Overall, these changes will be of low significance
- If the reinstatement and bio-restoration is successful, the habitats of the temporarily disturbed areas (the ROW, construction camps, river crossings and lay-down areas) will recover to near original condition and will be colonised by local species. These temporary changes to baseline conditions will be of low significance.

10.8 Air Quality and Greenhouse Gas Emissions

This section discusses emissions of atmospheric pollutants and greenhouse gases during construction and operation of the SCPX Project and associated mitigation measures to be adopted.

10.8.1 Aspects of the SCPX Project that have the potential to Emit Atmospheric Pollutants and Greenhouse Gases

Engines and processes that combust fuels, depending upon the nature of the fuel, may have the potential to emit atmospheric pollutants including nitrogen oxides[5] (NO_x), sulphur dioxide (SO_2), carbon monoxide (CO) and particulate matter (PM)[6], greenhouse gas carbon dioxide (CO_2) and volatile organic compounds (VOCs)[7] that include both atmospheric pollutants and greenhouse gases.

The following planned Project activities involve fuel combustion:

- Operation of diesel-powered vehicles for logistics, ROW access road preparation, ROW clearance, pipe stringing, CSG2 access road construction, facility clearance and civil engineering, process equipment installation at facilities, operation and maintenance of SCPX (NO_x, CO, SO_2, VOC, PM_{10})
- Operation of diesel-powered construction plant at the ROW and facility sites (NO_x, CO, SO_2, VOC, PM_{10})
- Operation of diesel power generators at construction camps during the construction phase
- Function testing of the diesel back-up generators at facilities during the operation phase (NO_x, CO, SO_2, VOC, PM_{10})

[5] NO_x includes nitrogen dioxide (NO_2) and nitric oxide (NO).
[6] Particulate matter is used in this context to describe inhalable particles generally PM_{10} and below.
[7] The term VOC is loosely applied to a wide range of organic compounds but in this context it is used as defined in the UNECE VOC Protocol (1991) as “all organic compounds of an anthropogenic nature, other than methane, that are capable of producing photochemical oxidants by reactions with nitrogen oxides in the presence of sunlight”.

- Operation of gas-fired power generators (turbines and engines) to supply electricity at facilities during the operation phase (NOx and CO)
- Operation of gas turbines to drive the compressors at CSG1 and CSG2 (NO_x and CO)
- Operation of gas-fired water bath heaters at CSG1 and the PRMS (NO_x and CO)
- Operation of the TEGs at the pigging station.

The following operations have the potential to emit fugitive unburnt hydrocarbons:

- Fugitive emissions from facilities, block valve and pigging station (VOC mainly methane)
- Venting during routine maintenance of equipment at the facilities block valve and pigging station during the operation phase (VOC mainly methane) (emergency venting is discussed in Chapter 12).

The following planned Project activities have the potential to raise nuisance dust[8]:

- Soil removal and stockpiling at ROW and facilities
- Pipeline trenching
- Placing aggregate for road construction and facility site preparation
- Blasting
- Concrete batching
- Excavation at the facilities
- Vehicle movement on dry roads.

10.8.2 Key Sensitivities

Human health is sensitive to exposure to levels of atmospheric pollutants that exceed the ambient air quality standards (see Table 6.11 for the SCPX Project Ambient Air Quality Standards). Potential sensitive receptors include the communities and isolated residences in the vicinity of CSG1 and the communities in the area surrounding CSG2 and the PRMS.

The SCPX Project ambient air quality standards for the species modelled for operational phase are:

- NO_2: 40μg/m^3 annual average, 200μg/m^3 hourly average
- CO: 10mg/m^3 (10,000μg/m^3) 8-hour average, 30mg/m^3 (30,000μg/m^3) hourly average.

Baseline ambient air quality levels for NO_2 and CO are described in Chapter 7, and are all within the above ambient air quality standards. Existing background levels in the vicinity of CSG1 are highest due to the relatively more industrial nature of the surrounding area.

The human respiratory function is sensitive to exposure to dust levels above the SCPX Project ambient air quality standards:

- PM_{10}: 20μg/m^3 annual average, 50μg/m^3 24-hour average (not to be exceeded more than 3 days a year, 99th percentile)
- $PM_{2.5}$: 10μg/m^3 annual average, 25μg/m^3 24-hour average.

Baseline ambient air quality levels for PM_{10} and $PM_{2.5}$ are reported in Chapter 07, summer levels are generally higher than winter soils and deposited dust on surfaces are likely to be

[8] Nuisance dust is a term commonly used to describe deposition of inert dust on or around sensitive receptors (e.g. on vegetation, dwellings and clothes on washing lines)

drier during the summer, and more readily available for suspension or resuspension in air, leading to higher concentrations of suspended particulate matter.

Residents of houses and occupants of schools or hospitals and vegetation and crops that are close to the sites where construction activity raises dust are likely to be particularly sensitive to dust emissions and have the potential to be adversely affected. Nuisance dust, i.e. > 10μm in diameter, can also cause disturbance by depositing in or around sensitive receptors.

Table 10-14: Dust Sensitive Locations

Approx. KP	Locations particularly sensitive to dust
KP1.8	Building
KP3	Military camp
KP24	Buildings in Akhali Samgori
KP27.5	Buildings north of route
KP26.5	Buildings north of route
KP31	Buildings on the outskirts of Rustavi
KP40	Buildings in Krtsanisi
KP42.5	Buildings south of route
KP45	Kumisi, school, houses north of railway
CSG2 access road	Buildings in Nardevani
CSG2 access road	Buildings in Berta/Oliangi

10.8.3 Potential Impacts

Release of exhaust gases

Projected emissions from construction equipment are summarised in Section 5.7.3.

During construction, the release of combustion gases will mostly be from vehicles and relatively mobile sources. These may locally increase concentrations of atmospheric pollutants (NO_x and SO_2) to a limited extent, but as they are from mobile sources spread over a wide area that are in use for a limited period of time, the increase has not been modelled. Given the good ambient air quality in the Project area, it is not anticipated that construction releases will result in exceedance of the Project ambient air quality standards at receptors.

During operation, however, the gas turbines at CSG1 and CSG2 are large static sources that will emit exhaust gases. Modelling has been carried out to predict the dispersion of CO and NO_x emissions. In the case of CSG1 and the PRMS, the emissions from existing BTC/SCP facilities were included in the predictions. Owing to the absence of significant diesel combustion equipment in operation, it was not felt necessary to model SO_2 emissions.

The compressor gas turbines are dry low emission (DLE) turbines that have lower NO_x emissions than standard turbines, at high turbine loads. The smaller power generation turbines are standard combustion turbines. The compressor turbines may not always be able to operate within their optimum DLE mode owing to variations in ambient temperature and pipeline throughput. Modelling was therefore carried out to evaluate the effects on ambient air quality for both the turbines operating within DLE mode and out of DLE mode, where NO_x emissions are higher.

The model was also used to verify the stack heights for the main emission sources: the compressor driver and power generation gas turbines and the water bath heaters. If ambient air quality had been predicted to be significantly affected, a sensitivity analysis with increased exhaust stack heights was to be carried out.

CSG1

Table 10-15 presents the peak (hourly) and mean (annual) concentrations of CO and NO_2 from CSG1 operating together with PSG1 that are predicted at receptors, i.e. farmhouses and settlements in the surrounding area. The results include background NO_2 (5ug/m^3, recorded) and CO (0.5mg/m^3, assumed) concentrations that were measured prior to the operation of PSG1 to avoid double counting these emissions.

Two model runs were carried out to evaluate the effect of the compressor drive turbines operating in DLE mode and out of DLE mode. The results below (Figure 10-5 to Figure 10-12), assumed that the compressor turbines operated at their highest vendor provided NOx emission rate all year.

The highest predicted ground-level CO concentration at any receptor is approximately 3% of the WHO hourly peak limit and the maximum predicted annual mean CO concentration is approximately 5% of the WHO 8-hour mean limit. The highest predicted ground-level NO_2 concentration at any receptor is approximately 18% of the WHO hourly peak limit and the maximum predicted annual mean NO2 concentration is 22% of the WHO annual mean limit.

The greatest short-term process contribution to CO concentrations experienced by receptors is predicted to be 1% of the hourly standard and the maximum long-term process contribution is predicted to be 1% of the 8-hour mean CO standard. The greatest short-term process contribution to NO_2 concentrations experienced by receptors is predicted to be 18% of the hourly standard and the maximum long-term process contribution is predicted to be 9.5% of the annual mean NO_2 standard.

Table 10-15: CO and NO_2 Concentrations at Receptors around CSG1 (Background Concentrations Included)

Receptor	CO Peak (hourly)	CO Mean (annual)	NO_2 Peak (hourly)	NO_2 Mean (annual)
	mg/m^3	mg/m^3	ug/m^3	ug/m^3
AM455 Community	0.59	0.5	12.51	5.29
CS1-N10 Farmhouse	0.63	0.5	18.38	5.28
CS1-N2 Former Railway	0.84	0.52	35.04	6.62
CS1-N5 Farmhouse 2	0.69	0.51	20.14	5.87
CS1-N8 Farmhouse 4	0.61	0.5	13.65	5.09
CS1-N9 Farmhouse	0.63	0.5	18.47	5.18
Gardabani E	0.69	0.5	21.3	5.24
Jandari E	0.69	0.5	20.45	5.28
Kesalo E	0.68	0.5	21.46	5.14
Rusibolo E	0.58	0.5	12.45	5.14
Vakhtangisi C	0.57	0.5	13.01	5.03
Vakhtangisi E	0.57	0.5	14.25	5.03
CS1-N1 Farmhouse	0.94	0.54	36.95	8.83
CS1-N3-Military Camp	0.83	0.51	32.73	5.59

The contour plot presented in Figure 10-5 and Figure 10-6 shows that the peak (hourly) concentrations of CO and NO2 are localised and that at settlements the concentrations will be well below the WHO hourly limits of 30mg/m^3 for CO and 200µg/m^3 for NO_2.

The plot presented in Figure 10-7 and Figure 10-8 and shows that the mean annual concentration contours for CO and NO_2 extend to the southeast and cross the border with Azerbaijan at levels that are very low compared with the WHO limits of 10mg/m^3 for CO and 40µg/m^3 for NO_2.

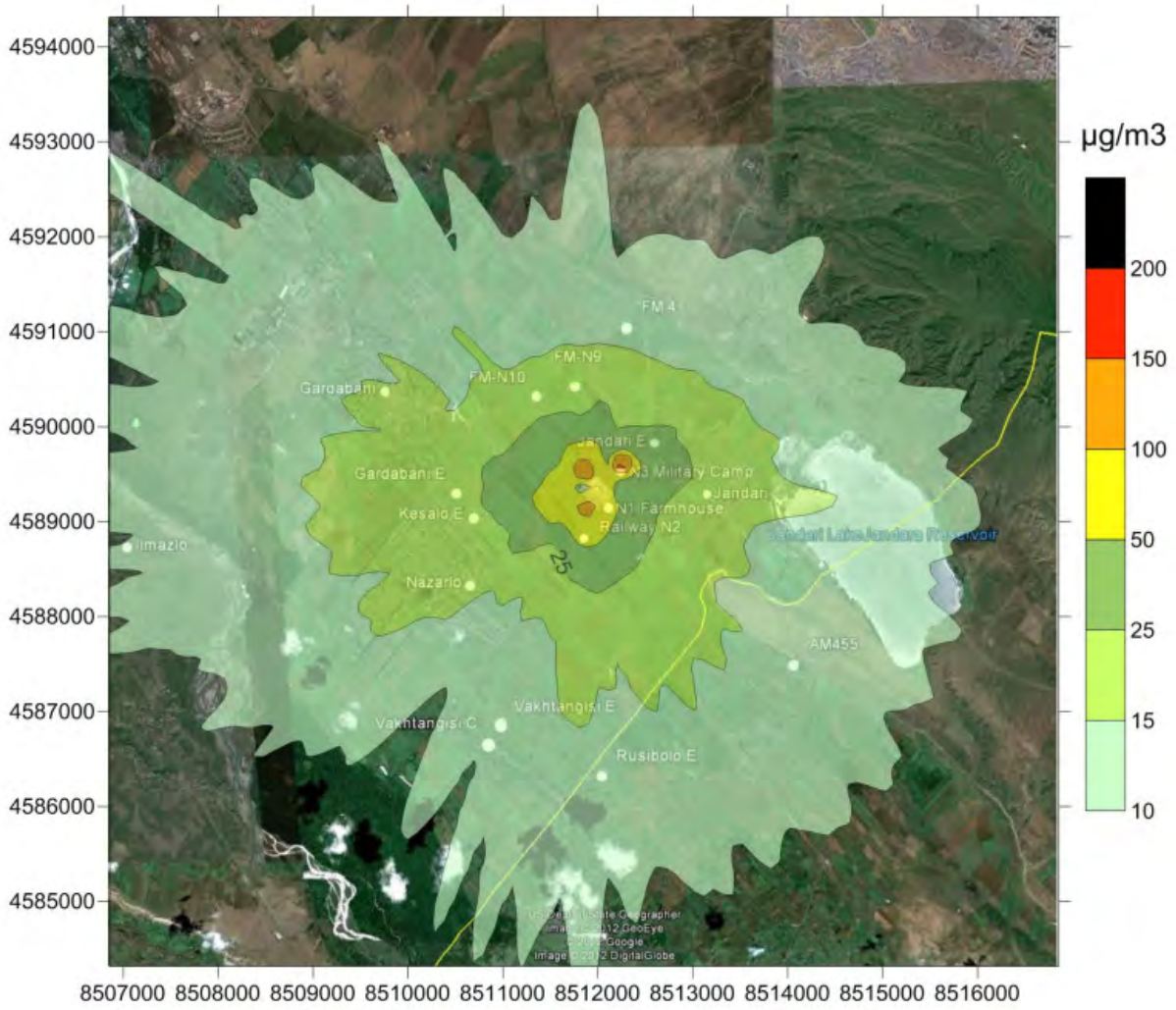

Figure 10-5: CSG1 Peak (Hourly) CO (10km Grid)

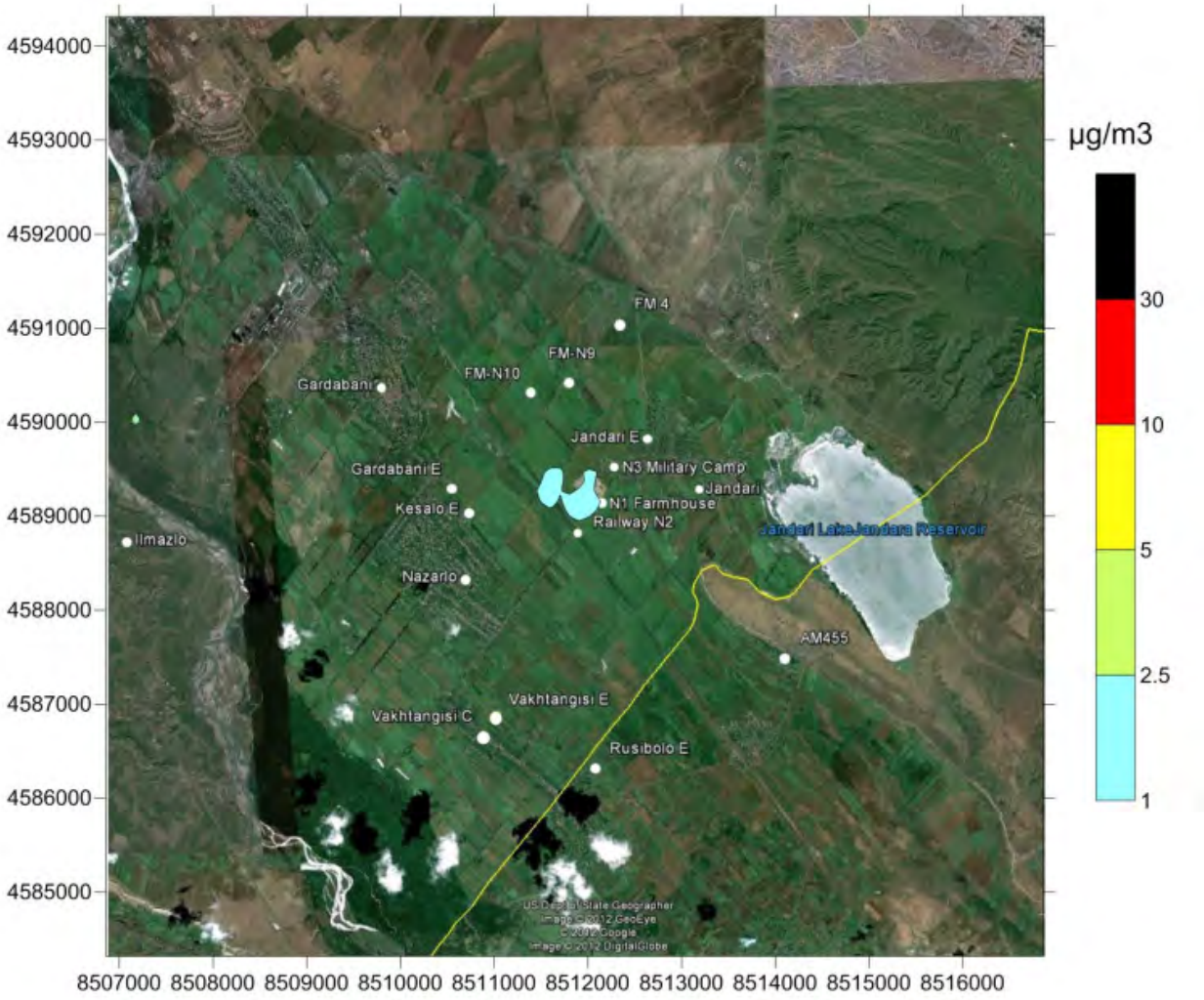

Figure 10-6: CSG1 Peak (Hourly) NO_2 (10km Grid)

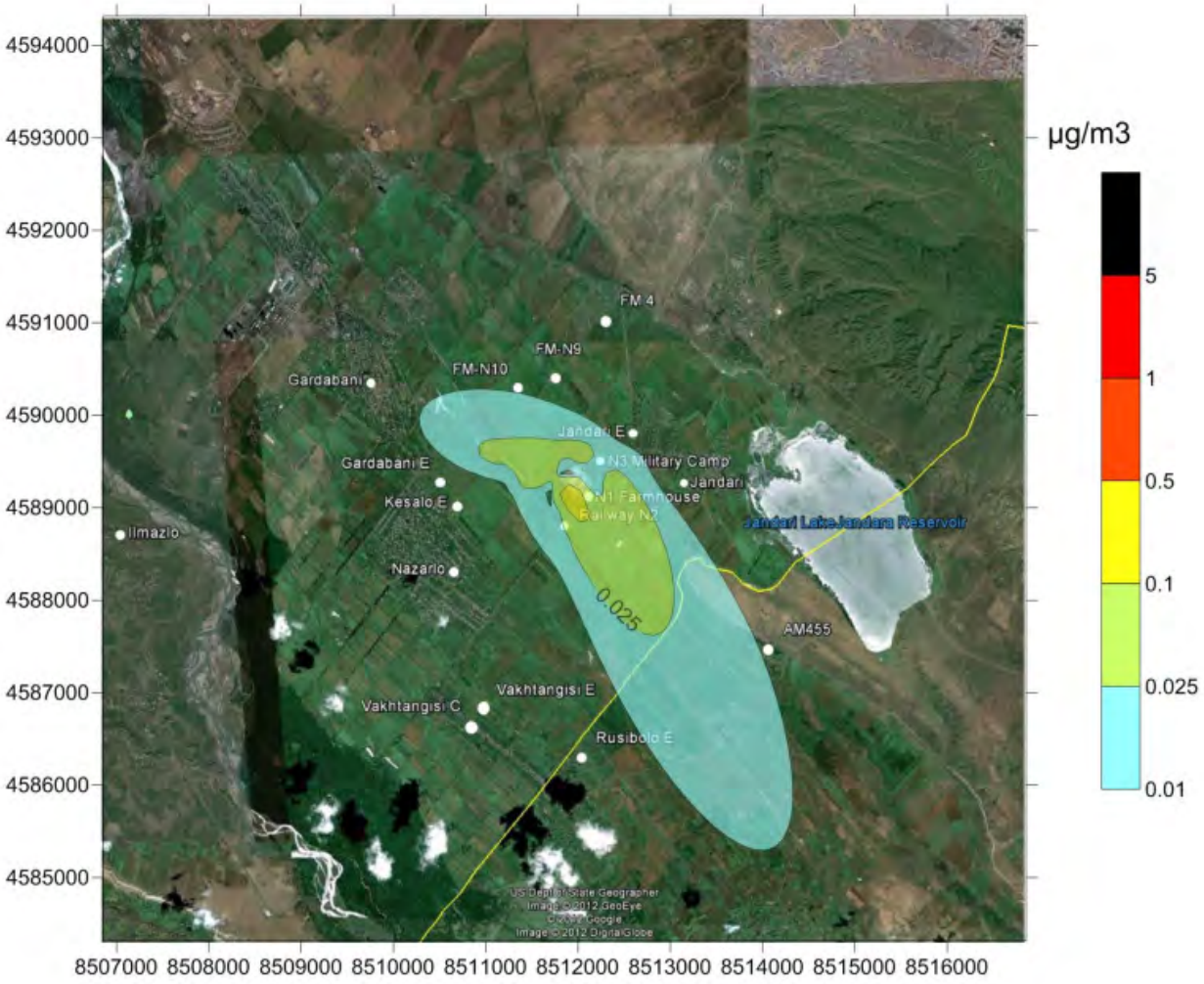

Figure 10-7: CSG1 Mean (Annual) CO (10km Grid)

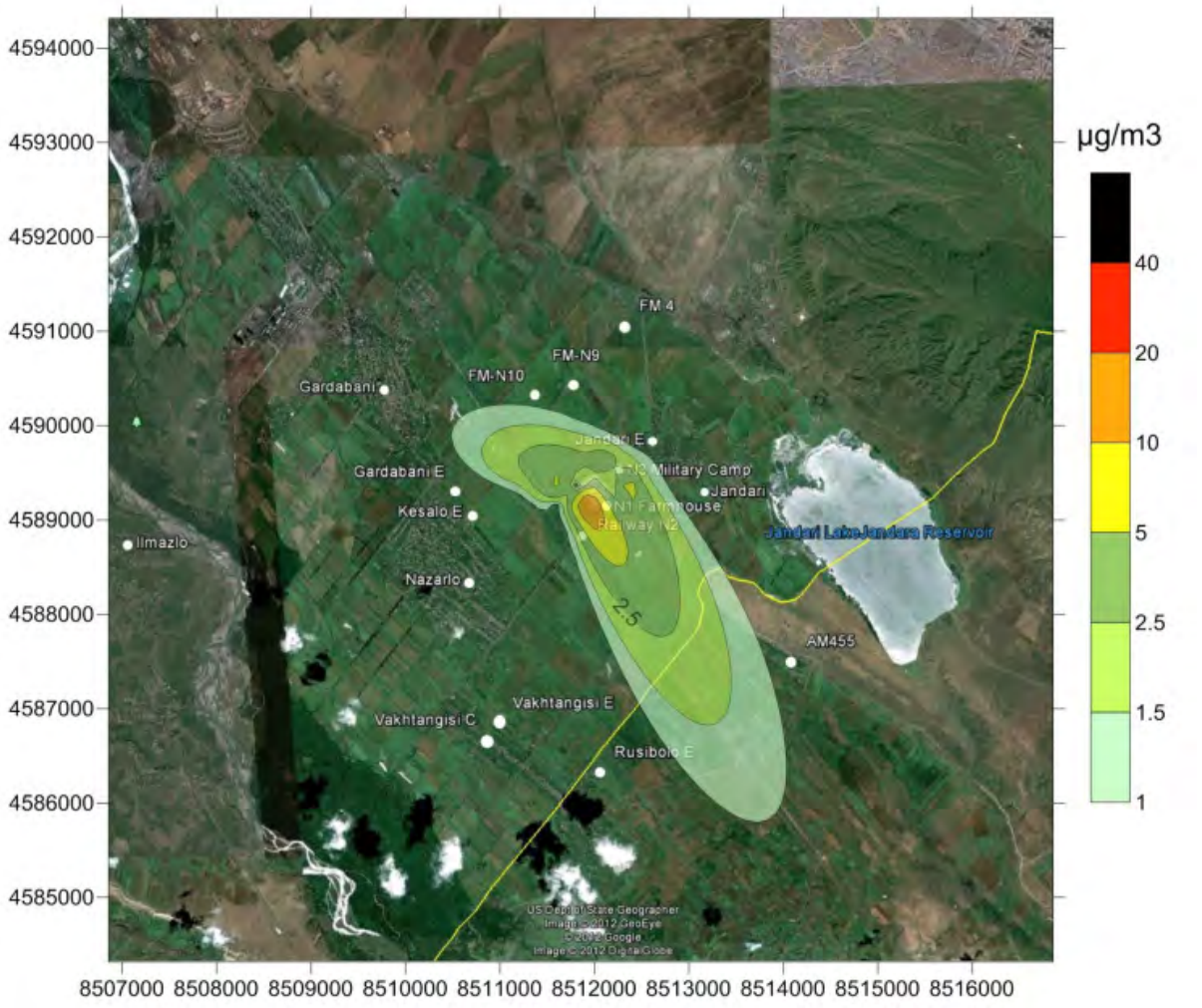

Figure 10-8: CSG1 Mean (Annual) NO_2 (10km Grid)

CSG2

Figure 10-9 presents the peak (hourly) and mean (annual) concentrations of CO and NO_2 from CSG2 that are predicted at settlements in the surrounding area, including existing background levels of NO_2 (5µg/m^3, recorded) and CO (0.5mg/m^3, assumed). The results below, in Table 10-16, assumed that the compressor turbines operated at their highest vendor provided NO_x emission rate all year.

The concentrations predicted at CSG2 are lower than those predicted for CSG1. The highest peak hour ground level CO concentration at any receptor is approximately 2% of the WHO hourly peak limit and the maximum annual mean CO concentration is approximately 5% of the WHO annual mean limit. The highest peak hour ground level NO_2 concentration at any receptor is approximately 6% of the WHO hourly peak limit and the maximum annual mean NO_2 concentration is approximately 13% of the WHO annual mean limit.

