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

TABLE OF CONTENTS

Tables

Figures

10 ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION (PLANNED ACTIVITIES)

10.1 Introduction

This chapter describes the potential environmental and social impacts associated with undertaking the planned elements of the WREP-SR Project. It also addresses issues raised during consultation meetings and discusses the proposed mitigation measures which aim to reduce or remove the potential impacts or enhance potential beneficial effects.

Mitigation measures, described in this chapter, focus primarily on impacts associated with planned construction activities as described in Chapter 5 Project Description. This impact assessment does not cover operation of the existing WREP pipeline, for which established plans and procedures are in place. Nevertheless, a few operational mitigation measures[1] have been developed as a result of this impact assessment to address potential operational impacts associated with WREP-SR sections that are new or different to those currently managed under existing WREP operations procedures.

It should be noted that this chapter deals only with the assessment of routine events and minor spills such as would occur during generic construction activities. Unplanned events (e.g. oil spill during de-oiling) are assessed in Chapter 12 Hazard Analysis and Risk Assessment (Unplanned Events).

10.1.1 *Activity, Aspect, Impact and Mitigation Tables*

The activities, aspects, impacts, mitigation measures and residual impacts associated with the WREP-SR Project have been identified in line with the methodology described in Chapter 3 (Approach and Methodology). They are presented in this ESIA as three key tables, which are in Appendix B:

- Table B-1 presents a matrix of **activities and environmental, social and cultural heritage issues** associated with construction of the new sections of pipeline and with the temporary access roads. Shaded cells identify which issues are relevant to each activity. Each issue is numbered (A0 to A42) to aid traceability throughout this section
- Table B-2 presents **potential project impacts** associated with each issue identified in Table B-1 and outlines mitigation measures to reduce adverse impacts or enhance potential beneficial effects. The significance of each impact has been scored before and after implementation of the mitigation measures, using the tables in Chapter 3 which take account of the sensitivity of the receptor and the magnitude of the potential impact. Significance is recorded as High, Medium or Low Adverse, or Beneficial
- Table B-3 presents **potential site-specific impacts** (i.e. those impacts relating to areas of particular environmental, social or cultural heritage sensitivity, as identified through the baseline surveys outlined in Chapter 7 and 8). Mitigation measures and scoring of impact significance is as per Table B-2.

A discussion of the sources of impact, the identified impacts for the WREP-SR Project and the proposed mitigation measures is provided in Sections 10.3 to 10.14. Each mitigation measure is numbered to allow cross referencing to Tables B-2 and B-3 and to the commitments register.

[1] Operational mitigation measures are denoted by a commitment number starting with OP, e.g. OP51.