The greatest short-term process contribution to CO concentrations experienced by receptors is predicted to be 0.4% of the hourly standard and the maximum long-term process contribution is predicted to be 0.1% of the 8-hour mean CO standard. The greatest short-term process contribution to NO_2 concentrations experienced by receptors is predicted to be 3% of the hourly standard and the maximum long-term process contribution is predicted to be approximately 0.5% of the annual mean NO_2 standard.

Table 10-16: CO and NO_x Concentrations at Receptors around CSG2 (Background Concentrations Included)

Receptor	CO Peak mg/m³	CO Mean mg/m³	NO_2 Peak ug/m³	NO_2 Mean ug/m³
Avranlo C	0.59	0.5	11.1	5.19
Berta (Oliangi) C	0.57	0.5	9.26	5.04
Burnasheti E	0.6	0.5	11.19	5.04
Gumbati C	0.57	0.5	9.07	5.09
Khando C	0.57	0.5	9.2	5.09
Kuschi C	0.57	0.5	8.77	5.07
Kizilkilisa C	0.61	0.51	11	5.33
Rekha C	0.62	0.5	11.59	5.09

The contour plots presented in Figure 10-7 and Figure 10-8 show that the peak concentrations of CO and NO_2 are localised and that the contours representing 1–2.5mg/m³ CO does not extend to any settlements. The peak concentration of NO_2 (11.59µg/m³) at Rekha village is well below the WHO hourly standard of 200µg/m³.

Compared with the plots for CSG1, those for CSG2 clearly show lower ground level concentrations at receptors in the area. This is due to the absence of existing emission sources at CSG1 and because the nearest receptor to CSG2 is farther away than the nearest receptor at CSG1.

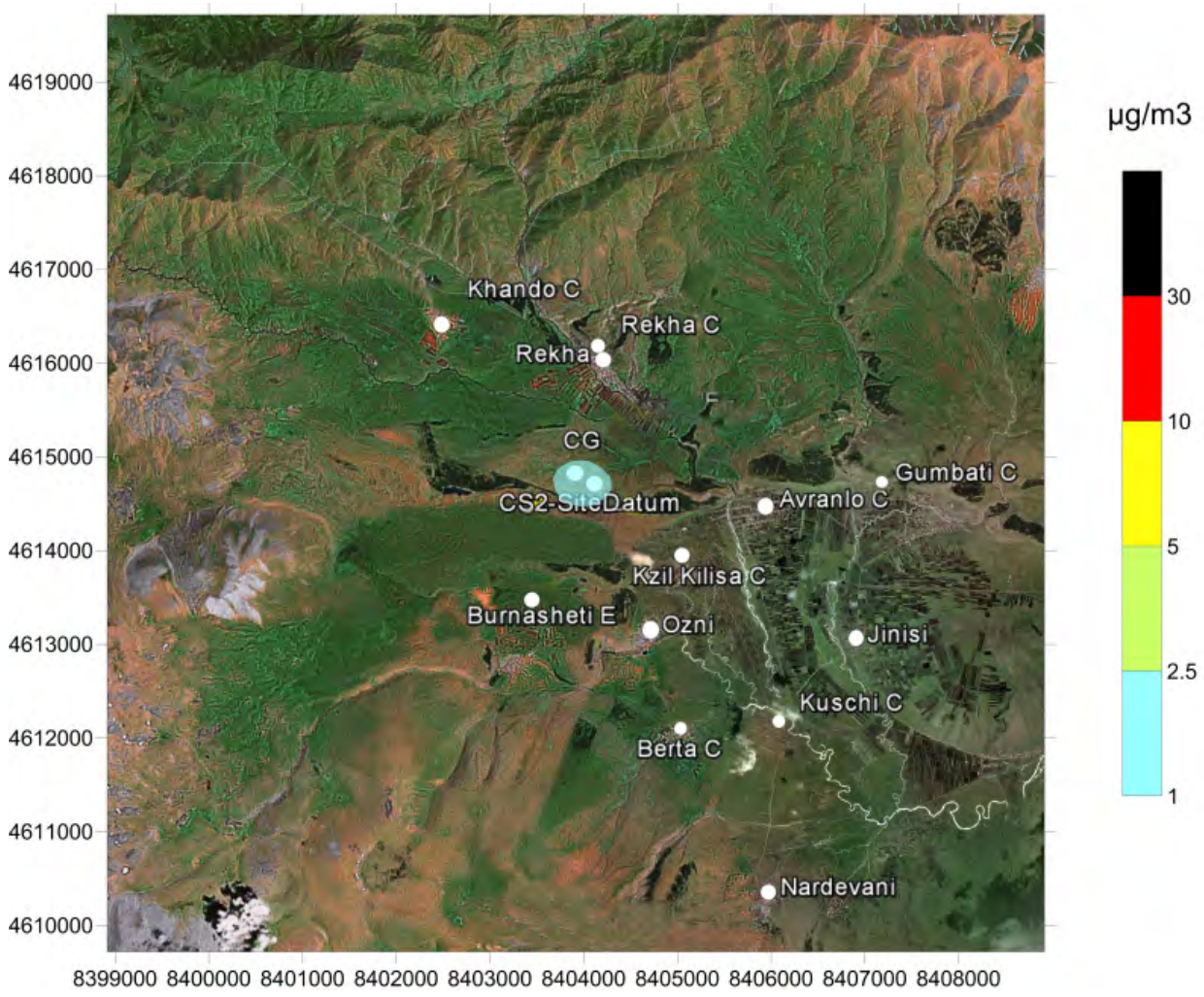

Figure 10-9: CSG2 Peak (Hourly) CO (10km Grid)

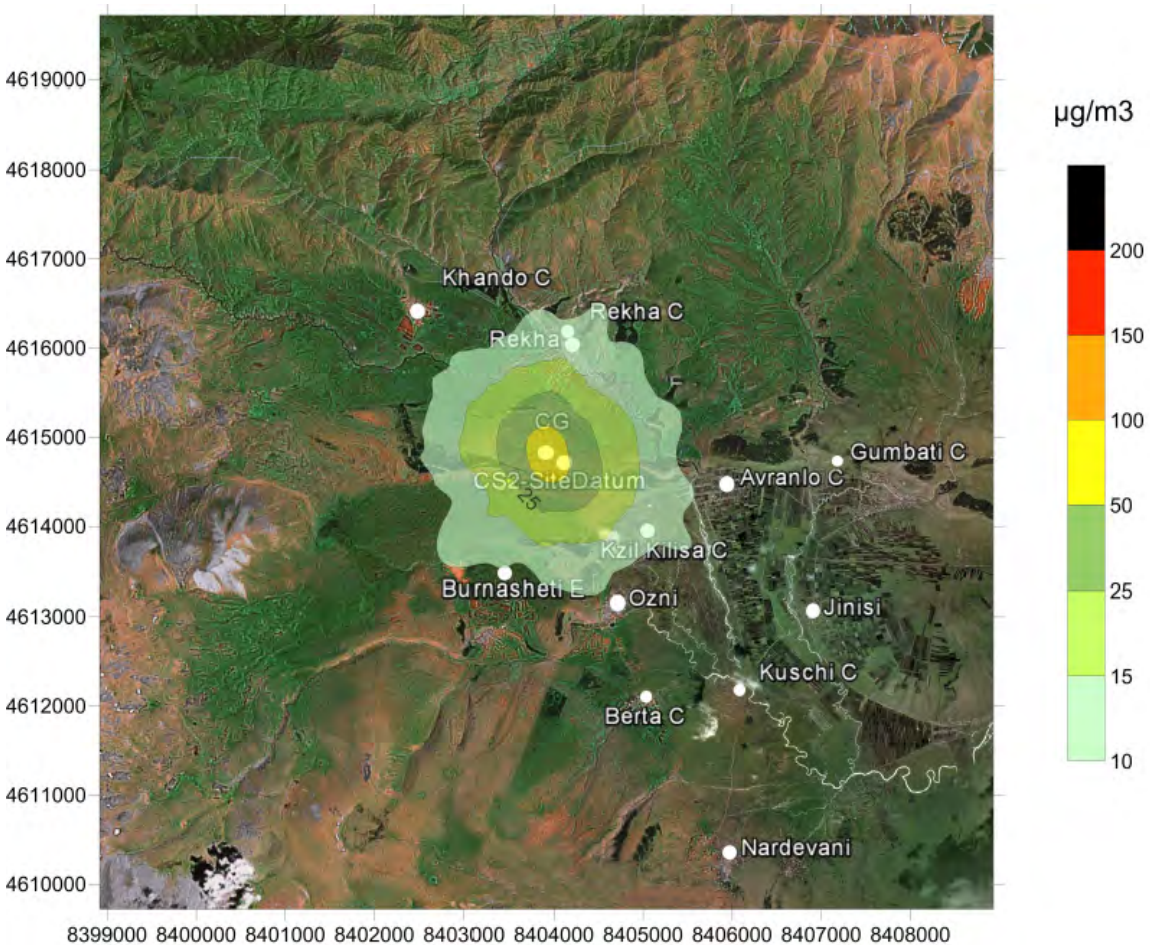

Figure 10-10: CSG2 Peak (Hourly) NO_2 (10km Grid)

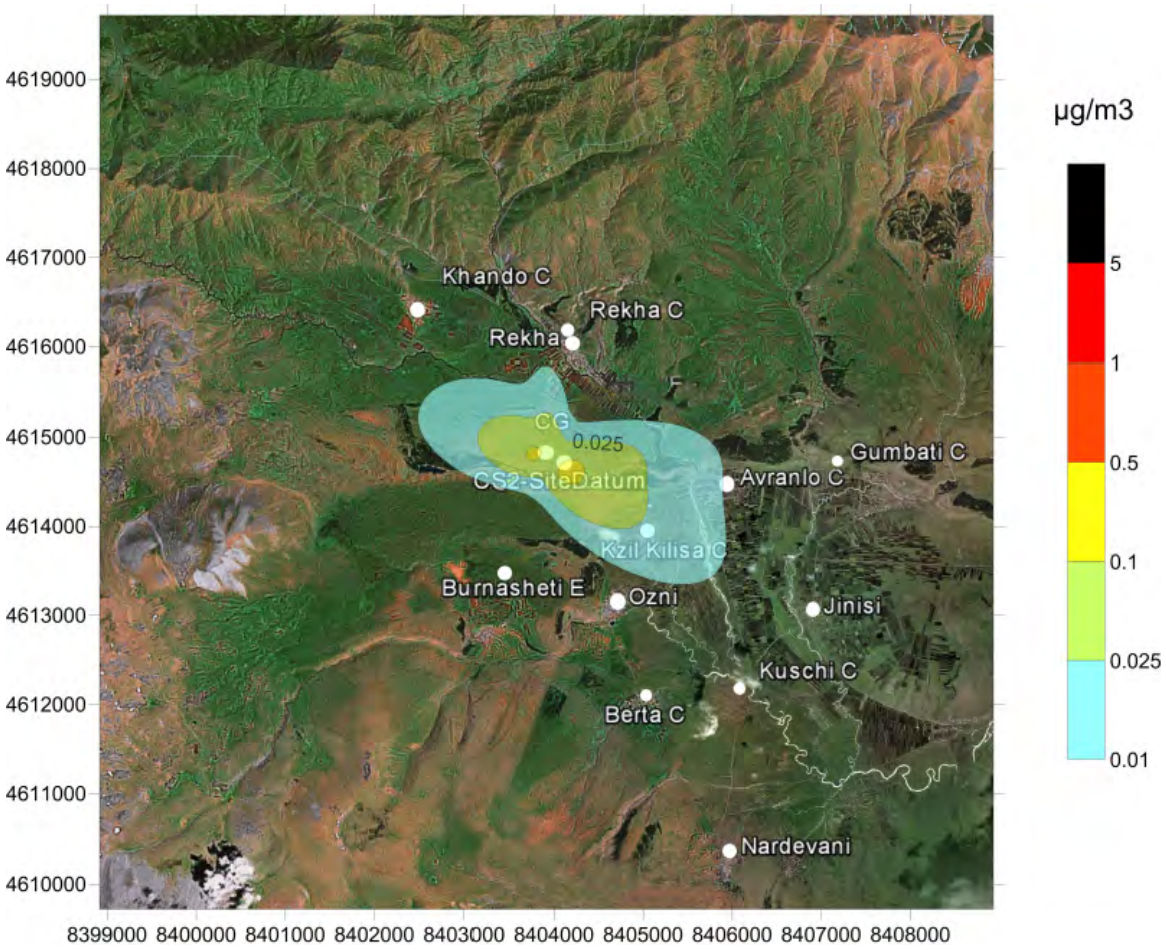

Figure 10-11: CSG2 Mean (Annual) CO (10km Grid)

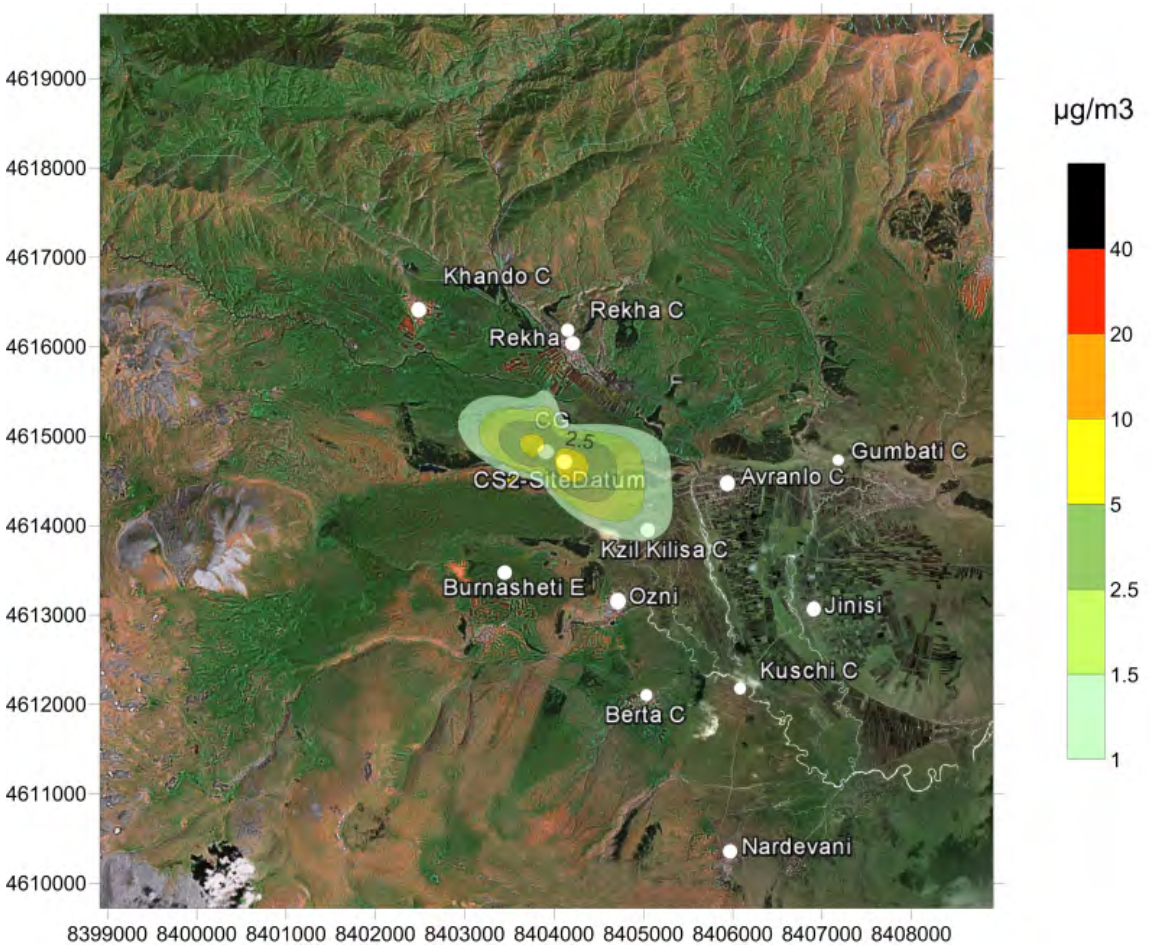

Figure 10-12: CSG2 Mean (Annual) NO_2 (10km Grid)

PRMS

Table 10-17 presents the peak (hourly) and mean (annual) concentrations of CO and NO_2 from the PRMS and Area 80 that are predicted at receptors in the surrounding area. The model includes the operation of both the existing sources (power generation and water bath heaters) and the new sources the proposed Project will introduce (two water bath heaters). Background concentrations prior to the operation of the existing facilities of NO_2 (2µg/m^3, recorded) and CO (0.5mg/m^3 assumed) were used to avoid double counting the emissions.

Two model runs were carried out to account for the differences in gas heating demand between winter and summer. The first assumed that heating was required all year (representative of winter operation) and the second that no heating was required (representative of summer operation). Power generation remained the same for both models. Table 10-17 shows the winter results. Results for summer were lower than that for winter at all locations.

Predicted concentrations are lower than those at CSG1 and higher than at CSG2. The highest peak ground level CO concentration at any receptor is approximately 1.7% of the WHO hourly peak limits and the maximum predicted annual mean CO concentration is approximately 5%of the WHO 8-hour mean standard. The highest predicted peak ground level NO_2 concentration at any receptor is approximately 13% of the WHO hourly standard and the maximum predicted annual mean NO_2 concentration is 15% of the WHO annual mean standard.

The greatest short-term process contribution to CO concentrations experienced by receptors is predicted to be 0.03% of the hourly standard and the maximum long-term process contribution is predicted to be negligible (nearly zero percentage of the 8-hour

mean CO standard). The greatest short-term process contribution to NO_2 concentrations experienced by receptors is predicted to be 12% of the hourly standard and the maximum long-term process contribution is predicted to be approximately 10% of the annual mean NO_2 standard.

Table 10-17: CO and NO_2 Concentrations at Receptors around the PRMS: Background Concentrations Included.

Receptor	CO Peak (hourly)	CO Mean (annual)	NO_2 Peak (hourly)	NO_2 Mean (annual)
	mg/m^3	mg/m^3	ug/m^3	ug/m^3
Armutveren C	0.51	0.5	15.14	5.21
Didi Pamaji C	0.5	0.5	10.35	5.08
Gumuskavak C	0.5	0.5	10.96	5.08
Incedere C	0.51	0.5	11.34	5.14
Julda C	0.51	0.5	14.79	5.16
N3 Fuel Station	0.51	0.5	20.49	5.39
N9 SPPD Post for GC2	0.51	0.5	23.83	5.89
Turkgozu C	0.51	0.5	11.84	5.11
Vale C	0.51	0.5	13.71	5.22
Naokhrebi E	0.52	0.5	26.41	5.23

Due to the low concentrations, within ambient air quality standards at all receptors, the stack heights for the equipment have been validated and no sensitivity analysis for higher stacks is deemed necessary. Stack heights are reported in Chapter 5.

Greenhouse gas emissions

The carbon dioxide emitted from all engines and combustion equipment is a greenhouse gas. Methane is a more potent greenhouse gas than carbon dioxide. Fugitive emissions from flanges and connections in the SCPX facilities will result in the small-scale release of methane.

During construction, the quantity of greenhouse gases emitted from vehicles and temporary mobile construction equipment is considered to be relatively low (see Chapter 5).

During the operation of SCPX, it is estimated that the consumption of gas for compression, power generation, water baths, together with the venting of gas for emergency or maintenance blowdown will emit CO_2 (other emissions expressed as CO_2 equivalent) at the rate of approximately 603,500 tonnes CO_{2eq}/yr.

A benchmark assessment of the GHG emissions compared to other similar major pipeline systems is provided in Chapter 11 (Cumulative and Transboundary Impacts).

SO_2 and particulate matter

The operation of vehicles and equipment powered by internal combustion engines may result in the emission of exhaust gases containing the pollutants SO_2 and PM_{10}. The quantities emitted depend on factors such as engine type, service history, pattern of usage and fuel composition. The emissions will be from a number of small, mobile sources and will be for a short duration (see Chapter 5 for emissions estimates during construction).

Dust

Fugitive dust emissions arising from construction and demolition activities are likely to be variable in nature and will depend upon the type and extent of the activity, soil type and moisture content, road surface conditions and weather conditions. Periods of dry weather combined with higher than average wind speeds have the potential to generate more dust. Construction and activities that are considered to be the most significant potential sources of fugitive dust emissions are:

- Excavations and earth moving, due to the handling, storage and disposal of soil and subsoil materials
- Construction aggregate usage, due to the transport, unloading, storage and use of dry and dusty materials (such as cement and sand)
- Movement of heavy site vehicles on dry or untreated routes
- Movement of vehicles over surfaces where muddy materials have been transferred off site (for example, on to public highways).

Fugitive dust arising from construction and demolition activities is generally of a particle size greater than the PM_{10} fraction (that which can potentially impact upon human health). Appropriate dust control measures are highly effective for the dust-generating activities identified above, and adverse effects can be greatly reduced or eliminated.

Dust may be a subjective nuisance to local residents. There are no regulatory limits on dust deposition. Prolonged exposure to high levels of airborne dust can affect the health of people who suffer from respiratory disorders. Dust deposition on vegetation can reduce crop productivity and honey production in bees, which in turn can affect livelihoods.

Dust has a limited ability to remain airborne and, depending on the particle size and weather conditions, readily drops from suspension as a deposit, typically fairly locally.

Impact summary and assessment of significance

Table 10-18 provides an assessment of the significance of potential air quality impacts before and after implementation of the proposed mitigation measures that are discussed in the rest of this section. Impacts on the locations identified as particularly sensitive to dust are assessed in Table 10-19.

Table 10-18: Potential Impacts on Air Quality

Issue		Potential Impacts	Potential Impact Significance	Mitigation Measures	Potential Residual Impact Significance
A22	Use of energy	Reduced air quality	B1, low	D5-098, D5-099, 22-1, 22-02, D23-01, 23-02, 23-03, 2-02, OP147	B1, low
A23	Release of gases, exhausts and vapours to atmosphere	Reduced air quality from construction emissions	B2 Low	22-03, 23-02, 23-03, 7-01, 7-13, 14-10	B2 Low
		Reduced air quality from operational emissions, CSG1	NO_2, Peak: B3: Low NO_2 Annual: B4: High	D5-019, D5-094, D5-097, D5-098, D23-01, 22-01, 22-02, 23-03, 23-02, OP16, OP17, OP18, OP19, OP21, OP10, OP11, OP46, OP12, 14-10, 7-13,	NO_2, Peak: B2: Low NO_2 Annual: B3: Low
		Reduced air quality from operational emissions, CSG2	NO_2, Peak: A2: Low NO_2 Annual: A2: Low		NO_2, Peak: A2: Low NO_2 Annual: A2: Low
		Reduced air quality from operational emissions, PRMS	NO_2, Peak: A2, low NO_2 Annual: A2, Low	D5-099, 22-01, 22-02, 23-02, OP10, OP11, OP12, OP16, OP17, OP18, OP19, OP21, OP46, 14-10, 7-13,	NO_2, Peak: A2, low NO_2 Annual: A2, Low

Issue		Potential Impacts	Potential Impact Significance	Mitigation Measures	Potential Residual Impact Significance
A24	Dust	Reduced air quality	B4 Medium	2-02, 4-09, 24-01, 24-02, 23-06, 23-05, 24-05, 24-06, 24-07, 33-01, 33-18, X8-01, X8-02, OP13, OP23	C1 Low

* Assessed using Tables 3-12/13

Table 10-19: Impact Assessment for Construction Dust Emissions (Construction Phase)

Location	Sensitive Receptor	Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
CSG1	Settlements around CSG1	Reduced air quality	E3, Medium	2-02, 24-01, 24-02, 23-06, 23-05, 24-05, 24-06, 24-07	E1, Low
CSG2	Settlements around CSG2	Reduced short-term air quality	E3, Medium		E1, Low
PRMS	Settlements around the PRMS	Reduced short-term air quality	E3, Medium		E1, Low

* Assessed using Tables 3-12/13

Table 10-20: Impact Assessment for Locations Sensitive to Dust (Construction Phase)

Approx. KP	Locations Particularly Sensitive to Dust	Potential Impact Significance*	Mitigation	Residual Impact Significance*
KP1.8	Building	E3 Medium	X8-01, X8-02	E1 Low
KP3	Military camp	E3 Medium		E1 Low
KP24	Buildings in Akhali Samgori	E3 Medium		E1 Low
KP27.5	Buildings north of route	E3 Medium		E1 Low
KP28.5	Buildings north of route	E3 Medium		E1 Low
KP40	Buildings in Krtsanisi	E4 Medium		E3 Medium
KP42.5	Buildings south of route	E3 Medium		E1 Low
KP45	Kumisi, school, houses north of railway	D3 Medium		D1 Low
CSG2 access road	Buildings in Nardevani	E3 Medium		E1 Low
CSG2 access road	Buildings in Berta/Oliangi	E3 Medium		E1 Low
Rustavi	Buildings	E3 Medium		E1 Low

* Assessed using Tables 3-12 and 3-13

10.8.4 Mitigation of Emissions

The impact avoidance and mitigation measures summarised below will be applied to activities that release atmospheric pollutants and greenhouse gases.

At the design stage

The compressor stations will have four gas compressors mechanically driven by dry low emission (DLE) gas turbines (D5-019) to reduce NO_x emissions. The turbines will be sized appropriately to aim to operate within their low-NO_x operating range for as much of the year as reasonably practical when considering ambient temperature variation and variation in pipeline throughput (D5-097).

A connection to the Georgian national electricity grid will be installed at CSG1 and the PRMS. The grid will initially be used as a back-up power supply and the Project intends to gather reliability information on the electrical connection with the aim of moving to using the electricity grid as the primary source of site power (i.e. for heating and lighting etc) in the future, provided there is no impact on the pipeline operation (D5-098, D5-099). Use of electricity from the Georgian grid will reduce fuel consumption and therefore reduce direct emissions associated with powering the site, as hydroelectric power is the primary source of electricity within the Georgian grid.

Seal gas that leaks from the compressors will be recovered during normal compressor operation (i.e. excluding start-up and shutdown) and returned to the process system (D23-01), which will reduce methane emissions and overall greenhouse gas emissions.

The stand-by generators at the facilities will run on diesel and largely will only be used in an emergency when gas turbine power generators have to be shut down (D5-094).

In the construction phase

Use of energy

The workforce training will include advice on minimising energy consumption (22-02). Example measures will include advice on minimising engine idling time and using equipment of a suitable size for the task. Energy efficiency in the camps will monitored against key performance indicators (KPIs) and measures will be identified and implemented with the aim of continual improvement (22-01).

Ambient air quality monitoring will be carried out prior to construction to establish a baseline on the boundary fence and at receptors in the vicinity of CSG1, CSG2 and PRMS (22-03).

Release of exhaust gases and fugitive emissions

Equipment and vehicles will be regularly maintained in accordance with the manufacturer's recommendations to maximise fuel efficiency and help minimise emissions (23-02). Preferentially the Project will use fuel that has low sulphur content of 0.1%, where practical and available within Georgia (23-03). The applicable air emissions permits will be obtained for combustion equipment prior to the emission commencing (14-10).

Controlled or uncontrolled burning of waste will not be allowed (with the exception of Company-approved incinerators) (7-01).

Dust

Measures that will be adopted to help prevent dust problems from occurring include:

- Contractor will be required to have an adequate supply of bowsers and to regularly damp down ROW, access roads and village roads used by construction traffic during dry conditions (24-01)
- Vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency) (2-02)
- A strict Project speed limit of 30km/hr will be enforced for Project vehicles using unmade tracks and the ROW (24-02)
- Vehicles carrying fine aggregate materials will be sheeted to help prevent dust blow and spillages (23-06)

- Treated waste water will be used for damping down road surfaces to mitigate dust generation (24-07)
- Dust generation and concentrations in the air will be visually monitored during construction where activities are near communities. If dust is visible, additional mitigation measures, such as the imposition of tighter speed limits, will be implemented with the aim of avoiding causing disturbance to residents or land users (23-05)
- Community Liaison Officers will identify any beekeepers whose hives are within 300m of the pipeline and facility construction, camp and pipe storage areas or access routes before the start of the honey production season. These beekeepers will be asked to move their hives (both mobile hives and stationary hives) a suitable distance (at least 300 metres) from the route for the season (24-05). The Company will develop and implement a policy for the compensation of beekeepers adversely affected by Project impacts (24-06).

Particular attention will be paid to the implementation of dust suppression measures:

- Where the ROW passes close to the military camp (KP3), residences in Akhali Samgori (KP24), residences at Krtsanisi (KP40), the dachas and school at Kumisi (KP45) and other buildings (KP1.8, KP27.5, KP28.5, KP42.5) (X8-01)
- Where the CSG2 access road passes close to Nardevani and Berta/Oliangi (X8-02).

In the operational phase

The SCPX Project design has specified the use of dry low-NO_x technology for compressor gas turbine drives. Additional mitigations to reduce the potential impacts on air quality during the operations phase are as follows:

- Dust generated by operational activities is considered a disturbance issue and will be monitored through visual inspection (OP13)
- All off-site dust disturbance complaints will be logged, reported, investigated and actioned as appropriate (OP23)
- All major combustion plant will operate on natural gas where possible (OP16)
- Preventative maintenance programme to minimise fugitive emissions and maintain performance of emission abatement technology will be implemented (OP17)
- An operations phase energy efficiency procedure will be implemented to monitor energy efficiency at the Facilities with the aim of identifying opportunities for improvement (OP147)
- Ongoing training programme for facility personnel will be implemented to include environmental compliance requirements and reporting (OP18).

Should there be any significant changes to the operations of SCPX such as increased throughput, environmental policies and standards shall be considered as an integral part of any engineering assessment this will be achieved through the Management of Change system (OP19).

An air quality monitoring programme encompassing ambient air quality and stack emissions monitoring will be developed and implemented in relation to the Project Environmental Standards. Where monitoring results demonstrate consistent compliance with the Project Standards, the frequency and scope of monitoring will be reviewed and revised if appropriate to include less frequent, boundary fence monitoring (OP21).

The applicable air emissions permits will be obtained for combustion equipment prior to the emission commencing (14-10). Stack emission monitoring of NO_X and CO emissions will be undertaken for major point source emissions (compressor drive turbines, power generation turbines and engines and water bath heaters) and emissions of PM and SO_2 will be determined using accepted calculation methodologies (OP10) – see Table 10-21. Where stack emission monitoring shows values which are consistently within the Project

Environmental Standards the frequency and scope of monitoring will be reviewed and revised if required (OP11).

In addition to the site induction, more detailed emissions management training will be provided for managers and technicians who will be involved in site operations (OP46).

Table 10-21: Proposed Stack Emission Monitoring

	Stack Emissions Testing		Determination (by calculation method)	
	NO_x	CO	PM	SO_2
Compressor turbine drives	6 monthly	6 monthly	6 monthly	6 monthly
Power generation turbines and engines	6 monthly	6 monthly	6 monthly	6 monthly
Water bath heaters	6 monthly	6 monthly	6 monthly	6 monthly

An atmospheric emissions inventory will be prepared and updated annually. The inventory will detail all relevant emission sources including direct and indirect emissions based on monitoring results and estimates based on fuel consumption or other process inputs as required (OP12)

10.8.5 Residual Impacts on Air Quality and Climate

Upon implementation of the above mitigation measures, the residual impacts associated with combustion emissions at CSG1 are assessed to be of low significance. Concentrations of key air pollutants generated as a result of the Project contributing more than 20% of the relevant air quality standard (21%). In combination with background levels, predicted ambient air quality levels are however less than 50% of relevant exposure assessment levels (EALs) designated to protect human health and are also within EAL for the protection of ecosystems (used for benchmarking purposes only).

The residual impact significance of combustion emissions at CSG2 and the PRMS is also expected to be low. Process contributions are less than 20% of the relevant air quality standards and in combination with background levels, resulting ambient concentrations are within 20% of relevant EALs designated to protect human health and are also within EAL for the protection of ecosystems (used for benchmarking purposes only).

In terms of fugitive dust emissions resulting from the Project, the residual impact significance is expected to be low, except at Krtsanisi village, where due to the proximity of the ROW to residences, it is expected to be medium. Particular attention will be paid to the implementation of the proposed mitigation measures at this location.

Overall, the residual impacts on air quality and climate are not considered to result in any detrimental effects on human health, vegetation and ecosystems.

10.9 Noise and Vibration

This section discusses potential impacts due to noise and vibration generation during construction and operation of the SCPX Project and associated mitigation measures to be adopted. Noise is assessed quantitatively based on a comparison of predicted noise levels to baseline noise levels. Vibration is assessed qualitatively based on distances from sources of vibration.

10.9.1 Aspects of the SCPX Project that Could Generate Noise and Vibrations

The following planned Project activities could generate noise and vibrations in the Project area:

Construction

- Logistics and use of access roads by construction vehicles
- Construction camp operations (including generators)
- Use of construction plant on the ROW and the construction sites of the permanent facilities
- Stringing pipe
- Cold pipe bending
- Pipe welding
- Excavation (e.g. pipeline trench on ROW, equipment foundations at facility sites)
- Hydraulic drills at KP56
- Blasting at CSG2 and PRMS
- Piling activities during construction.

Commissioning

- Running pumps and compressors during pipeline hydrotesting and facility testing
- Drying and venting activities during testing and commissioning of the SCPX pipeline.

Operation

- Running gas turbines, compressors, after-coolers and power generation turbines at CSG1 and CSG2
- Pressure reduction skids at the PRMS
- Venting at the facilities.

10.9.2 Sensitive Receptors

Exposure to noise at extremely high levels for a long period of time can harm the hearing of humans and animals. At lower levels noise can be perceived as a nuisance, particularly to people who are not able to move away from the source of the noise and need to communicate (e.g. people in schools) or rest (hospitals, dwellings when people are trying to sleep).

The closest receptors to each facility which would be deemed to be sensitive to relative noise changes as well as absolute noise levels are residential:

- CSG1 – a single settlement 250m and Jandari 1.5km
- CSG2 – 1.8km to the villages of Kizilkilisa and Rekha
- PRMS – the village of Naokhrebi (1.4km) and a few closer isolated houses.

For each site, noise measurements were made at locations representative of residential receptors in different directions from the site (Table 10-22). The assessment of predicted noise uses the following noise indices:

- $L_{Aeq,\ 16\ hours}$ (day) $_{and}$ $L_{Aeq,\ 8\ hours}$ (night) for attributing limits to receptors for the purposes of the construction noise assessment
- $L_{A90,\ 5\ hours}$ for assessing operation during the night-time (as a worst case scenario), except where specified (see tables below).

As discussed in Chapter 7, certain measurement locations were not considered representative of normal occupied conditions at the nearby residences and therefore measurement proxies were used in these cases. The following sections provide a summary of the noise environment at each receptor and the noise levels used to assess against the predicted site noise levels.

Table 10-22: Receptor Baseline Noise Levels

Receptor	Represented by Measurement Location #	Distance to Site (m)	$L_{Aeq,\ T}$ (dBA) (Construction limits in brackets)		$L_{A90,\ T}$ (dBA)	L_{A90} time average notes
			Day	Night		
CSG1						
Farmstead to south (CSG1-N1)	CSG1- N1	250	50	51	44	Average of noise throughout the night
Disused military camp (CSG1-N3)	CSG1- N1	1600	50	51	44	Average of noise throughout the night
Jandari (CSG1-N4)	CSG1-N6	1500	50	47	33	00:00-05:00
Farmstead to south (CSG1-N5)	CSG1-N6	2000	50	47	33	00:00-05:00
Farmstead to south (CSG1-N6)	CSG1-N6	2800	50	47	33	00:00-05:00
Farmstead to north (CSG1-N9)	CSG1-N6	250	50	47	33	00:00-05:00
Farmstead to north (CSG1-N10)	CSG1-N6	1600	50	47	33	00:00-05:00
Nazarlo/Kesalo (CSG1-11)	CSG1-N11	1500	43	44	33	Lowest $L_{A90,\ 5\ hours}$ measured within a 24 hour period
CSG2						
Burnasheti (CSG2-N1)	CSG2-N1	4000	55	48	35	00:00-05:00
Kizilkilisa	CSG2-N1	2300	55	48	35	00:00-05:00
Rekha (CSG1-N3)	CSG2-N1	1800	55	48	35	00:00-05:00
Khando (CSG1-N4)	CSG1-N4	4100	51	42	24	00:00-05:00
PRMS						
Naokhrebi PRMS-N1	PRMS-N1	1400	49	47	35	Lowest $L_{A90,\ 5\ hours}$ measured within a 24 hour period
Vale PRMS-N10	PRMS-N10	1800	52	45	27	Lowest $L_{A90,\ 5\ hours}$ measured within a 24 hour period

10.9.3 Noise and Vibration Impacts

Construction noise

CSG1, CSG2 and PRMS

CSG1, CSG2 and the PRMS are located in, and the pipeline ROW generally passes through, rural areas with very few noise-sensitive receptors, where the background noise is mainly generated by birdsong and insects or agricultural activities. Pipeline and facility construction activities will be louder than the baseline noise sources and will vary according to the equipment being used. Reversing vehicles sound warning signals that are generally louder than the operating equipment. The combination of machinery being used at any one time during the construction process will vary and noise levels will fluctuate accordingly.

This assessment has considered both construction noise from the pipeline and construction noise from the Facilities. Owing to the length of pipeline, noise levels have been predicted for standard pipeline construction activities at set distances. Noise levels for construction activities at the Facilities are based on predicted noise levels from each activity from the centre of the proposed site.

Pipeline

Table 10-23 shows typical noise levels that may be expected at various distances from the pipeline construction.

Table 10-23: Typical Noise Levels Associated with Various Pipeline Construction Activities

L_{Aq} [9](DB) calculated from BS 5228 at varying distances from ROW					
Construction Activities	50m	150m	250m	350m	450m
Initial access and fencing	76	67	62	59	57
Topsoil stripping and site grading	82	72	68	65	63
Earthworks	74	65	60	57	55
Pipe transport and stringing	83	73	69	66	64
Cold pipe bending	73	63	59	56	54
Pipeline welding	79	70	65	62	60
Trench excavation	79	70	65	63	60
Pipe lower and lay and tie-in	75	66	61	58	56
Backfilling	72	62	58	55	52

This suggests that daytime construction noise will be less than 65 dB(A) and will not cause nuisance at a distance of about 400m. At the Kumisi dacha settlement (KP45) there is a school that could be affected by construction noise. The following residential areas could be affected by noise from pipeline construction: the military camp (KP3), Akhali Samgori (KP24), Krtsanisi (KP40), Kumisi dachas and isolated buildings (KP1.8, KP27.5, KP28.5, KP42.5). Noise from construction work on the CSG2 access road could affect parts of Nardevani and Berta/Oliangi. Piling hammering operations at the Algeti River crossing and blasting operations at CSG2 and the PRMS can generate high intermittent noise levels. The closest buildings to the Algeti River crossing are about 1km to the south-east, and the closest community to CSG2 is Rekha about 1km to the north. At this distance, piling and blasting are not likely to cause disturbance.

Construction work will be temporary and discontinuous. In the case of the pipeline loop construction, it will progress along the ROW and will not expose local residents to nuisance noise for extended periods.

At night, generators may be required to run security lighting at the pipeline AGI construction sites, on roads and at river crossings.

[9] L_{Aeq} is the A-weighted continuous equivalent sound pressure level, an average value used to represent fluctuating noise sources, as heard by the human ear.

Construction traffic movements may cause a noticeable increase in daytime noise levels in small rural villages but this effect will be localised and temporary. The effect of noise from the pipeline construction would be considered of low significance.

Construction

Noise levels have been predicted for the construction works expected to take place at the facilities. At night, generators may be required to run security lighting. The plant complement during construction is presented in Table 10-24. To ensure the calculations are worst-case scenarios, it is assumed that all plant is operating simultaneously. In reality, this is unlikely to be the case.

Table 10-24: Typical Noise Levels Associated with Various Facility Construction Activities

Plant	Noise level at 10m (L_{Aeq}- dB) – Taken from BS 5228:2009
40-ton mobile crane	70
20-ton mobile crane	76
20-ton excavator	66
Loading shovel	76
Backhoes	67
Dozer D5/6	86
Bob Cat excavators/shovels	71
Grader	76
14-ton roller compactor	78
50kVa generator	76
30-ton crane	70
20-ton trax crane	76
Trax excavator 20T	78
R. terrain forklift (5 ton)	73
Welding sets (with generators) *	74
Concrete package	82
Generator –100kVa	77
Rotary bored piling rig	83
Crane mounted auger	82
Excavator	66
Water pump	68

* Not in use at PRMS

The resultant noise levels at each receptor for each facility during construction are presented in Table 10-25.

Table 10-25: Predicted Facility Construction Noise Levels

Receptor	Ambient Noise Level (L_{Aeq}- dB)	Construction Noise Limits (L_{Aeq}- dB)	Predicted Noise Level (plant noise combined with baseline noise) during construction (L_{Aeq}- dB)
CSG1			
Farmstead to south (CSGN-1)	50	65	65
Disused military camp (CSGN-3)	50	65	53

Receptor	Ambient Noise Level (L_{Aeq}- dB)	Construction Noise Limits (L_{Aeq}- dB)	Predicted Noise Level (plant noise combined with baseline noise) during construction (L_{Aeq}- dB)
Jandari (CSG1-N4)	50	65	53
Farmstead to south (CSG1-N5)	50	65	52
Farmstead to south (CSG1-N6)	50	65	51
Farmstead to north (CSG1-N9)	50	65	65
Farmstead to north (CSG1-N10)	50	65	53
Nazarlo (CSG1-11)	43	65	50
CSG2			
Burnasheti (CSG2-N1)	55	65	55
Kizilkilisa	55	65	56
Rekha (CSG1-N3)	55	65	56
Khando (CSG1-N4)	51	65	51
PRMS			
Naokhrebi PRMS-N1	49	65	52
Vale PRMS-N10	52	65	53

The results show that the noise effect from each activity would likely be of 'low' significance.

Commissioning noise

Hydrostatic pressure testing of the pipeline loop over a 24-hour period will generate noise levels at the ends of the sections being tested, where pumps are needed to pressurise the pipeline and generators are run to power lighting systems.

Air compressors that are run to dry the pipeline and compressors that are used to test equipment installed at CSG1, CSG2 and the PRMS will also generate noise levels typically about 80 dB(A) at 1 metre. The release of pressure after testing can generate sudden noise at levels over 100 dB(A) at 1 metre for short periods.

The distance attenuation of these noise sources are presented in Table 10-26.

Table 10-26: Commissioning Noise Levels at Difference Distances (ignoring air and ground absorption)

Source	Noise Level $L_{Aeq,15min}$ dB at Distances from Source					
	50m	150m	250m	350m	450m	900m
One diesel pump and one generator	70	60	56	53	50	45
Air compressor during testing	46	36	32	29	27	21
Air compressor release after testing	66	56	52	49	47	41

The closest receptor to the testing of equipment at CSG1, CSG2 and PRMS is the resident in the farmhouse near to the CSG1 security hut to the south-east of the proposed site. This receptor is 500 metres distant from the nearest proposed plant and noise levels would not exceed the night-time criteria for construction at this location.

Operation noise

The SCPX surface facilities will constantly operate equipment that generates noise.

CSG1 and CSG2 will have the following significant noise sources (sound power levels provided):

- Compressors, approximately 115 dB(A)
- Cooling fans, approximately 90 dB(A)
- Gas turbine enclosures, approximately 110 dB(A)
- Gas turbine exhausts, approximately 100 dB(A)
- Compressor suction and discharge lines, approximately 90 dB(A).

Noise from the PRMS will be primarily generated from pressure reduction, approximately 110dB(A) in total.

The noise from these sources will be attenuated with distance from the source. Attenuation can be enhanced by including noise insulation in the design of buildings in which turbines, compressors, engines and pumps are operated. In the case of CSG2, the design of such buildings is primarily intended to protect the process equipment from the winter weather, but it also contributes to the reduction of area in which noise can cause disturbance.

The extent to which the buildings reduce noise depends on the insulation properties included in the design. The type of noise insulation material fitted to suction and discharge pipes and the type of exhaust silencer fitted to exhausts affect the noise that is generated. The 3m-high perimeter walls round the facilities will also contribute to noise reduction. The SCPX Project have modelled noise levels at receptors surrounding CSG1, CSG2 and PRMS using SoundPLAN noise modelling software, incorporating British Standard ISO 9613 prediction methodology. RSK has undertaken a verification process using CadnaA noise modelling software. A comparison of the results from the two different models has been undertaken and the results are in close agreement. The results of the Project modelling are therefore considered reasonable representations of noise levels at receptors as a result of the developments. The predicted noise levels (site noise only) are graphically presented in Figure 10-13 to Figure 10-14. The modelling incorporates British Standard methodology (ISO 9613) for the prediction of noise propagation outside. Noise sources are represented by point (fans, vents), line (pipe work) and areas sources (vents, building walls). Noise propagation to receptor points (representing local residents) is affected by topography, intervening buildings, ground absorption (considered to be appropriate for grassland) and air absorption (using 10 and 70% humidity). The noise model will be updated during the detailed design phase as the engineering design progresses.

The results, displayed in Table 10-27 (rounded to the nearest dB(A)), show that for each facility noise levels are predicted to be under 42 dB(A) and not more than 3 dB above the background noise level at all receptors. These noise levels are within the Project criteria outlined in Table 6-8. These noise levels would be considered of ‘low’ significance.

Planned maintenance venting of gas to atmosphere will be required occasionally. It is predicted that for each site, the L_{Amax} of maintenance venting will exceed 60 dB(A), ranging from 61.2 dB(A) at CSG2-N2, 83.0 dB(A) at CSG1-N1 to 88.6 dB(A) at PRMS-N10. These noise levels, without mitigation, would be considered of ‘medium’ to ‘large’ significance.

During emergency situations and maintenance depressurisation, gas within the Facilities will need to be rapidly vented to atmosphere for safety reasons. The noise level predicted from emergency events is discussed in Chapter 12.

Table 10-27: Predicted Operation Noise Levels at Receptors

Receptor	Receptor Description	Approx. Distance to Site Centre (m)	Coordinates (GK8)		Site Noise Only dB(A)	Back-ground dB(A)	Total Noise dB(A)
			Easting	Northing			
CSG1							
CSG1-N1	Farmhouse	750	8512436	4588986	41	44	46
CSG1-N3	Demolished Military Base	1000	8512802	4589781	37	44	45
CSG1-N4	Jandari Village	2100	8513706	4590470	31	33	35
CSG1-N5	Farmhouse	1750	8513327	4588475	33	33	36
CSG1-N6	Farmhouse	1850	8513010	4587967	32	33	36
CSG1-N9	Farmhouse	2150	8511820	4591624	30	33	35
CSG1-N10	Farmhouse	2150	8510976	4591401	30	33	35
CSG1-N11	Nazarlo Village	2300	8510160	4587905	30	33	35
CSG2							
CSG2-N1	Burnasheti Village	3950	8402837	4611016	21	35	35
CSG2-N3	Rekha Village	2450	8405227	4616566	29	35	36
CSG2-N4	Khando Village	4400	8401097	4618233	20	24	26
CSG2-N1	Burnasheti Village	3950	8402837	4611016	21	35	35
PRMS							
PRMS-N1	Naokhrebi Village	1450	8320906	4609747	28	35	36
PRMS-N10	House	1950	8321369	4610349	25	27	29