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

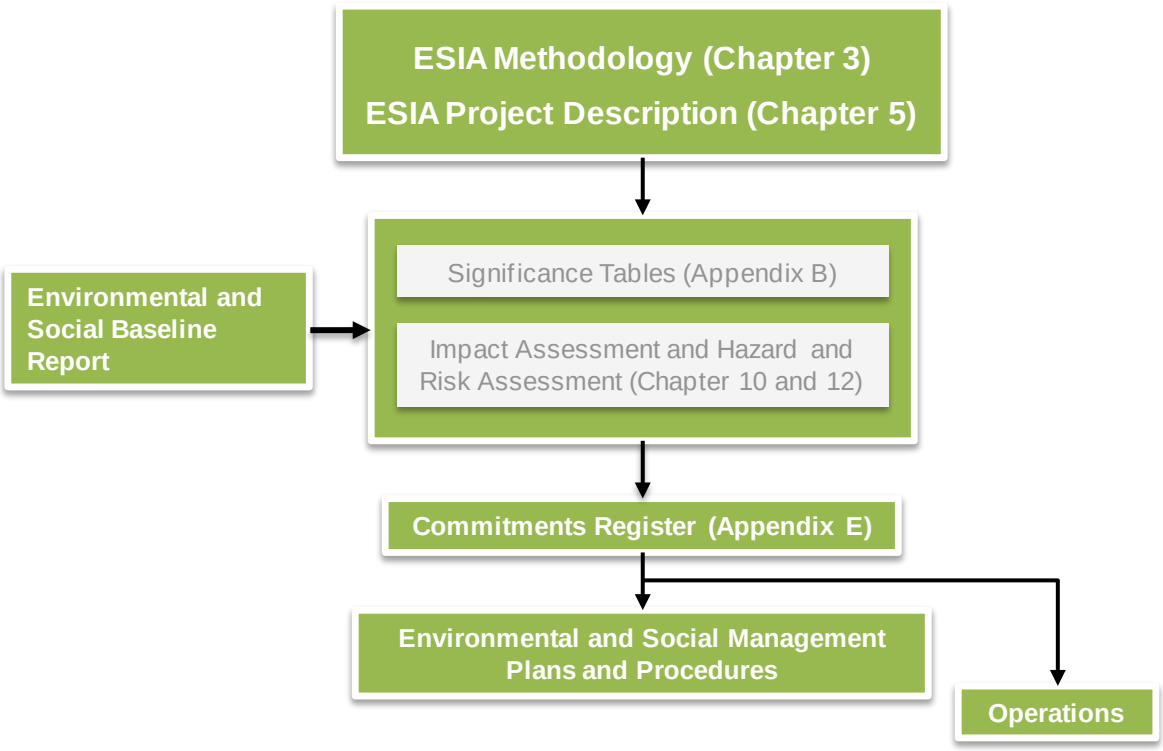

Figure 10-1: Schematic Showing Relationship between Impact Assessment and Commitments Register

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 which the listed measures aim to mitigate or manage, and the residual impact which may remain.

10.1.3 *Environmental and Social Management Plans and Procedures*

Each mitigation measure has been allocated a reference number and has been recorded in the Project's commitments register (Appendix E).

The primary mechanism for ensuring implementation of the commitments will be the project environmental and social management plans and procedures. The following management plans will be developed:

- Reinstatement Plan
- Ecological Management Plan
- Waste Management Plan
- Pollution Prevention Plan

- Resources 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.

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).

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

10.1.4 *Constraints Maps*

Constraints Maps are provided in Appendix A and include physical, biological, social and cultural heritage constraints. The maps illustrate the route specific constraints that are referred to in Table B-3, together with additional baseline information where useful to the reader. The maps should also be referred to when reading this chapter.

10.1.5 *Discussion of Impacts and Mitigation Measures*

The following sections provide a discussion of the main potential environmental and social impacts that are likely to arise as a result of development of the WREP-SR Project. The discussion focuses mainly on construction phase activities of the Project since existing WREP operations will resume after the Project has been completed and impacts associated with operation of the WREP system have been covered in previous EIAs. Impacts arising during the operational phase are only referred to if they are specific to the WREP-SR Project and not to the WREP system as a whole (e.g. monitoring of biorestoration of the WREP-SR sections that will continue after the end of the construction phase).

Mitigation of potential impacts is an integral part of the WREP-SR Project development, from conceptual design through to construction and operation.

Mitigation of impacts has been included during engineering design (e.g. reduction of the ROW in forest areas) as described in Chapter 4 Project Development and Evaluation of Alternatives and Chapter 5 Project Description.

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 WREP-SR 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 WREP-SR 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 impacts of the proposed WREP-SR Project with existing developments such as the SCPX and GOGC 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).

The interaction of individual impacts from the proposed WREP-SR 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 this Draft ESIA. WREP-SR Project design and routing decisions were influenced by taking account of such concerns (Section 9.6).

Examples of mitigation commitments designed to deal specifically with stakeholder concerns are as follows.

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).

10.2 Geology and Geomorphology

A discussion of the potential impacts on geology and geomorphology and associated mitigation measures to be adopted during construction of the WREP-SR Project is provided in this section.

Impacts on geology and geomorphology will be very limited as no blasting is currently expected to be necessary during construction.

10.2.1 *Aspects of WREP-SR Project that Could Affect Geology or Geomorphology*

Aspects of the WREP-SR Project that could affect geology or geomorphology are:

- Aggregate extraction for use during construction (A1)
- The levelling of ridges and side slopes to form a safe working platform (A5, A9)
- Ground disturbance that could trigger landslides and debris flows (A5).

Impacts on geomorphology associated with construction along ridges are discussed in Section 10.4, Landscape and Visual Impacts, erosion issues associated with ground instability are discussed in Section 10.3, Soils and Ground Conditions and the risk of landslides and debris flows 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.

10.2.2 *Key Sensitivities*

Extraction of aggregates from new sites will be most sensitive in areas of natural habitat, the beds of surface water courses or known cultural heritage. The sensitivity of any new sites will be assessed as described below in Section 10.2.4.