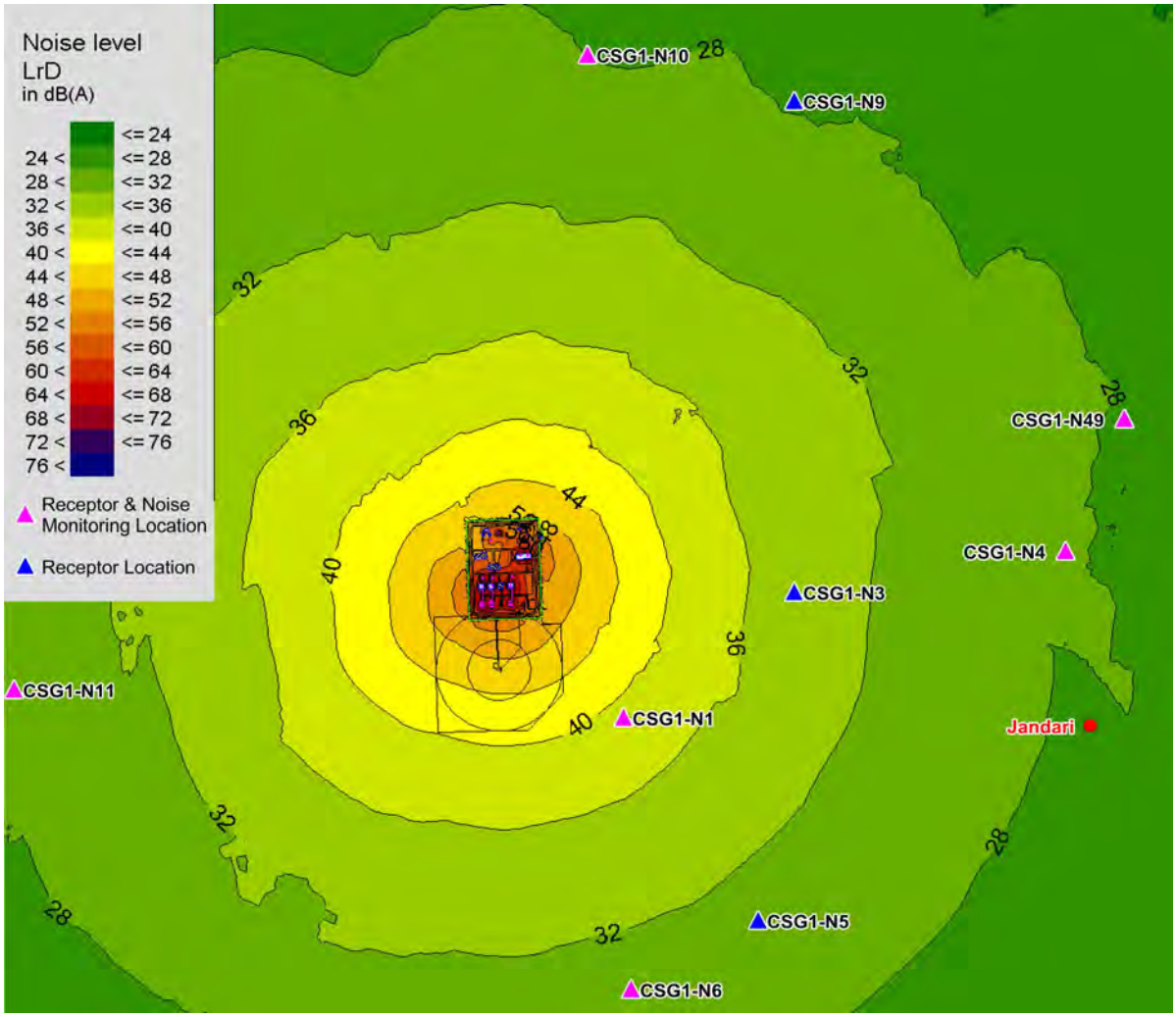

Figure 10-13: Noise Modelling for CSG1

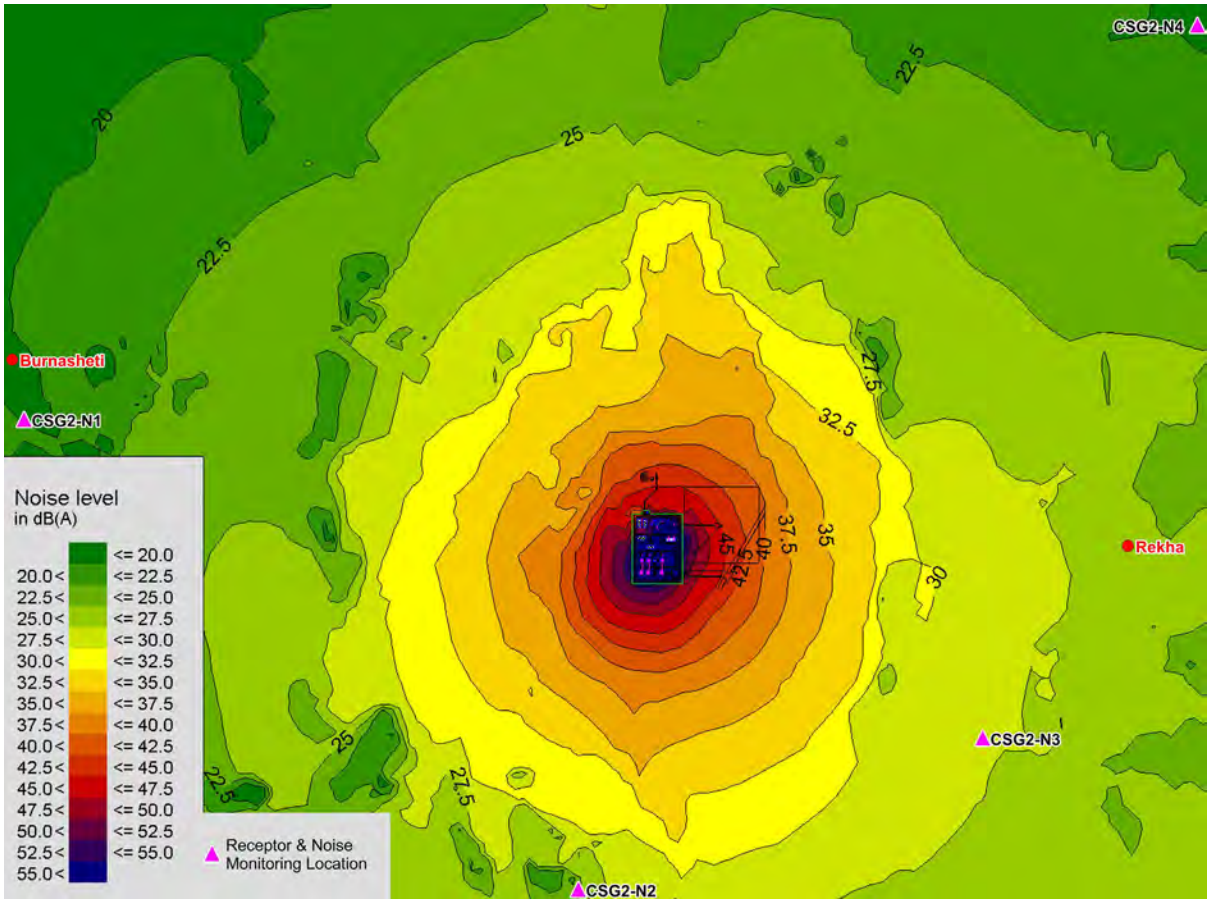

Figure 10-14: Noise Modelling for CSG2

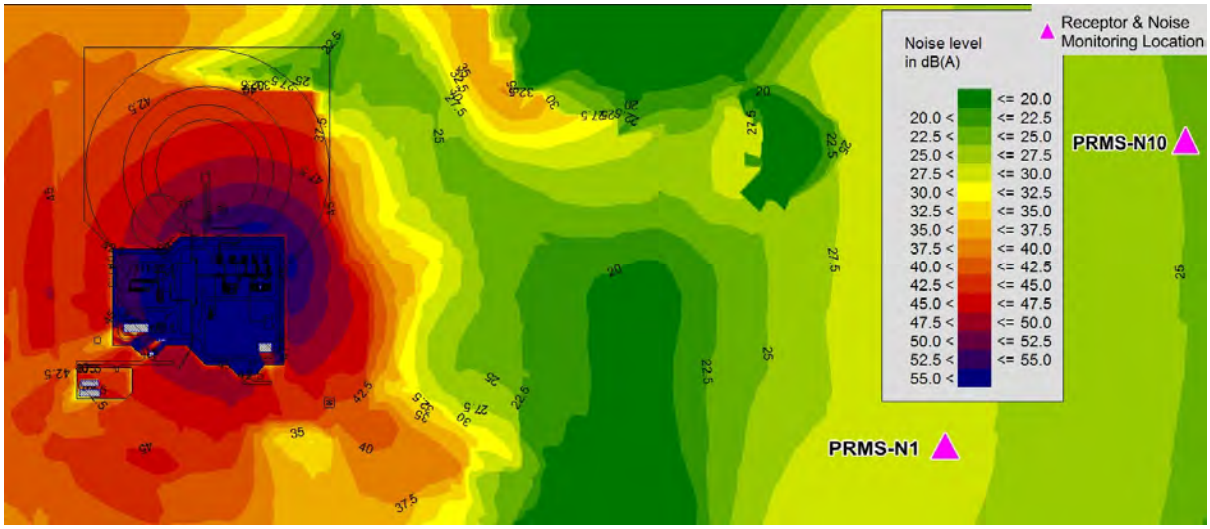

Figure 10-15: Noise Modelling for PRMS

Construction vibration

Humans generally become aware of vibration at levels of around 1.5mms^{-1}, although under some circumstances this can be as low as 0.5mms^{-1}. Nocturnal animals that rely on noise and vibration in order to locate prey are far more sensitive to vibration than human senses.

Bulldozers and rollers typically generate less than 2mms^{-1} at 5m and compactors less than 0.3mms^{-1} at 30m. Pile driving typically generates less than 3mms^{-1} at 50m. Unless buildings

are very close to construction operations, they are unlikely to be damaged by vibrations from the construction plant.

The CSG2 access road passes close to the village of Oliangi (Berta), where there is a monastery and some houses that are considered to be in very poor condition and could be prone to further damage due to vibration from construction activities and construction traffic.

Vibration caused by construction traffic is rarely high enough to be the direct cause of cracks in walls and ceilings, separation of masonry blocks, and cracks in foundations. Such cracks may be the result of soil settlement due to compaction rather than vibration (Hunaidi, O., 2000). The threshold vibration level needed to damage a building is not clear, though the US Office of Surface Mining considers that vibration of less than 38mms^{-1} will not damage structures. In some cases, when a building is subjected to vibration for many years, repeated vibration causes fatigue damage. In other cases vibration can contribute to deterioration of buildings that are already damaged by soil settlement, moisture, temperature cycles or poor maintenance. If construction traffic adds to these problems, it could trigger damage and complaints from house owners.

The condition of the road surface near a building has a very significant effect on the levels of vibration. AES Engineering Solutions (website 2012) notes that vehicles on a smooth road surface create much lower levels of vibration (typically <0.2mms^{-1} at 20m) than do heavy vehicles travelling fast on roads with a rough surface of badly filled potholes or service trenches (typically <2mms^{-1}).

The effect of vibration would be considered of 'medium' significance owing to the proximity of sensitive receptors.

Impact summary and assessment of significance

Table 10-28 provides an assessment of the significance of impacts from noise before and after implementation of the proposed mitigation measures that are discussed in the following section.

Table 10-28: Impact Assessment Summary for Noise and Vibration

Issue		Potential Impacts	Potential Impact Significance	Mitigation Measures	Potential Residual Impact Significance
A25	Construction Noise	Disturbance causing nuisance and loss of concentration for shift workers and school children	D2 Medium (but under a month)	23-02, 25-01, 25-02, 25-03, 25-04, 25-05, 25-07, 33-01, 25-08, 25-09, 25-10, X9-01, X9-02, 33-18	D1 Low
	Operation Noise (continuous)	Disturbance causing nuisance and loss of concentration for shift workers and school children	C1 Low	D5-038, D5-039, D5-040, D5-041, D5-042, 25-02, 25-11, OP148, OP14, OP18, OP50, OP125, OP15, 33-18	C1Low
	Operation Noise (maintenance)	Disturbance causing nuisance and loss of concentration for shift workers and school children	C3 Medium – C5 High	OP137, OP138	C2 Low
A26	Construction Vibration	Damage to buildings (particularly those close to access roads already in state of disrepair)	C3 Medium	25-13, 25-14, 25-15, 25-16, 24-02, 37-08, 37-20	C2 Low

Assessed using Tables 3-12 and 3-13

Table 10-29: Construction Noise Impact Assessment at Sensitive Locations

Location	Issue	Potential Impacts	Potential Impact Significance*	Receptor-Specific Mitigation	Residual Impact Significance*
Military camp (KP3)	Noise	Disturbance causing nuisance and loss of concentration for shift workers and school children	C2 Low	X9-01, 23-02, 25-01	C1 Low
Akhali Samgori (KP24)	Noise		C2 Low		C1 Low
Krtsanisi (KP40)	Noise		C5 High		C4 Medium
Kumisi (School) (KP45)	Noise		D2 Medium		D1 Low
KP1.8	Noise		C2 Low		C1 Low
KP27.5	Noise		C2 Low		C1 Low
KP28.5	Noise		C2 Low		C1 Low
KP42.5	Noise		C2 Low		C1 Low
Rustavi	Noise		C2 Low		C1 Low
Oliangi	Noise		C2 Low	X9-02	C1 Low
Nardevani	Noise		C2 Low		C1 Low
Poladaantkari (Pipeline Camp)	Noise	Noise disturbance to houses closest to the camp (*c.*200m)	C2 Low	X9-03	C1 Low

* Assessed using Tables 3-14 and 3-1

Table 10-30: Operations Noise Impact Assessment at Sensitive Locations

Location	Issue	Potential Impact Significance*	Mitigation	Residual Impact Significance*
Jandari	Noise	C1 Low	OP14, OP15, 33-18, OP50, OP48, 25-11, OP138	C1 Low
Nazarlo	Noise	C1 Low		C1 Low
CSG1 Farmsteads	Noise	C1 Low		C1 Low
Rekha	Noise	C1 Low		C1 Low
Avranlo	Noise	C1 Low		C1 Low
Kizilkilisa	Noise	C1 Low		C1 Low
Burnasheti	Noise	C1 Low		C1 Low
PRMS Farmsteads	Noise	C1 Low		C1 Low
Naokhrebi	Noise	C1 Low		C1 Low
Vale	Noise	C1 Low		C1 Low

* Assessed using Table 3-14 and 3-15

Table 10-31: Vibration Impact Assessment at Sensitive Locations

Location	Issue	Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
CSG2 Access Road	Vibration	Damage to old buildings	C3 Medium	25-13, 25-16, 24-02, 37-08	C2 Low
KP40 (Krtsanisi)	Vibration	Damage to buildings	C3 Medium		C2 Low

10.9.4 Mitigation of Noise and Vibration Impacts

The impact avoidance and mitigation measures summarised below will be applied to activities that could generate noise disturbance.

At the design stage

Initial designs of CSG1 and CSG2 have included measures that are designed to have the effect of reducing noise. Sometimes the noise reduction is incidental to their main purpose (e.g. perimeter walls or building cladding at CSG2 that is required to protect equipment from winter conditions), and in other cases it is included specifically to reduce noise (e.g. pipework cladding and exhaust silencers) to ensure the Project standards are met.

At CSG2 the buildings housing the gas turbine and compressor units will typically be fabricated with 150mm-thick sandwich panels to control noise transmission (D5-038). Additionally, a moderate amount of absorption is included within the building itself.

At CSG1 the buildings housing the gas turbine and compressor units will utilise high-performance acoustic louvres to allow for natural ventilation and retain a high-performance acoustic design for the cladding (D5-039). High performance silencers for each of the compression and power generation gas turbine exhaust stacks will reduce noise power levels from 115dB(A) to 100dB(A) (D5-040). Silencers will also be included in the combustion and ventilation air inlet system to control noise power level emissions (D5-041). High performance acoustic insulation will be installed on the compressed gas pipework and the design for compressor after-cooler fans will also achieve reduced noise power level emissions (D5-042).

In the construction phase

Noise

Some noise impact on the surrounding environment and any nearby residents is inevitable during any construction operation. In order to avoid significant disturbance from noise emissions, the following mitigation measures will be adopted:

- Equipment and vehicles will be regularly maintained in accordance with the manufacturer's recommendations to help minimise emissions (23-02)
- During construction work will generally be undertaken in daylight hours (excluding specified operations). Where people live in close proximity to the works, or there is a high potential for disturbance (e.g. blasting), a location-specific risk assessment will be undertaken for activities undertaken between 7pm and 7am (25-01)
- Driver training will include advice on behaviours to reduce the potential for disturbance, including use of horn, loud radios with windows open, switching engines off when not in use, strictly observing speed limits and not accelerating or braking aggressively (25-02)
- Project induction training will include instructions about minimising noise disturbance (25-03)
- Local residents will be forewarned of planned activities that are considered by the Project to be noisy (e.g. blasting, pile driving and release of test pressure) (25-04)

- Noise will be monitored periodically against the Project Environmental Standards (25-05)
- Camp rules will be developed and implemented and will include restrictions on noisy activities (e.g. inappropriate use of personal radios) to help avoid causing disturbance (25-07)
- The Contractor will be required to develop and implement a Grievance Procedure to provide opportunity for local residents to raise concerns (33-01)
- The Project will avoid vehicle reversing where practical, and will preferentially use white noise[10] type reversing alarms (25-08)
- Community Liaison Officers may assist in raising community awareness about emissions-related issues and ensuring emissions-related complaints are followed up and responses provided (33-18)
- Site layout will be designed, where practical and feasible, to locate noisy plant in areas further away from houses at the pipeline camp where a risk assessment shows that there may be significant noise impacts on sensitive receptors (X9-03).

During construction of the pipeline and facilities and operation of the construction camp and pipe storage areas where the works are less than 400m from residential buildings for longer than one month, periodic noise monitoring readings of 10 minutes duration (in accordance with the Project procedure) will be measured at the building facade at the start of the potentially noisy activities. If the noise exceeds Project Standards, measures will be implemented to aim to reduce noise levels (e.g. hoardings) (25-09). Appropriate measures could be mitigation such as screening, location or orientation of equipment (such as generators), substitution or maintenance and time constraints. This will be applied particularly:

- At the military camp (KP3), residences in Akhali Samgori (KP24), residences in Rustavi (KP32) and residences at Krtsanisi (KP40) which are in the vicinity of construction, the dachas and school at Kumisi (KP45) and other buildings (KP1.8, KP27.5, KP28.5, KP42.5) (X9-01)
- Where the CSG2 access road passes close to Nardevani and Berta/Oliangi (X9-02)
- Construction camps and lay-down areas.

During construction of CSG1, CSG2 and the PRMS, the local community will be informed of when and where noisy activities (e.g. blasting, piling) will occur (25-10).

During commissioning and testing:

- During commissioning and testing noise emissions from equipment will be minimised through use of acoustic insulation as deemed appropriate by the Project (25-11)
- During early operations, 10-minute readings will be taken at the nearest noise sensitive receptors to CSG1, CSG2 and the PRMS to confirm that the site will meet the appropriate Project Environmental Standards (OP148).

Vibration

Vibration sensitive locations will be determined by the Contractor and listed in their relevant Pollution Prevention Implementation Plan, together with details for monitoring vibration before and during movement of heavy equipment. Further actions will depend on the outcome of vibration monitoring (25-13).

Prior to selection, all access routes will be subject to a multidisciplinary assessment (37-20). A survey will be undertaken to record the external condition of buildings in close proximity to

[10] A random signal (or process) with a flat power spectral density

the ROW or access roads prior to construction; this will provide baseline evidence in the event of claims for damage (25-14). The validity of any damage claims will be assessed; repairs will be undertaken or appropriate compensation paid if damage is associated with construction vehicle movements (25-15).

To minimise vibration, the Contractor will be required to implement the following:

- Correct tyre pressures will be monitored and maintained (25-16)
- A strict Project speed limit of 30km/hr will be enforced for Project vehicles using unmade tracks and the ROW (24-02)
- Surface of frequently used access roads will be subject to regular inspections and repair, with the aim of ensuring they are maintained in a good condition to reduce the potential for vibration, particularly where fragile buildings are close to roads (subject to site specific survey) (37-08).

In the operational phase

Noise monitoring will be carried out every six months at the sensitive receptors around CSG1, CSG2 and the PRMS to verify the modelling results and demonstrate that the Project Standards are met. When it has been established that the Project standards are being met, the frequency of monitoring will be reviewed and reduced (OP14). Free-field (i.e. 3.5 metres away from the façade of the building) noise measurements will be undertaken at identified receptors near the Facilities by a trained, competent person using a calibrated sound level meter in accordance with the international standard ISO 1996 Description and Measurement of Environmental Noise (OP48). An ongoing training programme for facility personnel will be implemented to include environmental compliance requirements and reporting (OP18).

Maintenance venting of large inventories of gas at CSG1, CSG2 and the PRMS, with a flow rate likely to generate an L_{Amax} noise level which would exceed the Project Standards, will not be undertaken between 23:00 and 07:00 (OP137). Local communities will be notified in advance of any maintenance work at CSG1, CSG2, PRMS expected to generate any exceptionally high noise levels (OP138).

A preventative maintenance programme will be implemented that is designed to ensure that all plant and equipment operate in accordance to with Project standards (OP50).

The relevant authorities will be informed in the case of planned or actual third-party development within the relevant pipeline and facility protection zones (OP125). This will include an assessment of the predicted noise levels at that location.

Driver training will include advice on behaviours to reduce the potential for disturbance, including use of horn, loud radios with windows open, switching engines off when not in use, strictly observing speed limits and not accelerating or braking aggressively (25-02).

The Project will monitor the occurrence of noise complaints to determine whether there is a specific link with noisy activity and determine whether further action is required (OP15). Community Liaison Officers may assist in raising community awareness about emissions-related issues and ensuring emissions-related complaints are followed up and responses provided (33-18).

10.9.5 Residual Impacts from Noise and Vibration

The effects of operational noise on communities located in the vicinity of the SCPX facilities is not expected to be significant owing to the distance between the facility and the nearest occupational area; initial siting of the facility complexes; topographical features of the location; plant design and equipment selection; local treatment such as use of acoustic insulation; and incorporation of sound-attenuating enclosures in the facility design.

When the proposed mitigation measures are implemented, the residual impacts from construction noise will at most cause discontinuous, temporary changes to the noise levels

experienced by residents, mainly in isolated houses, and will be of low significance, except at Krtsanisi village, where due to the proximity of the ROW to residences, it is expected to be medium. Particular attention will be paid to the implementation of the proposed mitigation measures at this location.

Noise emissions from operations at the facilities are considered to be low.

Noise emissions from commissioning and testing will be of short duration and the people who are most likely to be affected will be notified in advance and are of low significance.

Implementation of the proposed mitigation measures will help reduce the risk and severity of building damage from vibration during construction. The residual impact is considered to be of low significance.

10.10 Cultural Heritage

This section discusses potential impacts on cultural heritage sites during construction of the SCPX Project and associated mitigation measures to be adopted.

10.10.1 Aspects of SCPX Project that Could Affect Cultural Heritage

The following planned Project activities could affect cultural heritage in the Project area:

- The removal of topsoil and subsoil during preparation of the ROW, ROW access roads, construction camps, equipment lay-down and pipe yard areas, and the facility sites
- Construction and grading of the CSG2 access road
- Trench excavation in the ROW
- Excavation of foundations at the facility sites
- Movement of heavy vehicles and equipment.

Small-scale maintenance activities which can be expected during operation of the completed SCPX Project have the potential to have minor effects on cultural heritage, however these are expected to be generally undertaken within Project areas where the ground has been previously affected during construction.

10.10.2 Key Sensitivities

Georgia's long and complex history and pre-history of human occupation is reflected in the number of its archaeological sites. A major concern is that construction activities could damage sites with significant cultural heritage structures or artefacts before they have been studied and understood and before their importance has been assessed. Disturbance may move or damage fragile objects or makes the context of the remains difficult to interpret. Deposits may be deeply buried and not identified until their presence is revealed by construction work. Some features that may be of human origin have been identified during the baseline surveys.

Part of the pipeline route crosses an area where little information is known and the BTC and SCP pipeline monitoring revealed little additional information. Other parts of the Project are located in Tsalka region where there is a very high density of known information and a high potential for the discovery of additional features as was demonstrated in the BTC and SCP Projects. It is thus a high potential that new discoveries may be found during earthmoving operations as part of the Project.

Specific sensitivities identified during baseline surveys and further described in Chapter 7 are:

- Pipeline - three locations (CH06-CH08) with potential archaeological deposits at KP53-55
- CSG1 – despite visible features the region is still considered to have the potential for archaeological features
- CSG2 – A number of stony mounds which are considered to be potential cultural heritage features (CH54 – CH66)
- CSG2 access road and construction camp - A number of potential archaeological sites and features have been identified along the access road route and one feature (CH276) at the access road construction camp.

10.10.3 Impacts on Cultural Heritage

In many cases, detailed information on archaeological features only becomes available during the construction phase of a project because of the intrusive nature of the process. Therefore, the accurate assignment of consequence/severity prior to the construction phase is often not possible and relies on a preliminary assessment based on known information.

Construction

Activities associated with the construction of a pipeline and facilities may affect the archaeological record by physically damaging part or all of an archaeological site or historic monument. These features may be known prior to construction of the Project or be discoveries of previously unsuspected sites. Although evidence is physically lost, if the site is properly excavated and recorded, the information obtained can be studied by future generations and will add to the general understanding of the history of the area. Any archaeological programme associated with large-scale development can create an increase in knowledge both in previously explored areas and in locations where archaeological surveys have not previously been conducted. The observations of a project can create a link between archaeological sites and the landscape and environment it crosses.

Table 10-32 and Table 10-33 determine the significance of the impact by taking into account the protected status, level of preservation of remains and the potential for destruction of archaeological deposits. The cultural heritage assessment is based upon IFC Performance Standard 8 and uses the criteria from the UK Highway Agency Design Manual for Roads and Bridges Part 2 HA 208/07 Cultural Heritage. This last document is taken as the model from which the majority of assessments in the UK and Western Europe are performed.

Table 10-32: Potential Impacts on Cultural Heritage – Generic

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A27	Disturbance of archaeological remains	Loss/disturbance of known archaeology	C4 Medium	27-01, 27-02, 27-04, 27-10	A1 Low
A27	Disturbance of archaeological remains	Loss/disturbance of previously unknown archaeology during construction	C4 Medium	27-03, 27-05, 27-06, 27-07, 27-08, 27-09, 27-10, 27-11, 27-13, 19-05	C2 Low
A27	Disturbance of archaeological remains	Disturbance of archaeological remains during maintenance carried out in the operations phase	C4 Medium	OP139	C1 Low

* Assessed using Tables 3-17/18

Table 10-33: Potential Impacts on Cultural Heritage at Specific Locations

Location	Sensitive Cultural Heritage	Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
KP53 (CH6)	During SCP trenching, anomalies of indeterminate origin were noted in the trench profile	Construction may have an adverse effect on artefacts in the immediate vicinity	A2 Low	27-02, 27-06	A1 Low
KP54 (CH7)	During BTC ROW construction, Medieval period structural remains were found and excavated. Site boundaries are unconfirmed; it may extend into the SCPX ROW	Construction may have an adverse effect on artefacts in the immediate vicinity	C2 Low	D27-03, X10-01	A1 Low
KP55 (CH7–8)	BTC construction resulted in the identification of scattered artefacts and features within and exterior to the ROW. Some of these may lie within the SCPX ROW	Construction may have an adverse effect on artefacts in the immediate vicinity	C2 Low	X10-01	A1 Low
CSG2 (CH54–CH66)	These sites all relate to elevations with high concentrations stones. They are thought to be potential burial mounds	Construction may have an adverse effect on artefacts in the immediate vicinity	C2 Low	D27-01, X10-13	A1 Low
CSG2 access road (CH16–38)	These sites all relate to elevations with high concentrations stones. They are thought to be potential burial mounds	Construction may have an adverse effect on artefacts in the immediate vicinity	C2 Low	D27-02, X10-10, X10-12	A1 Low
CSG2 access road (many – Refer to Section 7.10.4)	Potential and probable Kurgans	Construction may have an adverse effect on artefacts in the immediate vicinity	C2 Low	D27-02, D27-04, X10-02, X10-04, X10-05, X10-14	A1 Low
CSG2 access road (CH15)	Obsidian flake scatter	Construction may have an adverse effect on artefacts in the immediate vicinity	C2 Low	D27-02	A1 Low
CSG2 access road (CH60)	60m-long section of well-preserved historical road to Berta, within the course of the route of the road (CH71)	Construction may have an adverse effect on artefacts in the immediate vicinity	C2 Low	X10-02, X10-07	A1 Low
CSG2 access road (CH67)	Well-preserved historical road to Kuschi	Construction may have an adverse effect on artefacts in the immediate vicinity	C2 Low	X10-06, X10-07	A1 Low

Location	Sensitive Cultural Heritage	Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
CSG2 access road (CH71)	Route of historical road (including CH60 well-preserved portion). The bulk of this route contains no surviving original features	Construction may have an adverse effect on artefacts in the immediate vicinity	C2 Low	X10-06, X10-07	A1 Low
CSG2 access road (CH41)	Perimeter of the Bronze Age settlement west of Ozni	Construction may have an adverse effect on artefacts in the immediate vicinity	C2 Low	X10-08, X10-09	A1 Low
CSG2 access road Berta (CH72)	Berta Monastery, historic site located in Berta Village	Use of road through village adjacent to site may cause damage by vibration and impact possible below ground features	B3 Medium	X10-11	A1 Low
CSG2 access road (CH275)	Segment of historical road south of CSG2	Construction may have an adverse effect on artefacts in the immediate vicinity	C2 Low	X10-06, X10-07	A1 Low
CSG2 access road camp (CH276)	Wall remnant found in association with Mesolithic period artefacts	Construction may have an adverse effect on artefacts in the immediate vicinity	C2 Low	D27-05, X10-04, X10-05	A1 Low

* Assessed using Tables 3-17/18

10.10.4 Mitigation

At the design stage

The CSG2 access road has been routed to avoid the majority of known cultural heritage features including:

- Nardevani Settlement
- A number of small stony mounds that could potentially be archaeological features and several probable Bronze Age burial mounds (D27-02)

  The features avoided include CH09, CH14, CH40, CH11–CH13, CH15–CH29, CH31–CH38, CH73–CH75, CH93, CH95, CH120, CH123, CH145, CH158, CH161–CH163, CH198, CH204–CH206, CH208, CH213, CH214, CH216, CH222, CH223, CH226, CH227, CH229 CH248, CH252–CH255, CH260, CH263, CH264, CH266–CH268, CH274, CH278–CH280 and CH292) which are described in Section 7.10.4
- Portions of the CSG2 access road drainage and embankments have been specially designed to protect and preserve in place possible archaeological features (D27-04). This has included CH94, CH124 and CH125 and probable Bronze Age burial mounds CH167, CH210, and CH273
- The CSG2 access road alignment has been routed to avoid all known archaeological sites except CH71, CH97, CH127, CH157, CH219, CH228, CH246, CH256-CH259, CH261 and CH265. These features will be subject to Phase 2 archaeological evaluations, and a recording and preservation programme if appropriate (X10-02)

- The CSG2 access road camp will be designed with the aim of protecting CH276. If this is not practical, phase 2 archaeological evaluation will be carried out before construction work commences. If the results of the evaluation recommend further excavation work, a scope for Phase 3 excavation will be agreed with the Ministry of Culture (D27-05).