10.2.3 *Impacts Associated with Aggregate Use*

It is estimated that approximately 50,000m^3 of aggregates will be required during construction. These will either be purchased from licensed suppliers or will be obtained from existing or new borrow pits or quarries. There is the potential for adverse impacts on ecology, water resources, cultural heritage and communities if borrow pits or quarries are poorly sited. There will also be an inevitable depletion of natural resources through the extraction and use of aggregates, although this will be small in magnitude. The significance of impacts associated with aggregate use is assessed in Table 10-1.

Table 10-1: Potential Impacts of Aggregate Extraction and Use

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, steel, oil and timber	B3 Low	1-01, 1-03, 1-05, 1-07, 1-09	B3 Low
		Operation of new or un-licensed borrow pits	B4 Medium		B2 Low

* Assessed using Tables 3-2, 3-3, 3-20 and 3-21

10.2.4 *Mitigation of Impacts Associated with Aggregate Use*

Aggregate impacts and mitigation measures relating to the use of aggregates and other quarried materials and the use of borrow pits are summarised below:

- Aggregates will only be sourced from licensed sources as approved by MENRP (1-01)
- The Project will give preference to using existing borrow pits where reasonably practical (1-03)
- 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 while they are in use by the Project and will include checks that no illegal extraction is occurring (1-05)
- All excavated materials will be screened and reused (e.g. for padding, backfilling etc.) to the extent deemed feasible by Company to minimise the need for new aggregates (1-07)
- All temporary borrow pits will be reinstated (unless instructed otherwise by regulatory authorities) (1-09).

10.2.5 *Residual Impacts*

With 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

A discussion of the potential impacts on soils and associated mitigation measures to be adopted during construction of the WREP-SR Project is provided in this section. The effects of ground conditions on the Project are also discussed. Details of reinstatement methods to be employed have already been provided in Section 5.7 of the Project Description chapter and should be referred to when reading this section.

10.3.1 *Aspects of WREP-SR Project that Could Affect Soils and Ground Conditions*

Project activities that may affect soil and ground conditions during construction and reinstatement of the WREP-SR Project are considered to be:

- Disturbance of soil during ROW and site clearance, potential widening of certain access roads and creation of new access roads (A2, A3, A4)
- Storage of topsoil and subsoil for re-use in backfilling and reinstatement (A2, A3, A4)

- Use of plant and equipment (A2, A4, A7)
- Use of the ROW as a vehicle running track to provide access to the works (A2, A4).

10.3.2 *Key Sensitivities*

Areas with high soil erosion potential are identified in Table 7-2 and areas of known contamination in Table 7-4.

10.3.3 *Impacts on Soils and Ground Conditions*

Compaction

Compaction of soils during construction may occur where the bearing strength is exceeded by the weight of construction vehicles. This is most likely on the ROW and access roads, which will be subject to repeated vehicle movements.

Soil compaction alters drainage characteristics and may cause surface run-off and localised flooding. It also decreases the ability of vegetation to re-establish and may reduce aeration levels (see Section 10.7.3). The latter can cause secondary impacts on soil micro-organisms and plant growth. Anaerobic and/or waterlogged conditions may develop and the viability of the seed bank may be reduced thereby impairing natural re-colonisation of the disturbed ground.

Soil properties

The depth of topsoil along the re-route sections is generally moderately thin (less than 100mm). However there are also a number of rocky areas where topsoil cover will be minimal which will make segregation of topsoil and subsoil more difficult.

Soil structure and nutrient content may be impaired, and therefore affect revegetation, if topsoil and subsoil layers are mixed during construction and/or storage, or if surplus subsoil is disposed of carelessly (e.g. by spreading over topsoil or vegetation).

Prolonged storage of topsoil can lead to a loss in fertility of the soil as nutrients become leached out by rainfall or anaerobic conditions can develop within the topsoil pile. It may also lead to the loss in viability of the seed bank contained within the stored soil.

Oxygen availability may be reduced by water logging of soils or prolonged storage; anaerobic conditions may develop if soil is stored for longer than 6 months.

Secondary impacts in terms of the above changes adversely affecting the establishment of vegetation following reinstatement are discussed in Section 10.7.3.

Erosion and soil loss

Preparation of the ROW and access roads, including removal of vegetation, topsoil stripping and benching, will disturb soil structure and stability. This will increase the risk of erosion particularly in areas where soils have poor cohesion or are steeply sloping. The erosion risk will be highest during wet weather, when runnels may develop, and will be exacerbated by vehicle movements.