Pre-construction phase

The following potential cultural heritage sites identified by surveys of Project-related sites will be excavated before Project construction begins:

- The stony mounds at the CSG2 site (CH54-58) (D27-01)
- Potential archaeological sites within the CSG2 Access Road footprint that cannot be avoided (CH97, CH127, CH157, CH219, CH228, CH246, CH256–CH259, CH261, CH265) (X10-14)
- There are areas of potential archaeology at KP55 (CH7) and KP56 (CH8), which will be examined in a programme of Phase 2 trial trenching if crossed by the SCPX ROW (X10-01).

Modern cultural resource management practice seeks to preserve archaeological deposits in situ. Preservation of cultural heritage remains allows future generations an opportunity to examine archaeological sites and monuments with more resources and better techniques to recover greater quantities of information about past societies. Where this is not practical, excavation is carried out to record observations, evidence and finds made by the excavator at the excavated site.

A Cultural Heritage Management Plan will be implemented that includes the five-phase strategy for the progressive assessment and mitigation of the effects of construction (27-01), which is presented in Table 10-34. Areas of potential cultural heritage impact will be examined and any necessary excavations conducted prior to construction (27-02). Archaeological sites identified during construction will be archaeologically recorded (27-03).

Issues relating to archaeological awareness (such as ownership of finds, notification of finds and protection of archaeological sites) will be included in induction training (27-11). No hunting, fishing or unauthorised gathering of products (including plants and cultural heritage artefacts) by the workforce will be allowed (19-05).

Table 10-34: Summary of the 5-Stage Cultural Heritage Management Strategy

Phase 1	Baseline surveys including desktop studies, walk-through surveys and examination of aerial photographs leading to the development of a Cultural Heritage Management Plan
Phase 2	Intrusive work: trial pits and preliminary investigation of potentially significant sites
Phase 3	Full investigation of major confirmed sites
Phase 4	Activities during construction: watching brief and excavation of newly discovered sites
Phase 5	Post-construction work: analysis of finds, archiving and reporting, dissemination of the results

The pre-construction works to evaluate and record known archaeological sites will be agreed with the Ministry of Culture and Monument Protection (27-04).

Pipeline

The SCPX ROW generally follows the route of the existing BTC and SCP routes. Consequently, there is good information on the potential for archaeological sites in this area. There are areas of potential archaeology at KP55 (CH7) and KP56 (CH8), which will be examined in a programme of Phase 2 trial trenching if crossed by the SCPX ROW (X10-01).

CSG2 access road
The CSG2 access road alignment has been routed to avoid all known archaeological sites except CH71, CH97, CH127, CH157, CH219, CH228, CH246, CH256–CH259, CH261, and CH265. These features will be subject to Phase 2 archaeological evaluations, and a recording and preservation programme if appropriate (X10-02).

CSG2
Phase 2 archaeological evaluation of nine potential features identified in the area of CSG2 (CH54, CH55, CH56, CH58) will be carried out before construction work commences. If the results of the evaluation recommend further excavation work, a scope for Phase 3 excavation will be agreed with the Ministry of Culture (X10-03).

Construction phase

General
Despite undertaking baseline surveys and trial excavations throughout the area of Project impact, the possibility of unearthing archaeological artefacts during topsoil stripping or trenching cannot be precluded. Therefore, a programme of archaeological surveillance (watching brief) will be implemented during:

- Topsoil stripping of the ROW, the facility sites, construction camps, equipment lay-down areas and ancillary areas
- ROW trenching.

The Company will be empowered to temporarily stop works, pending archaeological examination, if artefacts are seen (27-05).

Known archaeological sites within 50m of the pipe centreline or other construction activity will be demarcated throughout construction (27-10). Any ripping or other ground disturbance activities required during reinstatement will be planned to avoid archaeological evidence that has been preserved in-situ (27-13).

CSG2 access road
The width of the access road construction corridor will be evaluated during detailed design with the aim of narrowing to avoid three of the mounds near Burnasheti (CH16, CH19 and CH27). If these sites cannot be avoided, they will be subject to a Phase 2 evaluation (X10-12).

Known and potential archaeological sites within 50m of the CSG2 access road will be marked for avoidance before construction begins (27-10). This includes CH9 (Nardevani Settlement remains), CH67 (megalithic stones) and probable burial mounds CH10, CH30, CH161–CH167, CH208, CH215, CH270, CH273 and CH274 (X10-04). At CH16-38 the boundary of the sites will be marked out by the Cultural Heritage Monitor before construction of the CSG2 access road begins (X10-10).

During topsoil stripping, areas of the CSG2 access road which are adjacent to visible cultural heritage features and in the vicinity of CH276 at the access road construction camp will be monitored for any sites of archaeological features. If they are identified, work will be suspended while an archaeological investigation takes place (X10-05).

At CH71 and CH275 where the CSG2 access road crosses the historical road, the existing road surface will be protected by laying a layer of geotextile membrane over which the road surface will be built up (X10-06). All aspects of the historical road in the vicinity of the Project will be recorded prior to and during access road construction (X10-07).

At CH41 a small portion of the toe of an embankment of the road will lay across a part of the area identified as being part of the Bronze Age settlement west of Ozni. Possible cultural heritage features have been identified in this part of the site. Phase 2 work will be undertaken prior to construction to assess the features and identify the need for any necessary mitigation measures required (X10-08). A re-route of the access road was

considered, but it was not possible owing to topographical constraints. The archaeological watching brief will be maintained at CH41 during CSG2 access road construction that will enable any elements in this area to be excavated and recorded (X10-09).

Traffic movements will be managed during the Construction of the CSG2 Access Road with the aim of minimising heavy vehicle movements past the monastery in Berta (CH72) and reducing light vehicle movements to necessary journeys as far as practical (X10-11). Six potential features identified in the vicinity of CSG2 (CH03, CH59, 62, 64, 65 and 66) will be avoided during construction work and will be demarcated with protective fencing before construction starts (X10-13).

CSG2 access road temporary construction camp
At CH9 (Nardevani Settlement remains), CH67 (megalithic stones), and probable burial mounds CH10, CH30, CH161-CH167, CH208, CH215, CH270, CH273, CH274 and CH276 (Access Road construction camp) the boundary of the sites will be marked out by the Cultural Heritage Monitor before construction begins (X10-04). During topsoil stripping, areas of the CSG2 access road which are adjacent to visible cultural heritage features and in the vicinity of CH276 at the access road construction camp will be monitored for any sites of archaeological features. If they are identified, work will be suspended while an archaeological investigation takes place (X10-05).

General
If archaeological artefacts or structures are found, archaeological advice will be sought from relevant approved Georgian heritage institutions and the Ministry of Culture and Monument Protection and the Chance Finds Procedure followed (27-06) in accordance with the Cultural Heritage Management Plan (see Appendix D). The archaeologist conducting the watching brief will advise on procedures to be followed by the construction supervisor in line with the Chance Finds Procedure (27-07). The Company will consider making minor adjustments to the route of the pipeline where this will avoid damage to a cultural heritage feature that is discovered during construction operations (27-08). If the pipeline route cannot easily be adjusted to avoid damaging the feature, construction activities will be suspended at the site until the excavation and recording required by the authorities has been carried out (27-09).

In the operation phase

Activities involving topsoil stripping and excavation during operation, which are undertaken outside of areas previously disturbed during Project construction, will be subject to a cultural heritage assessment to determine appropriate mitigation measures before the work begins (OP139).

10.10.5 Residual Impacts

The SCPX Project has already added new information to the archaeological record of the area during the Phase 1 activities and will continue to do so during the remainder of the archaeological programme of work before construction (Phases 2 and 3) and during monitoring of construction activities (Phase 4). This is expected to bring positive benefits, increasing the understanding and awareness of the history and development of the territory of Georgia. A further benefit for the area will be the number of people employed on archaeological excavation and research.

Through implementation of the mitigation measures, the negative impact on the archaeological resource of Georgia will be reduced to low significance and the positive benefits will be maximised to the greatest extent practical.

Sensitive areas where unavoidable impacts will occur will be fully recorded and published in academic journals. In this way, the information can be made available for the people of Georgia and other nations, which will be beneficial.

10.11 Demographics

This section discusses potential impacts on demographics during construction and operation of the SCPX Project and associated mitigation measures to be adopted.

10.11.1 Aspects of SCPX Project that Could Affect Demographics

Opportunities such as increased job availability and creation of a larger and more diverse market for provision of goods and services can cause demographic changes (for example, attracting in-migrants, who are keen to benefit from economic opportunities). The extent of these opportunities, both over time and across the area affected, will determine the scale of demographic impacts.

The construction phase in Georgia will last approximately three years. The numbers of workers to be employed directly overall and by individual SCPX 'Project' area are shown in Figure 10-16. The main areas that are likely to experience a range of enhanced economic opportunities are:

- CSG1/pipeline loop (21 PACs): CSG1 is planned for construction from 2Q 2014 to 3Q 2017 and at peak is expected to employ approximately 1300 people. The pipeline is under construction from 2Q 2015 to 2Q 2017 and at peak is expected to employ just over 500 people for six months
- CSG2 access road (2 PACs) is planned for construction from 1Q to 4Q 2014 and at peak is expected to employ just over 300 people for three months
- CSG2 (7 PACs) is planned for construction from 1Q 2015 to 2Q 2018 with a four month break in the winter of 2015 and at peak is expected to employ approximately 1200 people by early autumn 2016
- PRMS (9 PACs) is planned for construction from 1Q 2015 to 4Q 2017 with a break for the winter in 2016 and a seasonal peak in employment of approximately 300.

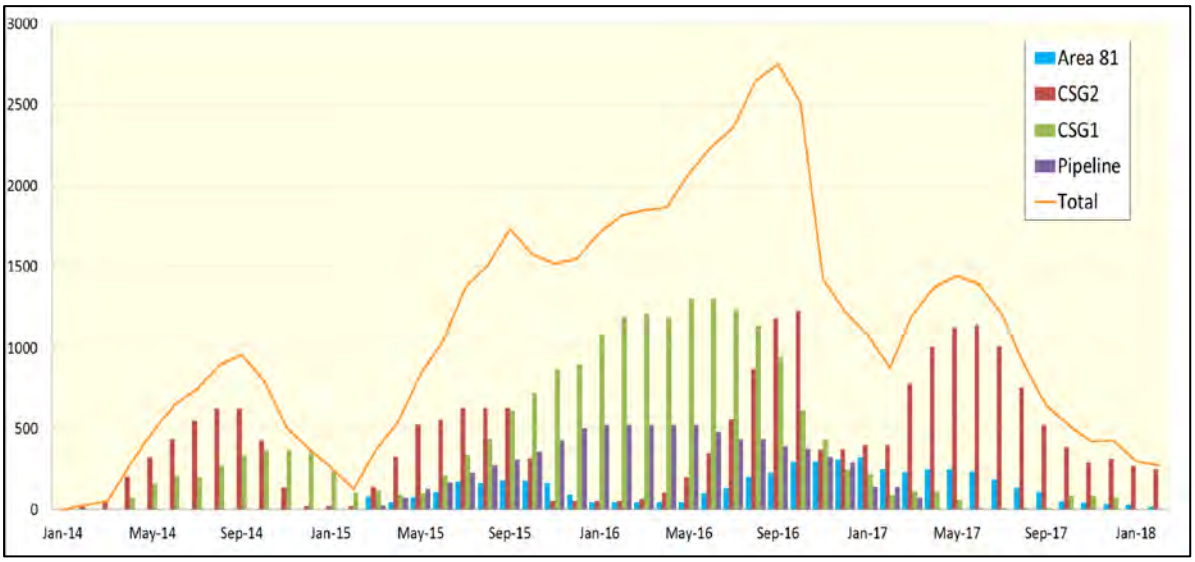

Figure 10-16: Anticipated Total Construction Manpower Levels (February 2014 to February 2018)

During the operational period a central control room at the Sangachal Terminal in Azerbaijan will control gas flow through the SCP and SCPX pipelines. Operation and maintenance at the Georgian facilities requires few employees, for example, the PRMS will employ 10 skilled technical personnel on a two-week rotation for day shift and two people for night shift. Semi-skilled and un-skilled workers will include 11 employed in the day shift

(7 security guards) and 6 in the night shift (6 security guards). Local residents are likely to be employed in the semi-skilled and unskilled workforce.

10.11.2 Key Sensitivities

Key sensitivities with respect to demographic impacts are:

- Higher numbers of pensioners, disabled, sick and IDPs within CSG2 and PRMS PACs, and proportionately higher numbers single-person/small households in the CSG2 area
- Community adaptability and acceptance of opportunities benefiting non-locals more than locals (whether a perceived or real situation)
- Housing availability and affordability
- Physical (such as water supply) and social (such as schools and healthcare facilities) infrastructure capacity and quality of service provision.

10.11.3 Demographic Impacts

The main factors that will determine the type and scale of demographic impacts:

- The extent to which it is widely understood and believed, locally and throughout Georgia, that a) local people will be given priority in terms of job vacancies in their vicinity and b) this is perceived to be the actual case in the first phases of recruitment
- The extent to which it is understood and believed that jobs will only be allocated to applicants who apply via the formal Project procedure
- The extent to which job vacancies are filled by local people
- The numbers of available jobs and their duration in the construction and operations phases. The construction phase is the main determinant of the total number of jobs created and their duration.

Currently, both unemployment and under-employment are relatively high in many PACs and incomes are relatively low. In addition, there is, to some extent, a culture of migration in the areas that the SCPX Project will affect. At present, out-migration is more common than in-migration. Out-migration occurs for a variety of reasons, but economic out-migration, to obtain a better standard of living, predominates in most rural PACs.

Construction phase

The following temporary but beneficial demographic impacts can be expected.

Out-migration
An increase in the number of jobs may act to reduce out-migration rates from certain PACs areas. Out-migration is a factor common to most rural PACs though the actual rates vary by locality. This impact is beneficial.

Local and regional populations
Unplanned in-migration, and reduced out-migration cumulatively are likely to result in an increase in certain local populations above baseline trend if all other factors remain unchanged. Some municipalities such as Gardabani have seen significant population declines in recent years, whereas others have been more of less stable while others have seen significant increases, for example, Tsalka. An increase in population will be seen as beneficial to those municipalities experiencing decline. This impact is beneficial.

The only adverse potential impact is unplanned in-migration.

Unplanned in-migration
Unplanned in-migration occurs when individuals, families/households move from one location to another to try to obtain a job or to exploit economic opportunities created by a

project. As it is unplanned, it can create problems for host communities, particularly small, rural settlements, in terms of *inter alia* housing availability/affordability, creation of temporary dwellings, imposing strains on infrastructure capacity and service delivery and, also, social disruption and tensions caused by presence/behaviour of 'strangers'.

Although socio-economic conditions were different when the BTC/SCP Project was implemented, this experience would indicate that unplanned in-migration remains a distinct possibility, as there will be continuous SCPX-related employment over a three and a half year period. Though continuous employment will not occur in all locations, it might be sufficient to cause unplanned in-migration in certain localities. It is not possible to predict its scale in a specific locality, though some factors can be identified that may shape potential in-migration.

CSG1 and the SCPX pipeline ROW are located near the city of Rustavi and the towns of Marneuli and Gardabani. Although this area will experience continual employment over most of the construction period and therefore could be an attractive destination for in-migrants, the potential to in-migrate may be lessened by an understanding, among potential in-migrants that these urban centres may be able to provide sufficient potential workers because of the numbers of highly educated and skilled workers residing there. This may deter potential in-migrants.

On the other hand some in-migration may occur in because:

- SCPX jobs and incoming-earning opportunities are longer-term and more stable than in other localities
- There has been a trend of in-migration in recent years compared to other areas in Georgia
- Relatively cheap housing exists (household survey evidence shows that this factor has been a motivator for about 20% of past in-migration)
- Longer-term prospects of getting another job are better because of the more diverse economy and presence of a city and large towns.

This area can probably absorb and even benefit from an unplanned influx of people owing to its existing economic diversity and large urban populations.

It is not expected that many residents of these settlements would consider out-migration to more rural PACs, in the vicinity of CSG1 and the pipeline loop, to obtain a job as they could live at home and commute.

PRMS and CSG2 PACs are small and rural with workforces having a limited skill base. Potential in-migrants may see potential for less 'competition' in terms of job recruitment although, with respect to both these sites, the towns of Akhaltsikhe and Tsalka are potential sources of skilled/unskilled labour. It may be expected, therefore, that there may be some in-migration of people during the early periods of the construction phases for the Project components (including construction camps) to be implemented near these PACs. This in-migration may result in adverse impacts, probably short-term, as in-migrants are unlikely to remain once jobs are lost.

It is very likely that there will be some return migrants from the PACs in such migrant flows. Although in-migrants that are non-native to the local communities may cause some adverse impacts, return migrants that remain may be a benefit as they will introduce new knowledge and skills to other PAC residents.

There is a potential for the construction contractor to move semi-skilled and, to a lesser extent, unskilled personnel from one location to another, thereby introducing the potential for in-migration.

Operational phase

As the number of jobs available will be very limited there will be no demographic impacts.

Impact summary and assessment of significance

Table 10-35 shows the potential demographic impacts of the construction phase.

Table 10-35: Potential Demographics Impacts

Issue		Potential Impact	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A28 A29	Employment Provision of goods, services and land	Reduced out-migration	Beneficial	28-01, 28-03, 28-04,28-02, 28-05,28-06, 28-07, 28-08, 28-18, 28-23	Beneficial
A28 A29	Employment Provision of goods, services and land	Local population increases	Beneficial		Beneficial
A28 A29	Employment Provision of goods, services and land	Unplanned in-migration increases	C3 Medium	D33-01, 28-01, 28-02, 28-03, 28-18	C1 Low

* Assessed using Tables 3-20 and 3-22

10.11.4 Mitigation

At the design stage

The Project has selected construction camp locations on the same sites as, or very near to, the major facilities (D33-01) reducing potential for a dispersed pattern of in-migration and settlement.

In the construction phase

In-migration

To help minimise the extent of in-migration, the Project's strategy on local recruitment will be disseminated publicly, including via media announcements at regional and national levels (as appropriate) (28-01). Unskilled labour will be preferentially recruited from the Project affected communities (28-02). Applications for employment will only be considered if submitted via the official application procedure (28-03). The Project will seek to manage employment expectations by explaining the number and type of opportunities in advance to local communities via the Community Liaison Officers (28-05). Recruitment procedures will be transparent, public and non-discriminatory and open with respect to ethnicity, religion, sexuality, disability or gender (28-06). Clear job descriptions will be provided in advance of recruitment and will explain the skills required for each post (28-07). The Project will give priority to people from the construction camp PACs for employment opportunities within the camp (e.g. cook, housekeeper etc.), where suitably qualified (28-23).

A plan will be developed and implemented that will aim to discourage and prevent the workforce from purchasing goods from informal vendors, to discourage vendors from establishing themselves at construction camp fence-lines in the hope of securing additional business (28-18). It is anticipated this will deter people from moving into the Project areas to take advantage of the buying power of the workforce. Environmental considerations will be included in the Project procurement process (1-02).

Contractual provisions will be made to minimise the potential for workforce in-migration, using employment mitigations for example commitment (28-04), referenced in Section 10.14, Economy, Employment, Skills and Livelihoods.

10.11.5 Residual Impacts

There is a potential for unplanned in-migration to occur. The implementation of the proposed mitigation measures will help ensure that the number of in-migrants will be limited; thus, the residual impact is considered to be of low significance.

It is not expected that there will be any indirect impacts from unplanned in-migration on:

- The housing market in relation to property purchase and rental costs
- Competition for jobs with local people resulting in increased social tensions
- Local infrastructure capacities.

10.12 Community Health, Safety and Security

This section discusses potential impacts on community health, safety and security during construction and operation of the SCPX Project and associated mitigation measures to be adopted. The impact assessment for community health and safety is based on the results of a parallel health impact assessment (HIA), which was carried out in close cooperation with the ESIA.

The key community safety and health impacts (those with an unmitigated impact of low and above) identified by the HIA have been summarised and discussed in the ESIA to demonstrate some of the mitigation measures that will be applied to reduce the potential impacts to community health. This is a non-exhaustive list and is not intended to replace the HIA but provide an indication of the results and also highlight the connectivity between environmental and social impacts and mitigations and community health and safety impacts and mitigations, such that relevant mitigations are included in the ESMMP and carried forward into the execution phase of the Project.

The identification of potential impacts was approached by reviewing the Project-Place-PAC within the context of available baseline data and a set of defined environmental health areas (EHAs). EHAs are a standard set of health effects categories that have been developed by the oil and gas industry and international multilateral lending institutions (IPIECA, 2005; IFC, 2008). The EHA approach includes all of the biomedical and social concerns originally developed by WHO and World Bank Group. Chapter 3 describes the EHAs in detail.

10.12.1 Aspects of SCPX Project that Could Affect Community Health

Community safety and security

The main Project-related activities that may result in impacts to community safety and security are:

- Road widening, upgrading or maintenance with use of vehicles unfamiliar to local people
- Road widening, upgrading and maintenance resulting in temporary creation of ditches, borrow pits, spoil heaps and other hazardous changes to ground surface conditions
- Increased vehicle movements, especially heavy goods vehicles and small light utility vehicles
- Presence of pipeline laying equipment unfamiliar to local people
- Creation of open excavated areas such as trenches
- Accidental spillages of chemicals

- Behaviour of security personnel.

Community health

The main Project-related activities that may result in impacts to community health are:

- Introduction of non-local workers, almost entirely males, to certain localities
- Provision of early works accommodation and construction camps for these workers with operating rules that allow for interaction between workers and local people
- Storage and handling of food and drinks in accommodation/camps
- Solid and liquid waste disposal.

10.12.2 Key Sensitivities

Community safety and security

Key sensitivities are:

- The road traffic accident rate (and accompanying injuries/deaths) in Georgia is one of the highest in Eastern Europe and has been increasing in line with car ownership. This increase in car ownership is occurring in rural communities as well as in urban areas
- Residents of PACs, not located near to BTC/SCP pipeline and Facilities, have limited knowledge of the hazards inherent in construction sites and activities for pipelines/Facilities and the risks of living and working close to such sites and are exposed to an increased risk of injury
- Children particularly may not understand the hazards and risks and how to avoid injury
- Cultural attitudes to risk taking
- Cultural attitudes of PAC residents, and other people in vicinity of Project sites, to non-local security personnel imposing restrictions on their normal 'day-to-day' activities.

Community health

Key sensitivities are:

- High tuberculosis (TB) rates and the prevalence of multidrug-resistant TB is amongst the highest globally
- Surveillance and control programmes for zoonotic and vector-borne diseases were discontinued after the collapse of the Soviet Union. Rabies, anthrax, tularemia, *Yersinia pestis*, brucellosis, and leishmaniasis are all endemic in the areas in which the SCPX Project will be implemented
- Respiratory infections are a leading cause for PAC residents to seek medical assistance. Households using wood and animal dung as sources of fuel for cooking and/or heating are at increased risk
- Baseline water quality and availability, as well as waste and sanitation facilities are poor in some rural PACs. Incidence of water and sanitation-related diseases are likely to be high among rural PACs as prevalence in rural Georgia as a whole is fairly high
- Access to healthcare services and the affordability of medicines is a concern for many PAC residents. Although health care provision has been improving in the PACs, a significant number of communities do not have a health-care facility. Ease of access and quality of health care is one of the key problems faced by many communities. Most people seek medical attention from polyclinics and hospitals not local doctor/clinic/ambulance station. This means that travel is usually involved, by car, thus increasing the risks that the patient's condition deteriorates during transport to a medical facility. Medicine affordability is a problem for many residents,

which also adds to the health risk threat to someone in receipt of medical treatment if medicines are not bought because of price.

10.12.3 Potential Impacts on Community Health, Safety and Security

Community safety and security

Most CSG1/loop and CSG2 PACs have experience of pipeline laying/pipeline repair from previous pipeline construction and subsequent operations/maintenance activities while PRMS PACs have experience of pipeline and the existing Area 80 facility construction and operations/maintenance activities. CSG2 PACs have not experienced construction of a major facility project such as a compressor station, although they do have experience of major pipeline construction. Experience of similar projects is not equally distributed amongst the population; older people are more familiar than younger residents.

SCPX has the potential to increase the threats to community safety and security. The key types of impacts are likely to be:

- Potential conflict between security personnel and local community members resulting in injuries
- Increased hazards (e.g. open excavations and open trenches) and increased risk of accidents causing injuries or fatalities
- Increased risk of road/traffic accidents causing injuries or fatalities. Although no permanent access road (constructed specifically for SCPX purposes) passes through a PAC, SCPX activities will result in significantly increased traffic flows on certain roads that are used by local residents (e.g. where such roads are used as access routes).

Potential injury as a result of unplanned events during Project operation is included in Chapter 12.

Community health

The most likely potential impacts on community health are:

- It is unlikely that exposure to fine particles (PM_{10}) will be sufficiently prolonged to increase the risk of serious respiratory illnesses, but changes in air quality may cause some respiratory problems for people who are particularly sensitive to this type of complaint
- Disturbance to sleep patterns from increased noise levels (covered in Section 10.9)
- Increase in disease vectors such as rodents (if food/drink is not stored properly and solid/liquid wastes are not managed adequately) with accompanying increased incidence of vector-borne diseases
- Increased risk of enhanced incidences of communicable diseases arising from interaction between workers living in the four main construction camps with local people. With potentially a peak of 500-1000 people (mostly men) living in each of the four main construction camps there will be a risk of communicable diseases (e.g. TB, and sexually transmitted diseases such as HIV/AIDS) passing through the workforce and possibly into the community
- Increased risk of water-borne diseases if liquid and solid waste management is not implemented effectively.

Impact summary and assessment of significance: community health and safety

The key community health and safety impacts (those with an unmitigated impact of low and above) identified by the HIA have been summarised and discussed below in accordance with the methodology outlined in Chapter 3.

Table 10-36 shows a summary of the potential impact and probability prior to mitigation and residual impacts and probabilities and post the application of mitigation measures, for each environmental health area.