A baseline assessment of the erosion Class of the soil along the pipeline sections has been undertaken and results presented in Chapter 7. Locations with the highest erosion risk are identified in Table 7-2. Construction activities may further decrease soil stability at locations prone to erosion; reduced soil stability may hinder effective reinstatement.

Topsoil removed from the ROW will be stored at the edge of the working area pending replacement during reinstatement. Topsoil stacks are usually poorly consolidated and therefore prone to erosion and soil loss.

Hydrotest water will be discharged either to land or to a watercourse. Erosion may occur at the point of discharge if the flow rate is inadequately controlled. This can lead to scour and increased sediment loading if the discharge is to a watercourse.

Where new access roads are built or existing roads widened, construction will entail the movement of topsoil and subsoil which will be permanently lost from its point of origin. Topsoil of any value will be re-used locally.

Ground settlement from removed from service pipe sections

The majority of the WREP pipe sections which are to be removed from service will be left *in situ* and filled with air at atmospheric pressure in line with the methodology described in Section 5.5.5. It is likely that these sections will slowly corrode and may eventually cause localised ground settlement and the creation of minor rills or gullies. These could form preferential surface water drainage routes and lead to surface erosion. Any subsidence is likely to be gradual and is therefore not considered to pose a significant risk to public safety.

Land contamination

Contaminated land impacts are addressed in this section in terms of:

- Undertaking construction in land that is contaminated
- Accidental contamination of land during pipeline construction or removal from service activities.

Pre-existing land contamination

A small number of contaminated and potentially contaminated sites were identified along the re-route sections as part of the baseline survey as detailed in Section 7.3.4. The impacts of encountering contaminated soils during construction could be twofold:

- Risk to health and safety of construction personnel (which is outside the scope of this ESIA)
- Risk of mobilising contaminants into the wider environment.

There is a chance that areas of as yet unidentified contamination may be encountered during pipeline construction, particularly in the following areas:

- Where the new pipe sections cross existing oil pipelines, which may have had underground leaks
- Areas where anthrax infected livestock may have been buried.

When contaminated land is disturbed, contaminants may be mobilised into the wider environment and could cause contamination of previously clean groundwater or surface water resources.

Contamination during construction

Activities associated with construction have the potential to produce soil, groundwater and surface water contamination. The principal potential contaminants associated with the construction activities are as follows:

- Fuels and lubricating oils

- Hazardous wastes
- Welding wastes and field welding and coating materials
- Paints and solvents
- Sewage from welfare units
- Hydrotest chemicals if used (e.g. biocides, oxygen scavengers and corrosion inhibitors)
- Hydrocarbons from de-oiling and cleaning of redundant pipe sections.

Soils, surface or ground water may become contaminated by fuel, oil and chemical spills from plant and by hazardous solid and aqueous wastes.

Contamination of surface waters by sediments running off construction areas is addressed in Section 10.5.

Impact summary and assessment of significance

Table 10-2 provides an assessment of the significance of impacts on soil resources before and after implementation of the proposed mitigation measures which are discussed in the following section.

Table 10-2: Impact Assessment Summary for Soils and Ground Conditions

Issue		Potential Impact	Potential Impact Significance*	Mitigation Measures	Residual Impact Significance*
A2	Soil compaction	Loss of drainage capacity with increased surface water run-off	C3 Medium	2-01, 2-02, 2-03, 2-04, 2-05, 2-07, 3-37	C1 Low
A3	Soil erosion following removal of vegetation and/or disturbance of ground	Loss of topsoil necessitating importation for reinstatement & associated risk of introducing unwanted species	C5 High	4-09, 3-23, 3-09, 17-10, 3-35, 4-08, 4-12, 4-15, 3-05, 3-03, 3-07, 3-08, 3-24, 3-26, D5-086	Generally C2 Low; C3 Medium on ridges and steep slopes
A17	Erosion leading to loss of natural habitat / vegetation		C2 Low	9-04, 3-03, 3-17, 3-28, 17-07, 3-15	C1 Low
A4	Loss of soil structure, fertility and seed bank	Development of anaerobic conditions in stored soil	C4 Medium	1-12, 4-09, 4-02, 4-04, 4-08, 3-11	C1 Low
A5	Ground settlement following installation of new sections or corrosion of redundant sections	Secondary impacts on animal safety	B2 Low	OP01	B1 Low
A6	Disturbance of known/unknown contaminated land	Mobilisation of contaminants with associated risk of polluting surface waters	C3 Medium	6-01, 7-05, 6-18, 6-22	C1 Low