Table 10-36: Community Health and Safety

Issue	Environmental Health Area	Potential Impacts	Potential Impact Significance, Probability*	Mitigation	Residual Impact Significance, Probability*
A30	Accidents/injuries, road-traffic-related injuries, spills and releases; community access to construction sites	Accident to local people and livestock from the Project site, particularly from open excavations	High, 6	30-02, 30-08, 30-09, 19-04, 30-23, 20-03, 21-01, 30-04, 30-06, 30-17, 30-18, 32-08, 32-09, 30-23, 33-15, 33-16, 33-19, 3-34, 21-02,	High, 5
		Risk of accident to local people and livestock particularly from traffic	High, 6	20-03, 24-02, 37-04, 30-15, 6-12, 30-21, 30-22, 30-23,37-09, 19-07, 37-03, 37-05, 7-10, 3-09, 2-02, 37-06, 30-08, 33-19, 30-24, 21-02, 30-18, 33-15, 33-16	High, 5
		Conflict between community members and security personnel leading to injury	High, 6	30-10, 30-12, 33-01, 33-15, 33-16	Medium, 3
	Transport to medical facility	Deterioration of patient's condition during transport to a medical facility	High, 6	31-02, 31-03	Medium, 5
A31, A24	Exposure to potentially hazardous materials	Spills impacting surface water and groundwater used in PACS	Medium, 6	6-12, 6-10, 6-20, 31-04, 6-03, 6-11, 14-03, 33-01, 33-15, 33-16	Medium, 3
		Air emissions from camps and facilities	Medium, 6	OP21, 23-05, 22-03, 33-01, 33-15, 33-06	Medium, 3
		Incremental addition of road dust	Medium, 6	23-05, 23-06, 33-01, 33-15, 33-16	Medium, 3
		Potential for field-related activity leaks and spills	Medium, 6	6-12, 6-10, 6-20, 33-01, 31-04, 33-15, 33-16	Low, 3
A31	Soil, water, sanitation and waste-related diseases	Project may add contaminants to water used for hydrostatic testing	Medium, 6	10-08, 31-05, 33-01	Low, 3
		Outbreaks of infection in camps, which could be transferred to PACs	Medium, 6	7-04, 31-06, 31-21, 33-01	Medium, 3
A31	Non-communicable diseases	Non-communicable diseases in local construction workers	Medium, 7	31-10, 31-11, 33-01	Low, 5
A31	Social determinants of health (SDH)	Increase in drug and alcohol abuse in the community	Medium, 7	30-15, 31-12, 31-13, 33-01	Medium, 7
A31	Sexually transmitted	Increase in prevalence of STIs in	Medium, 6	31-14, 31-15	Medium, 3

Issue	Environmental Health Area	Potential Impacts	Potential Impact Significance, Probability*	Mitigation	Residual Impact Significance, Probability*
	infections	camp and PACs			
A31	Housing and respiratory issues	TB outbreaks within the camp and PACs	Medium-Low, 5	31-16, 31-17, 31-18, 33-01	Low, 3
A31	Food and nutrition related issues	Transmission of food-related illnesses from Project to community and vice versa	Low, 6	31-19, 31-20, 31-21	Low, 4
A31	Zoonotic diseases	Risk of zoonotic diseases to Project and community	Medium, 3	31-22, 33-01, 6-22, X6-04, 6-25	Low, 3
A31	Vector-related diseases	Risk of vector-related diseases to Project staff	Low, 2	19-08, 31-23, 33-01	Low, 2

* Assessed using Table 3-26, the probability of each impact occurring was then evaluated on a graduated scale with 1 = Remote and 8 = Relatively Common

Table 10-36 demonstrates that community health and safety mitigation measures generally reduce either the magnitude of the potential impact or the probability of the impact occurring. This combines to reduce the overall health risk, as risk is a combination of impact magnitude and the probability of the event occurring. A summary of the mitigation measures proposed is included below.

10.12.4 Mitigation

At the design stage

The design mitigation measures listed in Section 12.6.1 aim to improve community safety.

In the construction phase

The Contractor will be required to develop and implement a Grievance Procedure to provide opportunity for local residents to raise concerns (33-01). The Project will review measures to mitigate community health and safety impacts regularly and will consult PAC leaders every six months, informing them on the status of implementation and results, and discussing any changes needed to the 'Pollution Prevention Plan' or the 'Community Health, Safety and Security Plan' in advance of proposed changes (33-15). Information will be disclosed to PAC leaders regarding potential community health and safety impacts and mitigations at a sufficient level of detail to help these stakeholders to fully understand current and expected risks, and, as necessary, additional measures to be implemented (33-16).

Risk of accident to local people and livestock from the Project site, particularly from open excavations

- Gaps will be left in pipe strings where safe to do so and necessary to allow people, wildlife and livestock to cross the ROW (32-08)
- The length of the continuous open trench (including trench with pipe installed but not backfilled and with a void space greater than 1m) will not exceed 10km per spread and the maximum length of open trench will not exceed 15km per spread (21-01)
- Protective barriers will be erected at excavations that are at a road or river crossing or close to a community or that are flooded temporarily in accordance with the Community HS&S Plan; warning barriers will be deployed around areas of lesser risk to members of the public (30-04)

- Warning barriers and/or signs will be erected where the pipeline or CSG2 access road route crosses locations identified with local communities as being heavily used by people, including herders (20-03)
- If water accumulates in the open trench (either from rainfall or because of a high water table) it will be pumped out before the pipe is lowered into the trench. All trench water will be discharged safely with the aim of minimising erosion (3-34)
- Water will be pumped from flooded excavations (e.g. with centrifugal pumps or well-points as appropriate) where a risk assessment concludes that they present a safety risk (30-09)
- Welded strings will be capped to prevent entry (19-04)
- The ROW of the SCPX pipeline and any additional temporary workspaces will be surveyed and set out (i.e. marked out and, where necessary, fenced off). The contractor will be required to keep within the designated footprint (30-23)
- Land users and local communities will be consulted to determine their requirements for access across the ROW (33-19)
- Bridges will be provided across open trenches and welded pipes at locations where there is demonstrable need for people to cross, if it is reasonable for them to do so and can be accommodated safely taking into account works being undertaken in that area at the time (30-06)
- Warning posts and bunting will be erected to mark overhead cables and temporary crossing points (30-17)
- Each section of open pipeline trench will have sloped ends or other mechanisms to aid egress from the trench (21-02)
- Construction traffic warning signs will be positioned at road crossings and other appropriate locations as determined by the Project, for example along access routes before they are used by construction traffic (30-18)
- The pipe will not normally be strung on the ROW more than 15km in advance of pipeline welding (32-09)
- Community Liaison Officers (CLOs) appointed by the Contractor will participate in, or deliver safety awareness training to, local children and their parents and/or their teachers (30-08). Particular emphasis will be placed on talking to children and explaining the dangers of construction sites and open excavations
- The ROW of the SCPX pipeline and any additional temporary workspaces will be surveyed and set out (i.e. marked out and, where necessary, fenced off). The Contractor will be required to keep within the designated footprint (30-23).

Risk of accident to local people and livestock particularly from traffic

- A strict Project speed limit of 30km/hr will be enforced for Project vehicles using unmade tracks and the ROW (24-02). Temporary traffic control measures will be employed at road crossings and junctions (flagmen, temporary traffic lights) where a safety risk assessment has identified traffic control measures will reduce the risk of traffic accidents (37-04)
- Random drug and alcohol testing of the workforce will be conducted, recorded and audited regularly (30-15)
- At sensitive locations where traffic will be using local roads, and particularly where schools and markets are close to the road, awareness of safety issues will be raised through village meetings and classroom lessons (30-02)
- Temporary traffic control (e.g. flagmen) and signs will be provided where necessary to improve safety and provide directions (37-03). Where traffic is diverted around crossings, traffic control or careful selection of the exit from the working areas will be provided with the aim of ensuring vehicles join the road in a safe manner (30-21)
- All contractors and subcontractors will adhere to BP driving rules (37-09). All drivers will undergo safety and environmental and social awareness training; driving

performance will be assessed and monitored with additional training provided if necessary (19-07). Night-time driving will be by exception only, as approved by the Company, to minimise driving risk and disturbance to communities (37-10)

- People will be actively discouraged from using the ROW as an access road (through use of signage, public education, leaflets etc.) (3-09) Vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency) (2-02)
- At locations where schools are very close to a road used by SCPX traffic, the construction contractor will plan works to minimise the delivery of heavy loads at times when children are likely to be walking to and from school (37-06). The authorities will be notified when oversize heavy loads need to be transported and the loads will be escorted by the Project (37-05). Construction traffic warning signs will be positioned at road crossings and other appropriate locations as determined by the Project, for example road signs will be positioned along access routes before they are used by construction traffic (30-18)
- The selection of any further access roads (in addition to those used during BTC/SCP construction) to Project working areas will aim to avoid sensitive receptors such as centres of communities, hospitals, clinics and schools as far as practicable (30-22)
- The ROW of the SCPX pipeline and any additional temporary workspaces will be surveyed and set out (i.e. marked out and, where necessary, fenced off). The contractor will be required to keep within the designated footprint (30-23)
- The contractor will be expected to use the designated access roads and to apply for COMPANY consent to use any new or existing roads not designated for Project use (30-24).

Risk of conflict between community members and security personnel leading to injury

- The Project will implement the 'Voluntary Principles on Security and Human Rights' (30-10)
- During construction (and operations), due diligence will be applied to selection of security providers, rules of engagement will be devised, and training provided to all personnel. Performance will be monitored and audited periodically (30-12).

Risk of patient's condition deteriorating during transport to a medical facility

- Risk assessments will be carried out to identify sensitive receptors such as hospitals and clinics along Project access routes. The Project will ensure that access to and from these facilities is not restricted by Project activities or an alternative access is in place and has been agreed with the hospital or clinic staff (31-02)
- SCPX-related drivers will be briefed so they understand the importance of ensuring free access and egress of ambulances to the hospital and all traffic to clinics (31-03).

Accidental releases during construction

The measures described in Section 10.3.4 to reduce the potential for soil contamination and the procedures to be undertaken should contamination occur, will also mitigate the potential impacts on human health associated with groundwater contamination (for example, commitments 6-03 to 6-05, 6-11, 6-12 and 7-11 to 7-12, 7-14 and 7-15).

Vehicles delivering fuel or hazardous liquids will carry appropriate spill kits to allow an initial response to any spill to be deployed (6-20). In addition, the Project will apply a risk assessment approach to contaminated land management to evaluate the potential impact of soil, surface water or groundwater contamination on local receptors (31-04).

Water discharge

- A risk assessment will be undertaken before any chemical additives are used in hydrotest water (10-08). A risk assessment will be undertaken when considering waste water discharge options and locations (31-05). This risk assessment will also account for potential human health effects including an evaluation of all relevant exposure pathways (i.e. watering crops, drinking water, etc.)
- Measures taken to reduce the risk of surface water contamination, described in Section 10.5.4 which will also reduce the risk of impacts of surface water quality and the associated potential impacts on human health include; domestic sewage from camps and pioneer camps will be stored and transported to water treatment works or treated through a dedicated site sewage water treatment plant (14-02); all wastewater discharges will be in compliance with the Project Environmental Standards (14-06).

Air quality

- Dust generation and concentrations in the air will be visually monitored during construction where activities are near communities. If dust is visible, additional mitigation measures, such as the imposition of tighter speed limits, will be implemented with the aim of avoiding causing disturbance to residents or land users (23-05)
- Vehicles carrying fine materials will be sheeted to help prevent dust blow and spillages (23-06)
- Medical waste will be disposed of via a licensed medical contractor or a Company approved incinerator (31-06)
- Ambient air quality monitoring will be carried out prior to construction to establish a baseline on the boundary fence and at receptors in the vicinity of CSG1, CSG2 and PRMS (22-03)
- An air quality monitoring programme encompassing ambient air quality and stack emissions monitoring will be developed and implemented in relation to the Project Environmental Standards. Where monitoring results demonstrate consistent compliance with the Project Standards, the frequency and scope of monitoring will be reviewed and revised if appropriate to include less frequent, boundary fence monitoring (OP121).

Sanitation and waste

The prevalence of food-borne and gastrointestinal infection as well as infectious parasites is high in Georgia. An outbreak could be triggered at the camp if local hires bring in such infections, especially if they are a food handler. Similarly, such disease can be carried from the camp to back to the PACs.

The overall proposed strategy is based on (i) controlling construction camp conditions inside the Project, and (ii) adequate medical surveillance of the catering service workers. The following mitigations are therefore proposed to reduce potential impacts to communities:

- Waste management practices will be subject to regular monitoring and auditing (7-04)
- The mitigations presented below regarding food handling described in the Food and Nutrition section below.

Non-communicable diseases

Non-communicable diseases (NCDs) are already rapidly rising in Georgia and are a major contributor to a dramatic increase in costs to the national health care system.

The Project is likely to employ significant numbers of local workers during construction. It has been observed at many industrial locations that workers often experience significant

changes in weight, i.e. rapid weight gains. Negative changes in exercise and dietary habits are associated with increases in NCDs, particularly diabetes and cardiovascular diseases.

- Workforce education and health monitoring are the two proposed mitigations to reduce the potential impact of NCDs on Georgian nationals employed by the Project
- An NCD awareness programme will be implemented (31-10). In addition, pre-job fitness for task assessments will be implemented and will be repeated at regular intervals based on the employee risk profile (31-11). This may also identify employees at risk of or suffering from NCDs
- Worker education and awareness programmes will be conducted and materials regarding the health hazards of smoking, alcohol and substance abuse will be provided (31-13).

Social determinants of health
Alcohol misuse was cited as the most prominent social problem by most respondents in the household survey.

Determinants of health changes and impacts are typically associated with employment and income. Changes in employment and income (such as those experienced by community members employed by the Project) can trigger behavioural changes at the household level and may include increases in drug and alcohol use. Mitigation measures include:

- Project will prohibit the workforce from participating in illegal activities including use of illegal drugs (31-12)
- Worker education and awareness programmes will be conducted and materials regarding the health hazards of smoking, alcohol and substance abuse will be provided (31-13).

Sexually transmitted infections
STIs are notoriously under-reported owing to significant cultural stigma associated with these diseases. As noted in the baseline analysis, incidences of syphilis and gonorrhoea are high and cases of HIV have increased in recent years; however, these figures are likely underreported. Migrating workers are a potential “vector of spread” for STIs. In addition, camps will be “open” so workers residing in camps located near PACs could interact with locals and potentially spread STIs, which could inflate the overall prevalence of STIs in a given community.

Mitigation measures to reduce the potential impacts of STIs:

- A worker education and awareness programme regarding the risks and prevention measures associated with STIs including HIV/AIDS and other communicable diseases (e.g. TB) will be implemented (31-14)
- The Project will make information on communicable diseases and STIs available to communities close to the camps (31-15).

Housing and respiratory issues
Mitigation measures to minimise housing and respiratory issues include:

- Temporary Project housing structures will be constructed and maintained according to internationally accepted design specifications for space occupancy per person (31-16)
- The Contractor will operate a personnel health programme which will aim to prevent illness and disease occurring, and will include immunisations as required (31-17)
- A workplace TB control programme will be implemented (31-18).

Food and nutrition
Mitigations to reduce the effects on health through poor handling of food include:

- A food sanitation programme will be developed and implemented within all Project catering facilities based on internationally recognised standards (31-19)
- Food-borne illness investigation procedure will be implemented and workers will be educated regarding the prevention of food-related illnesses (e.g. hygiene practices (31-20)
- Food service operations, practices and facilities will be regularly inspected and findings and resolved non-compliance issues will be documented immediately (31-21).

Zoonotic diseases
Measures for preventing zoonotic disease transmission will be implemented (31-22). These measures are likely to include keeping animals (pets, livestock, etc.) outside of construction camp fence lines, implementing rodent control programmes at the construction camps and prohibiting feeding of wildlife.

The Company will carry out a due diligence exercise to identify and manage the risk of anthrax (6-22). The fencing at the known anthrax pit at KP30 will be maintained during construction to help protect the area from disturbance and workers will be made aware of the risks posed by this area and the need to avoid disturbance (X6-04). If any animal burial pits are identified during construction, works will cease in this location until the affected area has been subject to sampling by qualified personnel to determine if there is a risk of anthrax (6-25).

Vector-related diseases (VRDs)
A VRD prevention programme will be implemented (31-23). This may include the use of rodent control programmes at the construction camps and the provision of suitable PPE to reduce the risk of insect bites. Construction contractors will be required to manage the storage and disposal of food and organic wastes to avoid attracting vermin (19-08).

In the operational phase

The operational mitigation measures listed in Section 12.6.1 aim to improve community safety.

10.12.5 Residual Impacts

The HIA considered that accidents at the worksite, road traffic accidents and the possibility that a patient's condition could deteriorate if their journey to a medical facility is delayed would have residual impacts of high significance but the proposed mitigation measures cause a decrease in the probability of such an event occurring. Effective implementation of the proposed mitigation measures is likely to reduce the significance of other impacts on community health and safety to medium or low levels and decrease the probability that such events occur.

The operational controls listed in Section 12.6.2 will contribute to community safety during the operational phase of the SCPX Project.

10.13 Land

This section discusses potential impacts on land, including land ownership, land use and land-related livelihoods, during construction and operation of the SCPX Project, as well as associated impact minimisation, avoidance and compensation measures. This ESIA section provides a summary of the impact identification and assessment, and further details are provided in the specific land acquisition planning document developed for SCPX ("Land Acquisition and Compensation Framework") which should also be referred to.

10.13.1 Aspects of SCPX Project that Could Affect Land Ownership and Use

The SCPX construction corridor is generally 36m in width with potential extra width locally at river and other crossings and steep slopes. Except in the few locations where the SCPX will deviate from the existing BTC and SCP corridor, part of the Construction Corridor will be situated on land already purchased by BTC Co. and SCP Co. for the BTC and SCP pipelines, thereby reducing the purchase width of the SCPX corridor and minimising land acquisition impacts. The Project will acquire the pipeline land purchase corridor and land for the facilities as described in Chapter 5.

A total of about 287 hectares of agricultural land will be affected temporarily by the construction phase of the Project. After construction is complete, this land will be reinstated and handed back to its owners (for Facility and Pipeline AGI temporary land needs) or previous owners (pipeline) for agricultural use. In the case of the pipeline, restrictions will apply over a 30m-wide strip of land, but given the type of agricultural activities currently undertaken on this land, it is not expected that these restrictions will cause any long term impacts to livelihoods.

A total of about 125 hectares will be acquired and occupied permanently for the operation of the Facilities, CSG2 Access Road and Pipeline AGIs.

After construction of the pipeline and reinstatement of the corridor are complete, SCP Co. will remain the legal owner of the land purchase corridor. However, the right to agricultural use will be returned to previous landowners, subject to restrictions applicable in Zones 1 and 2 as described in Chapter 5. Temporary land at the facilities will be occupied for the duration of construction of the relevant facilities, until they are no longer required (generally three years), and will typically be leased from its current owners. After construction and reinstatement are complete or at the end of the lease, it will be handed back to its owners, who will be able to resume previous utilisation, whether agricultural or other.

During operations, and in addition to restrictions upon land discussed previously, the most likely potential impact would be damages to crops in the pipeline corridor or nearby resulting from maintenance activities or vehicular access.

Compensation principles for all land acquisition/usage actions are presented in the LACF and the associated GLAC.

10.13.2 Key Sensitivities

Key sensitivities relate to potential impacts on land-based livelihoods, as follows:

- Private plots are an important resource for inhabitants of rural project-affected communities as many inhabitants engage in some degree of agriculture (almost 100% in some communities) and the products obtained from agriculture make an important contribution to livelihoods (food for own use and sale of surplus)
- State land is primarily used for grazing and is an important ‘communal’ resource
- Permanently occupied land (construction and operations phase):
    - Loss of annual and perennial crops (CSG1, CSG2 access road and PRMS)
    - Loss of use of pasture land (block valve, pigging station, CSG2, CSG2 access road and PRMS)
- Temporarily occupied land (construction phase only):
    - Loss of annual and perennial crops (pipeline corridor, temporary facilities associated to pipeline and Facilities and CSG2 access road)
    - Loss of use of pasture land (temporary facilities associated to CSG2)
    - Restrictions to movement of livestock
- Use of watering holes to water livestock at CSG2 and PRMS

- Some PACs have a dependency on springs and wells for domestic and irrigation water supply
- A stone chapel adjacent to CSG2.

10.13.3 Impact Avoidance and Minimisation

Design

Avoidance of physical displacement was a key criterion of Project design, including Facility siting and pipeline routing.

The block valve, PRMS and the CSG1 have been collocated to minimise the requirement for additional development on greenfield sites (D5-096).

10.13.4 Impacts of Land Acquisition on Land-Based Livelihoods

Construction phase

Private plots are an important resource for inhabitants of rural Project-affected communities as many inhabitants engage in some degree of agriculture (almost 100% in some communities) and the products obtained from agriculture make an important contribution to livelihoods (food for own use and sale of surplus). State land is primarily used for grazing and is an important 'communal' resource.

Potential impacts on land owners/users and land-based livelihoods will primarily relate to temporary loss of crops over the period of construction (a maximum of three years) and associated reduction in income or means of subsistence. In addition, the following potential impacts may occur during construction:

- Access to agricultural plots may be severed or restricted during construction for some landowners or land users
- Movements of livestock may be restricted by construction activities (particularly the temporary presence of the pipeline trench and associated activities and equipment, which may cause severance); this is also addressed elsewhere in this document, and related mitigations are described in Section 10.7.4
- Impacts on livelihoods from restrictions on access for livestock will affect, at most, about 40% of households in the Project-affected communities as 35% own a cow and ~5% keep sheep/goats (averages of 4/3 respectively per household)
- Temporary disruption to irrigation and drainage due to interruption of networks as a result of construction activities, and associated losses of crops
- Accidents to livestock as a result of Project activities could also occur resulting in livelihood loss (discussed in Section 10.14)
- Damages to crops in plots neighbouring the pipeline construction corridor due to, for example, spill over of earth or intrusion of equipment.

Secondary impacts on livelihoods could potentially occur as a result of the following activities during the Project construction phase:

- Abstracting water from groundwater sources that may inadvertently affect surface drainage systems such as springs or wells that may be used for domestic water supply and/or irrigation water
- Temporary blockage of the irrigation channels to install the pipeline could result in changed water flows or localised flooding, affecting the livelihoods of farmers
- Increase in soil erosion, damage to soil properties and soil compaction which may affect the productivity of the land
- Accidental contamination during construction by spills or leaks

- Reduced production from beehives (discussed in Section 10.14) or crops such as fruit and vegetables as a result of increased dust generated from Project activities, which results in a loss of income.

Operational phase

The impacts on livelihoods of the restrictions to be imposed on land use in the pipeline corridor are likely to be negligible. Restrictions do not preclude agricultural activities and only affect actions such as erecting structures, growing certain kinds of deep-rooted trees and major earth moving. Farmers have continued agricultural activities successfully along the existing WREP and following the construction of both BTC and SCP pipelines.

Subject to proper reinstatement, vegetation growth is expected to recover to its former levels within approximately one to three years after construction. As the pipeline corridor is such a small proportion of the areas available for grazing, the small loss of biomass during the recovery period will only have a low impact on farmers or their animals. There may be some additional impacts damages to crops in the pipeline corridor or nearby resulting from maintenance activities or vehicular access

The impact of the permanent land acquisition entailed by the operation of the Facilities is more significant and may affect livelihoods of farmers.

Impact summary and assessment of significance

Table 10-37 provides an assessment of the significance of impacts on land acquisition on land-based livelihoods before and after implementation of the proposed mitigation measures that are discussed in the following section.

Table 10-38 shows potential impacts on sensitive land users in the vicinity of the proposed SCPX works.

Table 10-37: Potential Impacts of Land Acquisition on Land-based Livelihoods

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A2	Soil compaction	Loss of agricultural productivity	C3 Medium	2-01, 2-02, 2-03, 2-04, 2-05, 2-07, 3-09, 3-15, 4-06, 33-13, OP61	C1 Low
A3	Soil erosion and sediment run-off following removal of vegetation and/or disturbance of ground	Loss of agricultural productivity	C3 Medium	3-03, 3-08, 4-09, 4-12, 33-13	C2 Low
A4	Loss of soil structure, fertility and seed bank	Loss of agricultural productivity	C3 Medium	4-02, 4-03, 4-04, 4-09, 4-15, 4-22, 33-13	C1 Low
A13	Flooding caused by impeded river or ground surface flows	Loss of agricultural productivity	C3 Medium	13-01, 13-02, 13-03, 33-13	C1 Low
A24	Dust generation, particularly from vehicle movements, storage of excavated materials and operation of concrete batching plant	Reduced crop production resulting loss to livelihoods	C2 Low	4-09, 23-05, 23-06, 24-01, 24-02, 33-13	C1 Low

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A32	Permanent acquisition of private agricultural or grazing land in the pipeline land purchase corridor	Pipeline corridor: land is acquired on a permanent basis and occupied on a temporary basis during construction only, then reinstated to its previous condition and handed back for agricultural use to the previous owner – The impact is therefore the inability to use land for agriculture for a period of up to three years	C3 Medium	LACF 002 to 004, 005, 022, 029, 041-049, 054-59, 39-02, 39-01, 39-03, 32-04, 32-01, 32-07,	B2 Low
A32	Permanent acquisition of private agricultural or grazing land for Facilities and Pipeline AGIs	Facilities and Pipeline AGIs: land is acquired and occupied permanently – The impact is the permanent inability to use this land	C3 Medium	LACF 008, 022, 029, 041-049, 054-59, 39-02, 39-01, 39-03, 32-01, 32-07	B2 Low
A32	Permanent transfer of state land in the land purchase corridor	Impacts to users (see crops below)	C3 Medium	LACF 015, 39-02, 39-01, 39-03, 32-01, 32-07, 39-02	B2 Low
A32	Permanent or temporary severance or shape/size of the remaining plot of land making its previous use impractical or uneconomical	Impediment to agricultural use of land	B2 Low	LACF 005, 017-019, 3-15, 32-05	A1 Very Low
A32	Temporary occupation of private land during construction	Inability to farm on land for a period of up to three years	B2 Low	LACF 007 and 009, 32-05, 32-03, 35-08, 17-05	A1 Very Low
A32	Temporary occupation of State land during construction	Inability to farm on land for a period of up to three years	B2 Low	LACF 011, 17-05	A1 Very Low
A32;	Loss of annual crops	Inability to grow and harvest annual crop on affected plot	C3 Medium	LACF 015, 017-019, OP25	A1 Very Low
A32	Loss of pasture	Inability to harvest hay or to use land for grazing	C3 Medium	LACF 015, 017-019	A1 Very Low
A32	Loss of perennial crops	Loss of crop	C3 Medium	LACF 015, 017-019	B2 Low

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A20	Impeded movement of wild animals, domestic herds and people due to open trench, pipe string or spoil storage mounds	Disruption of movement of herds	B2 Low	21-01, 13-02, 30-06, 33-19, 33-14, 20-03, 32-17	B1 Low
A36	Severed access to irrigation supply, water holes and disruption to livestock movement	Difficulty to water animals	C3 Medium	LACF001 to 005, 32-04, 35-05, 35-06, 35-07, 35-08, 35-09, 36-03	B2 Low
A32	Impacts of land acquisition on vulnerable people	More severe impacts on people less able to claim compensation benefits	C3 Medium	LACF 040 and 041, 041-049, 054-59, 2-04, 32-01, 32-07	B2 Low

* Assessed using Tables 3-20 and 3-21 and an estimate of impact significance factors before and after mitigation

Table 10-38: Impacts on Land Users at Specific Locations

Location	Sensitive Receptor	Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
CSG1	Farmers in neighbouring PACs	Agriculture in this area is mainly based on irrigated and intensive open field cultivation. Not everybody engages in agriculture. Livelihood impacts are anticipated to be low prior to mitigation and appropriately handled through cash compensation, in line with the experience of the BTC/SCP pipelines	B2 Low	LACF 005, 007, 008, 009, 011, 015	A1 Very Low
CSG2	Farmers in neighbouring PACs	The site affects grazing land, some of which is also used for hay. There is no scarcity of such land in the area, due to low demographic pressure and diminishing population. Impacts are anticipated to be low prior to mitigation and appropriately handled through cash compensation, in line with the experience of the BTC/SCP pipelines	B2 Low	LACF 005, 007, 008, 009, 011, 015, 32-04, X13-01	A1 Very Low

Location	Sensitive Receptor	Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
CSG2 Access Road	Farmers in neighbouring PACs	The first c. 6km of access road traverses areas of arable land used to grow annual crops with the remaining 10km passing through areas used for grazing and some hay harvesting. Access to land does not appear to be a constraint. Impacts are expected to be of medium significance prior to mitigation and can be appropriately handled through cash compensation and the maintenance of current levels of access to unaffected land parcels	C4 Medium	LACF 005, 007, 008, 009, 011, 015, X13-02, D32-01	C2 Low
PRMS	Farmers in neighbouring PACs	The site affects a mix of grazing and agricultural land. There is no scarcity of land in the area due to low demographic pressure. Impacts are anticipated to be of medium significance prior to mitigation and can be appropriately handled through cash compensation, in line with the experience of the BTC/SCP pipelines	C3 Medium	LACF 005, 007, 008, 009, 011, 015, X13-01, 32-04	B2 Low

10.13.5 Impact Mitigation and Compensation

Key compensation principles

Detailed commitments in respect of land acquisition and associated compensation are made in the Land Acquisition and Compensation Framework (LACF). Therefore, this section must be read in conjunction with the LACF and, in the event of any discrepancy between this section and the LACF, the language in the LACF takes precedence. Commitments below are referred to by their number in the LACF (LACF 000); other commitments specific to this section are referred to as (0-00) etc.