Issue		Potential Impact	Potential Impact Significance*	Mitigation Measures	Residual Impact Significance*
A39	Accidental release of chemicals/oils	Soil contamination by accidental or uncontrolled discharge	C5 High	6-03, 6-05, 6-06, 6-09, 6-20, 6-12, 6-13, 31-04, 6-16, 23-02	C1 Low
A14	Production of black and grey water		C1 Low		C1 Low
A7	Production & disposal of solid & liquid waste		C2 Low	4-14, 6-03, 6-21, 6-24, 7-02, 7-03, 7-01 ,7-04, 7-08, 7-10, 7-12, 7-13, 7-14, 7-15, 7-16	C1 Low

* Assessed using Tables 3-2, 3-3, 3-6 and 3-7

10.3.4 *Mitigation of Impacts on Soils and Ground Conditions*

Compaction

In order to avoid compaction impacts outside the ROW, vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency) (2-02). Driving along the ROW will not be permitted in excessively wet conditions unless otherwise approved by the Company (2-03).

Load-bearing materials, such as bog mats, will be used to support heavy loads in areas of soft ground (including wetland areas) unless deemed impracticable by the Company (2-01).

Temporary drainage will be provided where necessary (as determined by the Company) to prevent ponding or water-logging of the working area (2-04). Surface water drainage from construction areas including access roads and temporary storage sites will be designed to minimise soil erosion in accordance with sustainable urban drainage systems (SUDS) principles (3-26). Where new sections of temporary road are required, drainage ditches will be included where necessary to reduce erosion/flooding of the road or adjacent land by rain or snow melt (3-37).

Back-fill will be adequately (but not excessively) compacted to prevent future settlement (2-05). After backfilling, the subsoil beneath the running track will be ripped prior to reinstatement of agricultural land (2-07) to alleviate compaction.

With implementation of the above measures, it is expected that adverse effects on soil compaction will be reduced from medium significance to low.

Soil properties

An important element in successful reinstatement and biorestoration of the ROW is topsoil handling.

Topsoil stripping depth will generally be to a depth of 300mm. In areas where topsoil depth is greater or lower than this, the stripping depth will be considered on a case by case basis with a view to minimising topsoil loss and mixing with subsoil.

Excavated subsoil and topsoil will be segregated and stored in free-draining stacks outside the running track to avoid mixing or compaction by construction plant/vehicles (4-02). This will ensure that sufficient soil is available for reinstatement at the end of the construction period and that the seed bank in the topsoil is not diluted by mixing with the subsoil.

Preservation of the natural seed bank is a fundamental requirement for successful biorestoration of the works areas (see Section 10.7.3). Topsoil stacks will be regularly

inspected for compaction and erosion and if topsoil is stored for more than six months, the stacks will be monitored for anaerobic conditions; corrective measures will be implemented (including manual aeration) if any anaerobic conditions, compaction or erosion is identified (4-04).

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 Project Reinstatement Specification (4-09). Trench spoil will be spread evenly beneath the topsoil and not left on the surface (1-12).

With implementation of the above measures, it is anticipated that adverse effects on soil properties will be reduced from medium significance to low.

Erosion

A soil survey of temporary works areas will be undertaken prior to construction to measure the depth of the topsoil layer 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).

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 will be prepared which includes mitigation for impacts to soils based on the following:

- Reinstatement will be undertaken as early as practicable and in accordance with the Project Reinstatement Specification (4-09)
- Erosion control measures will be implemented to achieve erosion Class 3[2] or better (3-03). A range of 'toolboxes' have been developed for erosion control as outlined in Table 10-3
- Erosion protection measures will be installed on ridges and side slopes as required by the Project Reinstatement Specification (3-35) and no side-casting of excess spoil outside the working area will be permitted (9-04)
- Local people will be actively discouraged from using the new and redundant ROW as an access road (through use of signage, public education, leaflets etc.) (3-09)
- Temporary dewatering or trench stabilisation will be undertaken where required to minimise slumping of trench walls (3-05)
- 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)
- 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)
- Trench breakers will be installed where downhill flow within the backfilled trench may lead to erosion (3-07)
- Backfill will be adequately (but not excessively) compacted to prevent future settlement (2-05)
- Soil loss will be monitored and corrective actions taken if it exceeds erosion class 3 (3-08)
- In the case of an unplanned event, any damage will be reinstated and compensated where appropriate (4-14).

[2] Erosion classes are defined in Table 7-1. Class 3 is used as a benchmark for the WREP, BTC, SCP and SCPX pipelines and is generally considered to be acceptable.

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). After backfilling, the subsoil beneath the running track will be ripped prior to reinstatement of agricultural land (2-07). Once the topsoil has been replaced it will be stone picked to remove any large stones that are not in keeping with the surrounding soil texture; surplus stone will be disposed of in accordance with the Waste Management Plan (3-11). The re-establishment of vegetation will be monitored following reinstatement until it has reached Project near- and long-term re-vegetation targets. 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 an experienced ecologist to be unsuitable for the area (17-10).

Table 10-3: Tool Boxes to be Applied for Erosion Control

Toolbox Number	Tool Box Definition
1	Top soil management
2	Subsoil and spoil management 2 – standard reinstatement 2S – special reinstatement
3	Re-vegetation 3G – reseeding 3P – replanting
4	Erosion mats
5	Install diverter berms. Spacing has been specified at 10m for the WREP-SR Project

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 reduce erosion and should help create a sustainable, self-generating plant community.

Upon completion of subsoil and topsoil reinstatement, the contractor and Company personnel will inspect disturbed areas jointly to assess compliance with the standards set out in the Reinstatement Plan and Pipeline Reinstatement Specification[3]; remedial measures will be implemented, if necessary (3-15).

The rate of discharge of water will be controlled to reduce the risk of soil erosion (3-17). At locations where water discharge causes scour or soil erosion, eroded areas will be reinstated (3-24).

Following mitigation by reinstatement in accordance with the measures above, the residual impacts of construction activities on soil erosion are expected to be reduced from high to low significance.

Ground settlement

Back-fill will be adequately (but not excessively) compacted to prevent future settlement (2-05). At road and rail crossings, and locations that are sensitive to ground subsidence, the redundant pipe will be left in situ and filled with grout. Sections of pipe that have been removed from service and left in-situ will be regularly monitored for indications of subsidence during operations (OP01). This will allow sensitive receptors to be identified and will inform any additional mitigation that may be required.

[3] Project document no. CB-WS00ZZ-PL-SPE-0003-000-D04.

Contamination

Known contamination

A baseline contamination survey of temporary works areas has been carried out and will be repeated before construction begins; identified areas of surface contamination within the Project footprint will be cleared before construction begins (6-01). This clearance will be performed to an appropriate standard in terms of construction personnel health and safety. Wherever possible, the excavation of contaminated soil will be limited to the pipeline trench and clearance of fly-tipped waste from the working areas. Contaminated soil will be segregated from uncontaminated materials and stored at least 50m away from any surface water or seasonal 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 air-born losses (6-18).

Unknown contamination

If soil contamination is suspected, sampling will be undertaken and, if necessary, for the health and safety of construction personnel, the contaminated soil will be removed. Wherever possible the excavation of contaminated soil will be limited to the pipeline trench.

The Company will carry out a due diligence exercise to identify and manage the risk of anthrax (6-22).

Contamination during construction

The following mitigation measures will be implemented with the aim of reducing the risk of ground contamination and minimising adverse impacts associated with the storage and handling of hazardous materials:

- The Pollution Prevention Plan will identify requirements and procedures for the storage of hazardous materials and contaminated soil, which will include the establishment of designated impermeable hazardous materials storage areas located at least 50m from any surface watercourse or seasonal water channel; minimisation of storage volumes; and the segregation of potentially reactive materials (6-03)
- All mobile plant (excluding vehicles) will be integrally bunded or will be equipped with a bund or drip tray that will be regularly inspected and emptied to prevent rainwater accumulating (6-21)
- Diesel storage tanks 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 largest 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 to confirm that they are functioning effectively (7-12)
- The Pollution Prevention Plan will detail requirements for record keeping and onsite maintenance of material safety data sheets (MSDS) (6-06)
- Relevant personnel will be trained in safe use and handling of hazardous materials as well as in use of spill kits and disposal practices (6-09)
- Vehicles delivering fuel or hazardous liquids will carry appropriate spill kits to allow an initial response to any spill to be deployed (6-20)
- Spill response equipment (absorbents etc.) will be available in hazardous materials storage areas, and a trained rapid response team will be mobilised in the event of spillage of hazardous materials (6-12)

- 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)
- Equipment and vehicles will be regularly maintained in accordance with the manufacturer's recommendations to maximise fuel efficiency and help minimise emissions (23-02).