Key principles for land acquisition and associated compensation are as follows:

- All losses will be compensated at replacement value (*LACF 022*)
- The Land Purchase Corridor will be purchased by SCP Co. from its current owners and shall remain in SCP Co.'s ownership after reinstatement (*LACF 002*). After construction and reinstatement are complete, the Land Purchase Corridor will be handed back to its former owners for agricultural use (*LACF 003*). Temporary works areas will be reinstated to near original condition (as compared to pre-construction survey reports or adjacent areas (17-05) and any disrupted irrigation or drainage systems will be reinstated on completion of construction to a standard at least equal to their original condition (35-08)
- Upon completion of subsoil and topsoil reinstatement, the contractor and Company personnel will inspect disturbed areas jointly for signs of erosion, slope stability,

relief, topographic diversity, acceptable surface water drainage capacity and function, and compaction. Remedial measures, if necessary, will be implemented at locations where reinstatement does not meet the Project criteria (3-15). Following reinstatement, the Company Land Acquisition Team, environmental representative and the construction contractors will carry out an exit inspection with the previous land owner/user of all land that was used during the construction period (32-05)

- Temporary drainage will be provided where necessary (as determined by the Company) to prevent ponding or waterlogging of the working area (2-04)
- Former owners will be entitled to recover a usage right over the Land Purchase Corridor, henceforth owned by SCP Co. Any agricultural use of the Land Purchase Corridor will be subject to the restrictions applicable in Zones 1 and 2. SCP Co. will be able to access this land at any time for surveillance and maintenance of the pipeline and any damage that may occur in respect of such access shall be compensated to land users (*LACF 004*)
- If small remainders of plot are made uneconomic as a result of the purchase or occupation, they may be eligible to compensation as “orphan land” based on a request lodged by the current landowner (*LACF 005*)
- All land occupied on a temporary basis will be reinstated to its previous condition (*LACF 007*)
- Land required permanently for the Facilities and Pipeline AGIs will be purchased by SCP Co. using replacement value rates and its usage will not be handed back to previous owners or users after completion of construction (*LACF 008*)
- Land required on a temporary basis for the Facilities and Pipeline AGIs will generally not be purchased by SCP Co. and will be leased from current owners by SCP Co. or the relevant contractor for the duration of construction and reinstatement based on lease agreements (*LACF 009*)
- Registered users on state land will be eligible to compensation for standing crops and any development that they can demonstrate ownership of (*LACF 011*)
- Crop losses will be compensated as follows (*LACF 015*):
    - Where SCP Co. purchases land on a permanent basis (Land Purchase Corridor and Facilities and Pipeline AGIs), crops will be compensated at replacement value for one year of production loss
    - Where SCP Co. leases land on a temporary basis (temporary facilities), crops will be compensated at replacement value for three years of production loss, assumed to be the duration of construction and reinstatement; if land cannot be handed back within this period of three years, additional compensation for crops may be due
- Pre-entry agreements including reinstatement requirements will be agreed prior to work affecting third party assets (35-09)
- If impacts to third party land or crops is caused by Project activity, for example due to interruption of irrigation or drainage, the Project's procedure for land and crop damage will be applied (36-03)
- SCP Co. will seek to enter into negotiated settlements with affected landowners and land users wherever possible (*LACF 029*); if good faith negotiations fail to result in an agreement, SCP Co. will use, as a last resort, legal means envisioned in Georgian law, such as Necessary Right-of-Way to seek a Court decision on land acquisition and further compensation; this may also apply in situations where the whereabouts of the landowner or land user are unknown (absentee landowners)
- Affected people will have access to a grievance mechanism, including a first tier of internal grievance review by SCP Co., with the possibility for aggrieved individuals to resort to a second tier of independent review of the grievance (*LACF 041 to 049*)
- Vulnerable people will be identified and specifically assisted as needed (*LACF 040 and 041*)

- SCP Co. will organise that a completion audit be carried out by an external auditor (LACF 054)
- Parking of Project-related vehicles will be restricted to designated areas (32-03)
- The relevant authorities will be consulted if the need for any additional land take is identified and the relevant permits and consents will be obtained (39-01)
- Site assessments (taking into consideration ecology, cultural heritage, social, erosion risk, water resources) will be undertaken if the need for additional land is identified following submission of the ESIA (39-02)
- An environmental and social assessment report will be prepared by the Project if any additional land outside that described in the ESIA is to be used, the scale of which will depend on the proposed activities and sensitivities of the area (39-03)
- Operations will liaise with the government authorities to establish guidelines regarding patrol behaviour with respect to access to/transit through agricultural lands and the reporting of any damage (OP25).

10.13.6 Information and Disclosure

The Project has prepared two specific documents addressing land impacts, acquisition and compensation:

- A detailed '*Land Acquisition and Compensation Framework*' (LACF), which presents details on Project land impacts, including applicable restrictions during construction and operations phases, all principles applicable to compensation, including rates and the process that SCP Co. will follow to identify and compensate landowners and land users, the details of the grievance process, assistance intended for vulnerable people, and principles for disclosure and information (*LACF 055 and 056*)
- A '*Guide to Land Acquisition and Compensation*' (GLAC), which presents practical information for all affected landowners and land users to participate meaningfully in the land acquisition and compensation process (*LACF 057 to 059*)
- The Project will consult with local government authorities, landowners and land users, including graziers, before restricting access to land and will establish the need for temporary fencing (32-01). This will be achieved through dissemination of the GLAC
- The Project will inform landowners/users about any reuse restrictions that apply to land used by the Project (32-07).

SCP Co. Land Team staff members and Community Liaison Officers will notify land and resource users of Project activities, carry out inventories of affected assets and identify associated owners and users, determine compensation amounts and act as a central point of contact should any issues arise during construction (*LACF 017 to 019*). SCP Co. will develop and implement a Grievance Procedure to provide an opportunity for local residents to raise concerns and complaints associated with land acquisition and compensation (*LACF 041 to 049*).

10.13.7 Irrigation Channels, Watering of Animals and Access for Grazing and Cultivation

Surveys of irrigation and drainage systems will be undertaken before construction to determine their location and condition (35-05). The Contractor will aim to maintain the integrity and viability of functional irrigation and drainage systems throughout construction, for example, by using measures such as pumping, channel diversions and fluming. Any deviations shall be subject to approval by the Company (35-06). Affected landowners and occupiers will be consulted to determine their views on the requirement for temporary measures if irrigation systems are to be disrupted (35-07). Any disrupted irrigation or drainage system will be reinstated on completion of construction to a standard at least equal to their original condition (35-08).

The Project will provide a substitute for substantial watering holes, used by livestock that cannot be used due to Project-related actions. The substitute will be of a type, and in a location, to be agreed with representatives of the livestock owners and herders (32-04). This applies particularly at CSG2 where a watering hole will be inside the site boundary. Substitutes will be provided for the wetland areas used as watering holes at CSG2 and PRMS sites, if access is restricted by construction activities (X13-01). The Project will seek to identify whether any herders use the construction areas and aim to consult with them on potential restrictions during construction (32-17). Local communities and grazers will be consulted prior to construction regarding access to grazing lands in the vicinity of CSG2 and the CSG2 Access Road to determine suitable alternative access routes to pastures (X13-02).

10.13.8 Maintaining Access

The construction contractor will be required to maintain safe access across the pipeline works to enable farmers to move freely between land plots. In order to minimise disruption to movement, the contractor will be required to adopt the following measures:

- The length of the continuous open trench (including trench with pipe installed but not backfilled and a void space greater than 1m) will not exceed 10km per spread and the maximum length of the open trench will not exceed 15km per spread (21-01)
- Gaps will be left in soil stacks at strategic locations to allow water through (13-02)
- Bridges will be provided across open trenches and welded pipes at locations where there is a demonstrable need for people to cross, if it is reasonable for them to do so and can be accommodated safely, taking into account works being undertaken in that area at the time (30-06)
- Warning barriers and/or signs will be erected where the pipeline or CSG2 access road route crosses locations identified with local communities as being heavily used by people, including herders (20-03)
- Land users and local communities will be consulted to determine their requirements for access across the ROW (33-19)
- To avoid disturbance of particular local events such as funeral ceremonies by construction traffic, the Community Liaison Officers will encourage local community authorities to provide advance warning of funerals (and other similar events) so that the Contractor can avoid the movement of heavy vehicles, equipment and pipe through settlements at these times (33-14).

The Project will inform land owners/users about any restrictions that apply to land used by the Project (*LACF_057_to_059*). Access to the church located close to CSG2 will be maintained throughout construction as long as the Project considers it safe to do so (X15-01). The Project will aim to maintain the existing level of access to unaffected land parcels adjacent to the CSG2 access road by providing junctions/crossing points connected to the main existing tracks (D32-01).

10.13.9 Residual Impacts

Implementation of the above mitigation and compensation measures will allow that:

- Livelihoods are maintained at levels prior to land acquisition
- Inconvenience relating to access to land during construction will be reduced. Landowners and land users will have opportunities and avenues to raise specific concerns in this respect so that they can be addressed by the construction contractor and SCP Co.

With implementation of the proposed mitigation measures residual impacts of land acquisition on land-based livelihoods are considered to be of low significance.

10.14 Economy, Employment, Skills and Livelihoods

This section discusses potential impacts on employment skills and livelihoods (only those livelihood impacts not resulting from land acquisition as these have been assessed in the previous section) during construction of the SCPX Project and associated mitigation measures to be adopted.

10.14.1 Aspects of SCPX Project that Could Affect the Economy, Employment, Skills and Livelihoods

SCPX activities will provide opportunities for companies at the national, and possibly regional, level to supply goods and services. The SCPX Project is expected to affect the local economies, employment, skills and livelihoods primarily by:

- Employing local people temporarily to carry out construction work on the pipeline, Facilities and the CSG2 access road. It will also employ permanent staff to operate and maintain the Facilities
- Local purchases of goods and services directly by the Project and workers, particularly in those PACs and other nearby communities located in the vicinity of construction workforce camps
- Potential in-migration of individuals/households to take advantage of economic opportunities created by the SCPX Project.

Other Project activities that have the potential to affect livelihoods are:

- Atmospheric emissions (especially dust) that cause a decline in crop productivity and affect the behaviour and health status of bees kept in domestic hives for honey production
- Pipeline installation
- Periodic security patrols either on foot or on horseback along the pipeline route damaging crops.

10.14.2 Key Sensitivities

Key sensitivities are:

- Continuing high levels of unemployment and poverty
- Seasonality of income for smaller rural agriculture PACs who are also more vulnerable to economic shocks
- High expectations among local people that they will be employed
- Concern that jobs should be given to local people and only to non-locals where no suitably qualified locals are available
- Concern that jobs will not be allocated fairly between communities with no discrimination in job allocation based on ethnicity and language skills (concern particularly prevalent in PACs with majority Armenian and Azerbaijani populations or with significant minorities of non-Georgian people)
- Reliance on ‘word of mouth’ for access to information regarding employment opportunities
- Job availability for women
- Food and healthcare costs.

10.14.3 Impacts on Economy, Employment, Skills and Livelihoods

Construction phase

In the construction phase the following beneficial impacts may occur:

- Increase in available jobs and incomes, leading to enhanced circulation of money in the local economy resulting in overall economic growth
- Improved standard of living for households with members who have increased incomes due to employment of local people
- Enhanced skills among local workforce
- Increase in sales for local businesses.

The following adverse impacts may occur:

- Un-met employment expectations
- Resentment between local people who are employed by the Project and those whose applications were unsuccessful
- Frustration and resentment if local workers perceive that foreign workers are receiving better pay or conditions for exactly the same job
- Tensions between and within communities if one or more ethnic groups considers that it is not receiving it perceived fair share of local jobs
- Resentment from business owners whose offer of goods and services is refused
- Tensions resulting from cultural differences, anti-social behaviour of construction workforce, potential prostitution and attraction of 'economic migrants' at camp sites
- Increased inflation, particularly of food and housing costs
- Accidents to livestock (including poultry) resulting in loss of income/adverse livelihood impact
- Decline in honey production due to disturbance of bees resulting in livelihood loss
- Retrenchment leading to significant numbers of individuals from certain PACs losing their jobs at the same time
- Local small- and medium-sized enterprises and public sector organisations 'losing' key workers to SCPX
- Subsistence farmers taking up SCPX jobs and land being neglected for periods of two or three years making it difficult to re-start farming when jobs cease following retrenchment.

National and regional level
At the national level SCPX expenditure is expected to make a positive contribution to GDP growth. The extent of this beneficial impact will depend on the scale of expenditure in Georgia on goods and services, for example, purchasing decisions will be contingent upon local suppliers meeting the Project's quality and reliability standards.

Regionally, Kvemo Kartli will benefit more than Samtskhe-Javakheti, as it contains the city of Rustavi and the two towns of Marneuli and Gardabani with their diverse economies and range of skills present in the workforce. It is likely that a significant proportion of workers for CSG1 and the pipeline will be sourced locally to the overall benefit of the local economy and that a range of goods and services can be purchased from local suppliers thus boosting the positive economic impact.

Local level – employment opportunities
Employment is expected to occur continuously from March 2014 to October 2018. The numbers and distribution of jobs varies by area and by year as follows (based on current Project schedule, which may change):

- In 2014 there is peak of approximately 480 with most at CSG1 and CSG2/access road
- During the winter period of 2014 all jobs are located at CSG1 with a peak of 200 jobs, with pipeline construction and PRMS work starting in early 2015
- In 2015 there is a peak of 1100 jobs, the majority at CSG1 and the pipeline

- In 2016 there is a peak of over 1700 jobs at the end of the year mainly at CSG2 and the CSG1
- During the winter of 2016/2017 there is minimum of 400 jobs across the Facilities and the pipeline as retrenchment occurs rapidly from late 2016
- In 2017 most jobs are at CSG2 with numbers reducing rapidly from late summer until early 2018.

The workforce will include a combination of professional/administrative, skilled, semi-skilled and unskilled workers:

- Skilled workers will include experienced staff in categories such as welding and machinery operation
- Semi-skilled workers will include experienced drivers, mechanics and night watchmen
- Unskilled work may include tasks such as sand bag filling and acting as a banksman for machine operators.

Unskilled workers may be employed with no prior construction experience, though preference will be given to applicants with experience. There are no figures available for the number of locals who may be employed, but based on comparable pipeline construction projects it is anticipated that approximately 35–60% of the workforce will be local. This will include not just workers laying the pipeline and constructing the facilities, but will include people servicing the camps. Here there will be the most favourable opportunities for hiring local labour to work as cleaners, cooks and in secretarial/office-type jobs.

It is likely that some of the local people have unrealistic expectations about the number of jobs that will be created during construction. It is likely that applications for employment will far exceed the number of vacancies, which could lead to disappointment and resentment.

The increase in the amount of money circulating in the local economies, from direct (at the Facilities, access road and pipeline sites) and indirect (at a local supplier) job creation, may contribute to induced job creation (e.g. a shop hiring an additional worker because of increased demand) via the multiplier effect. Any such effect will be small, and can probably be measured only in job-months rather than job-years owing to the temporary, short-term and limited nature of the increased income injected into the local economies by the Project spending.

Employment will increase incomes and improve quality of life, albeit temporarily, for individuals and households. This is a significant, but temporary benefit. Those who ‘lose out’ may feel resentment. Similarly at community level, there may tensions, and even conflict, if job allocations between communities are not perceived as being ‘fair’.

Local level – procurement of goods and services
The types of local contracts that are anticipated during construction and operation are shown below:

- Catering services to the office camp and construction sites
- Security services at the office camp and construction sites
- Provision of food supplies (indirectly through catering services)
- Supply of some construction equipment and materials, including timber and stone.

Through providing goods and services to the Project, some people will enjoy an increased income for a short period, which will be beneficial. However, there may be resentment from those who do not benefit from the Project. This impact will be localised.

Local level – inflation
Inflation is caused when demand exceeds supply or when the money supply increases significantly faster than the ability to supply desired goods and services. Inflation provides benefits as well as causing adverse impacts. Without inflation economic growth cannot

occur. However, there are negative impacts such as increased poverty for those on fixed incomes or incomes that fall increasingly behind the rate of inflation increases.

It is very difficult to predict the scale and nature of inflation. Not all available goods and services increase in price at the same rate, and there are fluctuations over time. In general, most adverse impacts occur when food, transport, housing and fuel costs rise steeply and continually.

Inflation in Georgia has been relatively high in recent years (in 2007 it was 11% and in 2010 it was 11.2% with a dramatic fall in 2008-09) although it has declined recently; by the end of November 2011 the consumer price index (CPI)[11] was 1.9% (year-on-year). Many HHs in the rural PACs spend most of their income on food/drink, utility services and health care and are thus sensitive to increase in their prices. The most vulnerable include the elderly, disabled/chronic sick and those with incomes below the official 'poverty line'.

The scale and extent of local inflation will depend, to a great extent, on the spending patterns of the construction workforces in their localities. At sites dominated by small rural PACs, workers will not be faced with extensive spending opportunities. Most purchases are likely to be small-scale such as food/drink items for immediate consumption or to be taken back by workers to their homes. This may lead to an increase in prices of some items at certain times of the year. Equally, it may give rise to an informal two-tier pricing system where higher prices are charged to 'outsiders' and lower prices to local or long-standing customers.

Expenditure in Rustavi and towns will not be of sufficient scale to result in inflation because of the size of the local economies. Overall, a boost to earnings for sellers of fruit and vegetables that can be easily consumed 'on the spot' or for 'cottage industry' food producers of honey and fruit/vegetable preserves, and, finally, for shop-owners is more likely than any significant increase in inflation above the base trend.

Any rise in prices is unlikely to affect utility prices, healthcare and housing costs. Thus, vulnerable groups are unlikely to be adversely affected, except for the possibility of some small and possibly seasonal increase in the prices of food/drink items. Should the government be successful in maintaining current low levels of inflation for the next four to five years then that will assist vulnerable groups more than the potential for adverse effects arising from small-scale and intermittent inflationary pressures.

Local level – loss of existing employees
Some small enterprises and the public sector may lose some key skilled workers. It may be difficult for employers to replace them easily and output/services may decline until replacements can be recruited and, if required, trained. This may threaten the viability of some enterprises, but as the number of enterprises is relatively small in terms of the local economies, particularly in rural PACs, this impact is likely to be very limited in scale.

Local level – retrenchment
The cumulative loss of many jobs towards the end of the Project construction phase will have an adverse effect on many PAC households in terms of livelihoods and incomes. Their standard of living is likely to fall as they return to previous livelihood patterns. Some may have been able to save some money to invest in their land or to set up small businesses, but overall the impact is likely to be adverse.

Local level – agricultural production
This may decline in some PACs if self-employed, unwaged subsistence farmers take up work on the SCPX Project. Their land may be left untended or under-utilised and decline in quality. Any decline in land quality/productivity over a two- or three-year period may require considerable effort and some financial investment on the part of the owner to recover its

[11] CPI is a measure of inflation.

previous potential. This potential situation will compound the problems of adjustment faced by those who lose their paid jobs.

Local level – beekeeping/honey production
Beekeeping is not a major commercial activity in the PACs. About 1% of CSG2/access road households keep bees with an average of 8 hives per household. Fewer CSG1/pipeline loop PACS keep bees (0.2%) but the average number of hives is slightly larger at 8.5 per household. No PRMS households keep bees. Apiculture is practised to provide honey for personal use and occasional sale. Honey production/sale is likely to be a major source of income in fewer households than actually keep bees. Honey production is important, however, for those households that keep a substantial number of hives.

SCPX activities may physically disturb bees where hives are located within about 300 metres of the pipeline or access routes. This is primarily due to dust (bees are sensitive to intensive dust on themselves and the surrounding flora), noise of the machinery and vibration at very short distances. Once the honey production season begins, bees, if moved, will attempt to return to their original home even if the hive has been moved, unless the move is several kilometres or only a few metres. Literature sources provide a range of acceptable distances with various web-sources quoting distances between 3km and 5km for the upper figure and 2m to 10m for the lower figure. In New Zealand, a 5km distance is generally recognised as being the minimum when shifting hives to ensure that they will not return to their old hive site (Matheson, 1997). There is a potential for adverse impacts on the livelihoods of some households if honey production is affected.

Where hives are located within foraging distance of the pipeline corridor and CSG2 access road, honey production may be affected by loss of vegetation due to ROW preparation. However, with a ROW of approximately 36m and 20m respectively and assuming that there is an equal distribution of flora suitable for honey production in the foraging radius, the loss of area would be insignificant.

Local level – accidents to livestock
A number of the potentially hazardous situations discussed in Chapter 12 that may cause human casualties can also cause casualties to livestock (such as open or flooded trenches, and construction traffic flows). Loss of livestock can adversely affect household livelihoods. Livestock includes poultry, as well as cows, sheep/goats, which are often allowed to roam freely during the day and therefore may be vulnerable to increased traffic flows.

Operational phase

Once operational, employment requirements will vary, but the number of workers employed will be very low compared to the construction phase. At all Facilities skilled and professional/administrative staff will be the main component of the workforce. It is likely that most of these workers will not be sourced from the local PACs. However, there will a few jobs available that may be filled by local residents, including women.

During this phase there is the potential for damage to crops resulting from security patrols.

Impact summary and assessment of significance

Table 10-39 provides an assessment of the significance of impacts on economy, employment, skills and livelihoods before and after implementation of the proposed mitigation measures that are presented in the following section.

Table 10-39: Potential Impacts on Employment, Skills and Livelihoods

Issue		Potential Impacts	Potential Impact Significance*	Mitigation and Enhancement	Residual Impact Significance*
A28	Employment	Increase in jobs available and incomes, leading to enhanced circulation of money in local/PAC economies resulting in overall economic growth, albeit small scale	Beneficial	28-04, 28-02, 28-03, 28-05, 28-06, 28-07, 28-08	Beneficial
		Enhanced economic growth on Kvemo Kartli and Samtskhe-Javakheti and consolidation of existing growth trends in towns of Akhaltsikhe and Tsalka	Beneficial	28-03, 28-04, 28-02, 28-05, 28-06, 28-07, 28-08, 28-17	Beneficial
		Unmet employment expectations and/or resentment between local people who are employed by the project and those whose applications were unsuccessful	C5 High	28-03, 28-04, 28-02, 28-05, 28-06, 28-07, 28-08, 28-15, 28-23, 28-22	C4 Medium
		Local concerns associated with recruiting local contractors/workers from regions away from the Project	C3 Medium	28-02, 28-03, 28-08, 28-17, 33-01, 33-03, 33-13	C2 Low
		Improved standard of living for households with members who have increased incomes due to employment of local people	Beneficial	-	Beneficial
		Enhanced skills among local workforce	Beneficial	27-11, 28-09, 28-10, 22-02, 28-11, D33-01, 19-06, 28-12, 28-13	Beneficial
		Retrenchment/loss of jobs	C5 High	28-14, 28-11, 28-21, 28-22	C4 Medium
		Loss of skilled employees to SCPX from small- and medium-sized enterprises and public sector and adverse effect on output/service delivery	C2 Low	28-02, 28-05	C2 Low
		Agricultural lands not cultivated for a period of 2–3 years as self-employed subsistence farmers work for SCPX and then farmers find it difficult to take up farming again after losing jobs	C2 Low	28-20	C2 Low
A29	Provision of goods and services	Increase in sales for local businesses and those involved full/part-time in 'cottage' industries	Beneficial	28-18, 1-02, 29-03	Beneficial

Issue		Potential Impacts	Potential Impact Significance*	Mitigation and Enhancement	Residual Impact Significance*
		Resentment from business owners whose offer of goods and services is refused	C3 Medium	28-18, 1-02, 29-03	C2 Low
A33	Community relations	Tensions resulting from cultural differences, anti-social behaviour of construction workforce, potential prostitution and attraction of 'hangers on' at camp sites	C5 High	33-02, 33-03, 33-04, 33-06, 33-08, 33-09, 33-10, 33-11, 33-13, 33-15	C4 Medium
		Frustration and resentment if local workers perceive that foreign workers are receiving better pay or conditions for exactly the same job	C5 High	33-01, 28-14, 28-15	C4 Medium
A37	Use of local road network	Accidents to livestock resulting in livelihood loss	C3 Medium	34-01, 33-13	C2 Low
A34	Loss of field boundaries	Accidents to livestock resulting in livelihood loss	C3 Medium	32-05, 32-07, 34-01, 33-13	C2 Low
		Impediment to agricultural use of land	B2 Low		A1 Low
A21	Open excavations	Accidents to livestock resulting in livelihood loss	C3 Medium	32-01, 34-01, 33-13, 32-04	C2 Low
A24	Dust	Less honey production and livelihood loss	C3 Medium	24-05, 24-06 2-02, 24-01, 24-02, 23-06, 23-05, X8-01, X8-02, OP13, OP23	C2 Low

* Assessed using Tables 3-20 and 3-22

10.14.4 Mitigation

At the design stage

Environmental and social considerations have been included in decisions on identifying construction camp locations.