If a spill does occur, a detailed contaminated land cleanup strategy will be implemented as follows:

- 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 Environmental Standards (Appendix F); a site specific remedial action plan will be developed if an environmental risk from contamination is identified (6-13)
- 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). This will be based on the source-pathway-receptor principle, which seeks to establish the linkages between the pollutants and the receptor, and whether harm to health or the environment is likely to occur. This approach does not specify defined clean-up standards as these depend on the land/water use and the presence of pathways to potential receptors. This will follow the methodology from the UK DEFRA and Environment Agency's approach as defined in: Model Procedures for the Management of Contaminated Land (CLR11 (DEFRA and the Environment Agency, 2004)
- 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)
- The contractor will prepare a plan to respond to a release of drilling mud if this occurs during a non-open-cut crossing, including clean up and remediation for the release on land and liaison with downstream users in the event of a release to water (7-16).

The following mitigation measures will be applied to waste management to reduce the risk of ground contamination from inappropriate or careless handling, storage and disposal:

- Non-hazardous waste will be disposed of at a Company and Government approved landfill site (7-02)
- A secure hazardous waste 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)
- Controlled or uncontrolled burning of waste will not be allowed (with the exception of Company approved incinerators) (7-01)
- Waste management practices will be subject to regular monitoring and auditing in accordance with the Waste Management Plan (7-04)
- 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)
- 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)

- Disposal of drilling mud will be subject to an environmental risk assessment (6-24)
- Waste will be segregated to facilitate recycling and re-use (7-08).

De-oiling and removal from service of the redundant WREP pipeline sections will have the potential for hydrocarbon contamination of the land, surface water and groundwater. A risk assessment has been undertaken as reported in Chapter 12 and oil spill response equipment will be located at high-risk locations during this stage of the Project.

10.3.5 *Residual Impacts*

Residual impacts can be summarised as follows:

- Residual impacts on the viability of the soil and seed bank will be reduced from medium to low significance by implementation of the proposed mitigation measures.
- Soil compaction will inevitably occur, but will be relieved by the proposed mitigation measures. The residual impact is considered to be of low significance.
- Similarly residual impacts on soil properties are considered to be of low significance.
- Implementation of the proposed mitigation measures are expected to reduce residual impacts associated with soil erosion from high to low significance except on the ridges and steep slopes where they will remain medium. Soil loss will be monitored and corrective actions taken if it exceeds erosion class 3.
- Residual impacts of the construction activities on existing, known, contaminated land are expected to be beneficial as any contamination will be is cleared.
- If a spill occurs, the potential impact will depend on the type and amount of the chemical, fuel or oil that has been spilt and the sensitivity of receiving environment. The residual impact on soils will generally be low if the remediation strategy outlined in Section 10.3.4 is followed, and considering the relatively small volumes of hazardous materials that are to be used during construction.

10.4 Landscape and Visual Impacts

A discussion of potential impacts on landscape and visual receptors and the mitigation measures to be adopted during construction of the WREP-SR Project is provided in this section. Details of reinstatement methods to be employed have already been provided in Section 5.7 in the Project Description chapter and should be referred to when reading this section.

10.4.1 *Aspects of WREP-SR Project that Could Affect Landscape and Views*

The aspects of the Project that may impact on the landscape of the area are:

- The temporary use of land for construction (ROW) (A8)
- Creation of new access roads (A8)
- Vegetation clearance and the levelling of ground to create the ROW and access roads (A8)
- Trench excavation and backfill (A9).

10.4.2 *Key Sensitivities*

Areas with the highest sensitivity and landscape value (see Section 7.4.4) are:

- The section of RR-001 that is close to the boundary of the Tbilisi National Park (TNP): The topography and scenic beauty of this section is high, but is lower than within the national park due the high visibility of the existing pipeline ROWs and

electricity pylons which decrease the aesthetic value of the landscape. Nevertheless, overall it is considered that the proximity of RR-001 to the TNP boundary warrants a Class C (medium) sensitivity

- Landscape protection zone (LPZ) surrounding Mtskheta UNESCO World Heritage Site, a key tourist area for Georgia: the WREP-SR route is within or close to the LPZ between KP6 and KP7.6 of RR-001. In recognition of the international designation of this site, and the importance of the landscape to the site's setting, this section of the route is given a Class E sensitivity.