In the construction phase

Employment

Targets for local recruitment from PACs will be agreed with the Contractor (28-04). The Project will seek to manage employment expectations by explaining the number and type of opportunities in advance to local communities via the Community Liaison Officers (28-05). Unskilled labour will be preferentially recruited from the Project affected communities (28-02). The Project will give priority to people from the construction camp PACs for employment opportunities within the camp (e.g. cook, housekeeper etc.), where suitably qualified (28-23). Applications for employment will only be considered if submitted via the official application procedure (28-03).

Recruitment procedures will be transparent, public and non-discriminatory and open with respect to ethnicity, religion, sexuality, disability or gender (28-06). Clear job descriptions will be provided in advance of recruitment and will explain the skills required for each post (28-07). Job vacancies will be advertised in the PAC through appropriate and accessible media (consistent with employment targets) (28-17). Community Liaison Officers will monitor that PACs are given priority in recruitment and that recruitment is non-discriminatory in terms of PACs and ethnicity (28-08).

The Contractor will prepare a retrenchment plan, with the aim of reducing the impacts of cessation of employment contracts (28-21) including for example and as appropriate, the implementation of a transparent retrenchment process and mechanisms of consultation with the workforce. The Contractor will explain the temporary nature of jobs during the recruitment process and explain to workers the need to prepare for losing jobs and to manage their income wisely while employed (28-22). The Contractor will advise workers about risks of neglecting their land during recruitment process (28-20).

When appropriate, on the job training will be provided to enable local employees to gain new and/or improved skills while working on the Project (28-09). The workforce training programme will include refresher and induction training with the aim of ensuring that all recruits have the necessary understanding and knowledge levels for each job, in particular with regard to HSE issues (28-10).

Environmental and social issues will be included in workforce and visitor induction training (28-11):

- Minimising energy consumption (22-02)
- Issues relating to archaeological awareness (27-11)
- Wildlife sensitivity to disturbance (19-06).

Particular emphasis will be paid to health and safety and community relations, with additional technical toolbox talks given on specific issues (28-12). Additional on-the-job informal training sessions and discussions will be provided as necessary during construction of the different SCPX component Projects (28-13).

All employees will receive at least the minimum wage as defined by Georgian legislation (33-02). All workers will have contracts describing their job description and conditions of work, and will have the contents explained to them (28-14). As part of the recruitment programme Community Liaison Officers will seek to manage any misconceptions in the community about perceived differences in pay or conditions (28-15).

Procurement of goods and services
Environmental considerations will be included in the Project procurement process (1-02). A plan will be developed and implemented that will aim to discourage and prevent the workforce from purchasing goods from informal vendors, to discourage vendors from establishing themselves at construction camp fence-lines in the hope of securing additional business (28-18).

Taking into account relevant commercial considerations as appropriate, the Project will seek to purchase goods and services from within Georgia and will monitor such purchases (29-03).

Bee-keeping/honey production
Measures to control dust included as mitigations in Table 10-39 and considered in Section 10.8.4 will help to prevent impacts on bees and honey production. However, two specific measures will be implemented to further mitigate the potential impacts. Community Liaison Officers will identify any beekeepers whose hives are within 300m of the pipeline and facility construction, camp and pipe storage areas or access routes before the start of the honey production season. These beekeepers will be asked to move their hives (both mobile hives and stationary hives) a suitable distance (at least 300 metres) from the route for the season (24-05). The Company will develop and implement a policy for the compensation of beekeepers adversely affected by Project impacts (24-06).

Grazing and livestock management
The Project will consult with local government authorities, land owners and users, including graziers, before restricting access to land and will establish the need for temporary fencing (32-01). Any field boundaries that are removed will be replaced with temporary fencing,

where feasible, to meet reasonable landowner/user requirements (34-01). The Project will provide a substitute for watering holes used by livestock that cannot be used due to Project-related actions. The substitute will be of a type, and in a location, to be agreed with representatives of the livestock owners and herders (32-04).

The Company Land Acquisition Team, environmental representative and the construction contractors will carry out an exit inspection with the previous landowner/user of all land that was used during the construction period (32-05).

Community relations

A Company policy limiting alcohol consumption in construction camps will be applied (33-08). The Community liaison teams will maintain regular liaison with local communities before, during and after construction (33-03). An employee Code of Conduct will be prepared and issued to all recruits and camp residents during the employee induction process (33-04). The Project will review measures to mitigate community health and safety impacts regularly, and consult PAC leaders every six months, informing them on the status of implementation and results, and discussing any changes needed to the 'Pollution Prevention Plan' or the 'Community Health, Safety and Security Plan' in advance of proposed changes (33-15).

The Employee Code of Conduct will prohibit the workforce from participating in illegal activities, including use of illegal drugs, bribery and corruption or requesting or receiving gifts from communities (33-06). A Company policy limiting alcohol consumption in construction camps will be applied (33-08).

Workforce training will include a briefing on camp rules and awareness of local social issues and sensitivities (33-09). No unauthorised access to, or use of, camp facilities will be allowed (33-10).

No hunting, fishing and unauthorised gathering of products (including plants and cultural heritage artefacts) by the workforce will be allowed (19-05).

A range of recreational facilities will be provided within the camps to reduce the need for finding recreation in the local community (33-11).

The Contractor will be required to develop and implement a Grievance Procedure to provide opportunity for local residents to raise concerns (33-01) Mechanisms shall be put in place that allow individuals to express grievances about Project-related activities and employees. As part of such mechanisms a grievance register will be used to document all third party grievances, corrective actions and outcomes (33-13). If the issue is not satisfactorily resolved through the Grievance Procedure, Georgian legislation provides for aggrieved parties to take action through civil courts.

In the operational phase

A community development initiative has been in operation in Georgia since 2003 to build and maintain positive relationships with the pipeline communities by socio-economic development. The next phase of the programme is planned to start in 2012 and will include the SCPX Project communities.

10.14.5 Residual Impacts

Overall the SCPX Project will bring economic benefits to Georgia and the two regions of Samtskhe-Javakheti and Kvemo Kartli and to towns near to the Project development areas. It is also expected to have a relatively small beneficial effect on PAC employment levels and some household incomes/standard of living during construction, but no impact once it is operational. It is inevitable though that some people will be disappointed not to secure employment on the Project. The impact in terms of un-met employment expectations despite the measures taken to provide transparent information is therefore classified as medium.

There will be significant phases of retrenchment where many will lose their jobs in a short timescale. This will have an adverse impact on individuals, households and many small PACs. This impact can be mitigated, to some extent and the residual reduced to medium.

Some small-scale economic disruption is likely to occur as small and medium enterprises and public sector organisations lose employees to SCPX and agriculture is neglected by farmers who obtain an SCPX job. These impacts cannot be easily mitigated and are of low significance.

Despite the mitigation measures there remains a reasonable probability that there will be community dissatisfaction with elements of job allocation and remuneration, potentially causing localised public expressions of discontent or even acts of civil disobedience. This potential impact is considered to be of medium significance.

There remains a reasonable probability that there may be tensions (and, potentially, localised expressions of conflict between the construction camp workers (especially if perceived to be 'foreigners') and local people. This potential impact is of medium significance.

Through providing goods and services to the Project, some people will enjoy an increased income for a short period, which will be beneficial. However, there may be resentment from those who do not benefit from the Project. This impact will be localised and is therefore assessed as being of low significance.

The residual impact on beekeepers and livestock owners/herders is expected to be low.

10.15 Infrastructure and Services

This section discusses potential impacts on infrastructure and services (including roads, electricity and water supply) during construction and operation of the SCPX Project and associated mitigation measures to be adopted.

10.15.1 Aspects of SCPX Project that Could Affect Infrastructure and Services

The SCPX Project will:

- Provide economic opportunities that may attract in-migrants, thus putting pressure on existing infrastructure and services, see Section 10.11 and Section10.14
- Undertake earth-moving/excavation works that may inadvertently damage existing infrastructure
- Use existing infrastructure and utilities for construction camps and other temporary or permanent aboveground facilities and existing roads for access to Project sites
- Undertake earth-moving/excavation works that may inadvertently affect surface drainage systems such as springs or wells that may be used for domestic water supply and/or irrigation water.
- Construction of three main road crossings and one rail crossings
- Widening and upgrading temporary access roads to the ROW
- Construction of new sections of the CSG2 access road.

The following potential Project impacts on infrastructure are assessed elsewhere in Chapter 10. In particular, the Project will:

- Use roads and railways, with the potential to create congestion and increase the risk of accidents, see Sections 10.12 and 10.16. The potential impacts of noise and vibration from construction traffic on buildings is addressed in Section 10.9
- Cross irrigation channels and canals see Sections 10.5 and 10.13.

10.15.2 Key Sensitivities

Many PACs are dependent on electricity for cooking, and in urban PACs by the ROW many households also use mains electricity or mains gas for heating. These PACs would be sensitive to any works that required the supply of electricity or gas to be interrupted or which inadvertently caused outages or a diminution in the supply.
Key sensitivities include:

- Infrastructure/utility services (quantity and quality of supply)
- Road conditions and ease of traffic flow/access:
    - The majority of main public roads to be used for the SCPX Project are in good condition however certain sections are still under construction such as the east-west highway by Gori
    - Many of the smaller roads are in poor condition, such as those in the vicinity of CSG2 and the road leading from the industrial area of Rustavi to the CSG1 site.

10.15.3 Impacts on Infrastructure and Services

It is known from the baseline survey that the quantity and quality of infrastructure and utility services is a key issue for many PAC residents (see Section 8). The design and operating principles for early works accommodation and construction camps is not yet finalised, but it is expected that they will be self-sufficient in terms of energy supply.

The main potential impacts during construction are as follows:

- Temporary loss or reduction in utility supply to other consumers
- Infrastructure capacity exceeded with reduction in service quality and quantity to all other consumers
- Wear/degradation of road surface - by using local roads for access to the ROW, construction vehicles will cause wear of the surface. When roads are used frequently by heavy trucks, the surface may deform and ruts may be caused. Where heavy over-sized loads are transported, the weight may cause cracks to appear in bridges and support structures
- Loss of access to church (CSG2)
- Loss of local access to certain dwellings on the edge of Poladaantkari village
- Traffic congestion and delays, particularly during movement of long or heavy loads
- Road widening and upgrades may result in easier and faster travel for PAC residents thus assisting integration into the wider economy.

In the operational phase the Facilities will be self-contained in terms of waste water disposal. CSG1 and PRMS may move to an electrical grid connection for site power supply (i.e. heating and lighting) in the future.

New road
The public will be allowed to use parts of the CSG2 access road as far as security and safety concerns permit. This may result in easier and faster travel to the Millennium Road for PACs including Burnasheti, Kizilkilisa and Oliangi and assist their integration into the wider economy.

Impact summary and assessment of significance

Table 10-40 provides an assessment of the significance of impacts on infrastructure and services (including roads) before and after implementation of the proposed mitigation measures that are discussed in the following section.

Table 10-40: Potential Impacts on Infrastructure and Services

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A35	Damage to third-party infrastructure (pipelines, cables etc.)	Temporary loss of supply to other consumers	D3 Medium	D30-01, 35-01, 35-02, 35-03, 35-04, 35-09	D2 Medium
A37	Use of local road network	Road widening and CSG2 construction resulting in more efficient transport links for local people	Beneficial		Beneficial
A37	Use of local road network	Damage to road from aggregate and oversize heavy loads – CSG1	C4 Medium	37-18, 37-20, 37-07, 37-08 Also refer to Section 10.16	C3 Medium
		Damage to road from aggregate and oversize heavy loads – CSG2 and access road	C5 High		C3 Medium
		Damage to road from aggregate and oversize heavy loads – PRMS	D4 High		D3 Medium
A38	Road closure	Restricted access to church at CSG2 preventing local community use	C4 Medium	X15-01	C2 Low
A38	Road closure	Restricted access to local access track to some dwellings on the edge of Poladantkaari village preventing local community use	C4 Medium	X15-02	C2 Low

* Assessed using Tables 3-23, 3-25/26

10.15.4 Mitigation

At the design stage

Construction design of river and stream crossings will seek to ensure minimal interruption to flow by using measures such as pumping, channel diversions and fluming (11-02). Where it is considered that there is a higher risk of the pipeline being damaged or interfered with, or where other services are crossed and at track and road crossings, the pipeline will be covered by concrete slabs at open cut crossings (D30-01).

In the construction phase

Services (water and electricity supply)

The Contractor will prepare a Method Statement that includes measures to protect the integrity of the third party services and is acceptable to the service operator (35-01). Pre-entry agreements including reinstatement requirements will be agreed prior to work affecting third party assets (35-09). Any damage to third-party services to be repaired promptly in consultation with, or by, the service operator (35-02). Any planned diversion of services will be communicated to local authorities and affected communities at least 72 hours in advance of the works (35-03). In the event of a disruption to services the Contractor will work with the service owner to effect repair in reasonable time (35-04).

Infrastructure (roads and access)
The Project will use the existing access roads established for construction of the BTC and SCP pipelines to access the pipeline ROW as far as practical (37-18). Prior to selection, all access routes will be subject to a multidisciplinary assessment (37-20), including for example including consideration of ecological sensitivity, known archaeological sites and potential impacts on community health and safety and infrastructure. Following construction, the Contractor will repair roads to at least their pre-construction condition (37-07). The surface of frequently used access roads will be subject to regular inspections and repair, with the aim of ensuring they are maintained in a good condition particularly where fragile buildings are close to roads (subject to site-specific survey) (37-08). The mitigation measures described in Section 10.16 to reduce traffic flows e.g. D5-036, D5-055 will also assist with mitigating potential impacts on existing roads.

Access to the church located close to CSG2 will be maintained throughout construction as long as the Project considers it safe to do so (X15-01). If the Project affects the existing access track at the Pipeline Camp on the edge of Poladaantkari an alternative access will be provided to dwellings in the village. The Project will locate the access as close as is practical to the existing track, taking into consideration potential health and safety impacts (X15-02).

10.15.5 Residual Impacts

Unplanned damage or disruption to infrastructure and utility services will reduce in probability, but cannot be eliminated and the residual impact is of medium significance.
The transport of oversize heavy loads of process equipment on public roads will cause some traffic congestion. Most of these deliveries will be to CSG1, where the roads are suitable, or to CSG2 where they will follow the Millennium Road and the dedicated CSG2 access road. Although the PRMS has fewer loads, the roads they have to pass along are less suitable. This is considered to have medium significance.

Any improvements to existing roads will benefit the communities as transport of people and goods will be easier and more cost-effective. In some cases it may be of more direct economic benefit to local communities if access to markets for goods/services is enhanced.

10.16 Traffic and Transport

This section discusses potential impacts on traffic and transport during construction and operation of the SCPX Project and associated mitigation measures to be adopted.

10.16.1 Aspects of SCPX Project that Could Affect Traffic and Transport

The following Project activities could affect traffic and transport in the Project area:

- Additional vehicle movements causing disturbance and inconvenience to local users and increased threats to health and safety of local people (considered in Section 10.12)
- Disruption of traffic flows causing inconvenience to local users
- Transport of aggregate from quarries and borrow pits to construction sites and the ROW
- Transport of line pipe from pipe yards to the ROW
- Transport of equipment from rail heads to lay-down areas at the facility construction sites
- Transport of workers between construction camps and construction sites

10.16.2 Key Sensitivities

The key sensitivities associated with traffic and transport are as follows:

- The smaller roads are subject to use by agricultural traffic in the Tsalka region

- The road between Marneuli and Tbilisi is busy, as it is the main route between Tbilisi and the south-west
- A large proportion of the traffic near Akhaltsikhe (in the vicinity of the PRMS access routes) is heavy vehicles
- There is a greater use of bicycles in Rustavi at weekends.

10.16.3 Impacts on Traffic and Transport

In the construction phase

Traffic disturbance at the CSG1 and the ROW

Transporting the workforce to the ROW, to the construction camps and, in the case of non-camp resident workers, from villages to the construction sites will need a different number of vehicle movements at different stages of the Project. When CSG1 construction manning is at peak levels (in 2016), it would take at least 20 buses to move the workforce to and from the site. The camp locations have been selected close to the facilities, which minimises the need for transport personnel on public roads. It is not known what proportion of the workforce will be employed from local communities that will need to travel to the construction sites either in private vehicles or in buses. If it was 50%, there would be 10 buses per hour forming about 1% of hourly average flow on the road south of Rustavi (or 300 cars that would double the current peak flow) travelling on the roads to CSG1 at the start and end of the working day.

Early in the Project fewer vehicles would be needed for worker transport, but to transport 513,000m^3 of aggregate from a borrow pit to CSG1 in a three-month period could need 40 truck journeys/hour, increasing the average hourly traffic flow on the road south of Rustavi by 48%.

An estimated 64 oversize heavy loads will be needed to transport modules of process equipment for CSG1 from the rail head at Rustavi to the CSG1 lay-down area. Transporting these loads may need overhead lines and street furniture to be lifted, irrigation crossing bridges to be reinforced.

The line pipe will be delivered to the pipe yard at Rustavi by rail, but it will take approximately five round trip truck journeys per hour to deliver them to the ROW in two months. That would be less than 1% of the average hourly traffic flow at Rustavi or Marneuli.

Additional vehicle movements could congest the flow of traffic causing delays and inconvenience to local road users. Increasing the traffic on busy roads also increases the threats to health and safety of local people (see Section 10.12).

Traffic flows are also disrupted if unusually wide or heavy loads are moved by vehicles travelling at slow speed.

On narrow roads that are used mainly by agricultural vehicles at slow speed, they may congest the flow of construction traffic.

Traffic disturbance at CSG2

Transporting the workforce to the construction camps, and, in the case of non-camp resident workers, from villages to the construction sites when CSG2 construction manning is at peak levels (in 2017) would take at least 25 buses. The camp location has been selected close to the facility site, which minimises the need for transport personnel on public roads. It is not known what proportion of the workforce will be employed from local communities that will need to travel along the CSG2 access road to the construction sites. If a significant proportion of the workforce travels in private vehicles, parking would become an issue. If 25% of the workforce is non-camp resident, their cars would increase the hourly average flow on the road at Tsalka (currently only 26 vehicles per hour) by many times at the start and end of the working day.

Early in the Project fewer vehicles would be needed for worker transport, but to transport 252,000m^3 of aggregate from a borrow pit to construct the construction camp and CSG2 site access in a one-month period could need 40 truck journeys/hour, increasing the average hourly traffic flow on the Millennium Road by two and a half times the numbers of vehicles currently on the road.

A substantial number of vehicle movements would also be needed to transport supplies of food and fuel to the camp.

It is estimated that 59 oversize heavy loads will be needed to transport modules of process equipment to CSG2 lay-down areas via the Millennium Road and the CSG2 access road.

Traffic disturbance at PRMS
The workforce at the PRMS is smaller than at the other facilities and would only need five buses a day to travel the short distance between the construction camp and the construction site (approximately 10% of average hourly traffic flows in the vicinity of Akhaltsikhe).

Early in the Project fewer vehicles would be needed for worker transport, but to transport 52,000m^3 of aggregate from a borrow pit to construct the camp and site in over a five-month period could need 6 truck journeys/hour, increasing the average hourly traffic flow on the Akhaltsikhe road by 10% the numbers of vehicles currently on the road.

Five heavy oversize loads will need to be transported from a railhead approximately 15km from the PRMS that passes through some villages.

Road crossings
The ROW will cross the road leading north from Akhali Samgori (KP25.7), the main road leading north from Rustavi to Tbilisi (KP36) and the main road from Marneuli to Tbilisi (KP53.5). In each case the pipeline will be installed below the road using non-open-cut pipe-jacking techniques that will not disrupt the flow.

There will also be an increased risk of accidents with animals or people (see Community Health and Safety in Section 10.12 and Economy, Employment, Skills and Livelihood in Section 10.14) and buildings may be damaged by vibration (see Section 10.9). Impacts on infrastructure caused by increased traffic flows are assessed in Section 10.15.

In the operational phase

Traffic generated by the operational phase will be very limited and have negligible effects on other road users or the physical state of the road network.

Impact summary and assessment of significance

Table 10-41 provides an assessment of the significance of impacts on traffic in the three development areas before and after implementation of the proposed mitigation measures that are discussed in the following section.

Table 10-41: Assessment of Impact of Traffic and Transport

Issue		Location	Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A37	Use of local road network	CSG1/ROW area roads	Disruption of traffic flows causing inconvenience to local users and Traffic disturbance	C5 High	D33-01, D5-055, D5-036, 37-03 to 37-05, 37-09 to 37-11, 37-14, 25-02, OP25, 30-21	B5 Medium

Issue		Location	Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
		CSG2 and CSG2 access road	Traffic disturbance	C5 High		C4 Medium
		PRMS area roads	Traffic disturbance	D3 Medium		D2 Medium
A38	Road closure		Disruption of traffic flows causing inconvenience to local users	D3 Medium	37-01, 37-02, 37-03, 37-14	D1 Low

* Assessed using Tables 3-24 and 3-25

10.16.4 Mitigation

At the design stage

CSG1, CSG2 and PRMS

The Project has selected construction camp locations on the same sites as, or very near to, the major facilities (D33-01) to reduce the construction traffic on public roads.

In the construction phase

Pipeline

The Project will undertake a road condition survey before construction begins in areas as defined by Project (37-17).

A pipeline construction camp will be established near Poladaantkari, north of Rustavi. It is conveniently located for access to the ROW and close to rail offloading area and the pipe yard in Rustavi. A pipe yard will be established a short distance from the rail offloading area in Rustavi. Five thousand 12m lengths of 56" line pipe will be imported into Georgia from pipe-fabricating/pipe-coating factories via the Black Sea ports of Batumi or Poti. Each length of line pipe weighs 8.5 tonnes. The line pipe will be transported by rail to off-loading points. The rail offloading point will be located close to the pipe storage area to reduce the number of HGV movements (D5-036).

Line pipe shall be transported by trucks from the pipe yards to the ROW along approved access routes and then along the ROW to the required location (D5-055).

Minor road and track crossings will be accomplished by open trenching. Where it is necessary to maintain traffic flow, the crossing will be made in two stages, and only one half of the road width will be used at a time. Steel plates will be laid to maintain one lane of through traffic (37-14).

The following crossings road crossings will require traffic to be diverted away from the construction spread:

- Railway at KP53 will be non-open-cut (pipe jack subject to survey of rail track)
- Road at KP25.7 will be non-open-cut (pipe jack) and traffic control in place for construction traffic
- Road at KP36 will be non-open-cut (pipe jack). Traffic control will be put in place for construction traffic
- Road at KP53.5 will be non-open-cut (pipe jack). Traffic control will be put in place for construction traffic
- Algeti River at KP54.5 will be open-cut. Construction traffic will be diverted around the river
- Large irrigation channel and road at KP12

- Mtkvari River crossing at KP30.

Where traffic is diverted around crossings, traffic control or careful selection of the exit from the working areas will be provided with the aim of ensuring vehicles join the road in a safe manner (30-21).

CSG2 and access road
The CSG2 access road design has a carriageway 6m wide with a 1m-wide gravel hard shoulder on either side and a maximum gradient of 7%.

In the construction phase

Advance warning (at least 72 hours) of any road/track closures will be provided to local communities (37-01). A bypass or alternative route will be provided at locations where road closure is unavoidable (37-02).

Temporary traffic control (e.g. flagmen) and signs will be provided where necessary to improve safety and provide directions (37-03).

Temporary traffic control measures will be employed at road crossings and junctions (flagmen, temporary traffic lights) where a safety risk assessment has identified traffic control measures will reduce the risk of traffic accidents (37-04).

The authorities will be notified when oversize heavy loads need to be transported and the loads will be escorted by the Project (37-05).

All contractors and subcontractors will adhere to BP driving rules (37-09). Night-time driving will be by exception only, as approved by the Company, to minimise driving risk and disturbance to communities (37-10).

Driver training will include advice on behaviours to reduce the potential for disturbance, including use of horn, loud radios with windows open, switching engines off when not in use, strictly observing speed limits and not accelerating or braking aggressively (25-02).

The Project will aim to provide buses to transport non-camp resident workers to the construction sites (37-11).

In the operational phase

The movement of SCP vehicles and those associated with the transfer of goods and materials to and from the SCPX facilities will also generate noise. The effects of these movements on nearby communities and wildlife populations will be mitigated through the following actions:

- Night time driving will be by exception only, as approved by the Company, to minimise driving risk and disturbance to communities (37-10)
- Driver training will include advice on behaviours to reduce the potential for disturbance, including use of horn, loud radios with windows open, switching engines off when not in use, strictly observing speed limits and not accelerating or braking aggressively (25-02)
- Operations will liaise with the government authorities to establish guidelines regarding patrol behaviour with respect to access to/transit through agricultural lands and the reporting of any damage (OP25).

10.16.5 Residual Impacts

If the proposed mitigation measures are implemented and non camp-resident workers are transported by bus, the residual impacts on traffic can be summarised as follows:

- The number of additional vehicles will cause a minor or moderate increase in traffic congestion on the roads. This would be most apparent on the roads by CSG2 and the PRMS, which have low baseline traffic flows and where some roads are narrow or in poor condition. This is considered to have medium significance at CSG2 and PRMS and low significance at CSG1/Pipeline ROW
- Road closures will lead to some disruption to traffic flows and inconvenience to local users, which is considered to be of low significance.