10.4.3 *Landscape and Visual Impacts*

Pipeline and temporary facilities

The pipeline ROW will be visible from the time of vegetation or topsoil removal until reinstatement is complete and vegetation has re-established fully. The visual impact is mainly short-term and temporary and there is unlikely to be any long-term landscape impact except where the pipeline is routed through forest or is on a prominent ridge or elevated slope.

Parts of the ROW in section RR-001 adjacent to the TNP may be visible from public viewpoints in Mushata Dasakhleba and Mtskheta town. The landscape value of this area is degraded by several linear utilities including pipelines, electricity cables and access tracks.

Routine surveillance of the re-route sections will be undertaken by horse patrols. However ongoing maintenance and survey activity will require movement of vehicles along the permanent easement, which will lead to a permanent track being established along the ROW and will cause a permanent visual impact. For most pipe sections, this impact will be of low significance.

There will be permanent benching of side slopes in some pipe sections in order for access to be gained easily in the event of emergency (as was practice for the original WREP pipeline construction). Re-route RR-001 traverses the Mtskheta LPZ for approximately 1km between KP6.5 and KP7.6 and is close to, but outside, the Tbilisi National Park. These areas, although visually degraded due to existing pipeline route corridors through the area, will be additionally impacted by the benching required on side slopes and removal of mature woodland vegetation.

Impact summary and assessment of significance

Table 10-4 and Table 10-5 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 10-4: Potential Impacts on Landscape (Generic)

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A8	Visual intrusion into landscape particularly where the pipeline is installed on ridge or steep slope and there is permanent modification of topography	Modification of views through changed topography and landscape	C3 Medium	4-09, 17-05, 3-14, 3-19, 3-35, 9-01, 9-04, 8-04, 17-07, 17-10, D5-093	C1 Low
A9	Disposal of surplus subsoil		C3 Medium		C1 Low

* assessed using Table 3.4 and 3.5

Table 10-5: Potential Impacts on Landscape at Sensitive Locations

Section	Constraint/Issue	Potential Impact Significance*	Mitigation	Residual Impact Significance*
RR-001, AR69, AR69a, AR69b and AR67 (100m)	Pipeline route is within or close to historic landscape protection zone (LPZ) associated with the Mtskheta World Heritage Site	E3 Medium	3-35, 17-10	E2 Medium
RR-001, AR63a, AR65, AR65a, AR66, AR66a, AR67, AR69, AR69a	Route and access roads are close to Tbilisi National Park	C3 Medium	17-30, 17-44, 17-33, 17-34, OP51	C2 Low

* assessed using Table 3.4 and 3.5

10.4.4 *Mitigation of Landscape and Visual Impacts*

All disturbed areas will be reinstated in accordance with the mitigation measures listed in this section. 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 addition, the following additional generic mitigation measures are proposed as follows:

- Temporary works areas will be reinstated to near original condition (as compared to pre-construction survey reports or adjacent areas) (17-05)
- Erosion protection measures will be installed on ridges and side slopes as required by the Project Reinstatement Specification (3-35)
- No side-casting of excess spoil outside the working area will be permitted (9-04)
- Lights will be shrouded or directed with the aim of reducing off-site light spill at construction sites (8-04)
- Field boundaries will be reinstated to pre-existing condition on completion of construction (3-19)
- A monitoring plan will be developed to determine the success of re-vegetation and biorestoration activities, including the appropriateness of species composition (3-14)
- 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 re-establishment of vegetation will be monitored following reinstatement until it has reached Project near- and long-term re-vegetation targets. 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 an experienced ecologist to be unsuitable for the area (17-10).

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 practical and in accordance with the Project Reinstatement Specification (4-09). The disturbed areas will be graded and the stored topsoil will be re-spread over the surface. The soil will contain dormant seeds, some of which can be expected to germinate during the early summer months before conditions become too hot and dry. Others will remain dormant until activated by autumn rain. Re-establishment of vegetation on the ROW will be an important factor in reducing landscape impacts.

Grading of the working width will have little significant effect on local topography, except where permanent benching on slide slopes is unavoidable. To the extent possible, side slopes have been avoided during routing.

To address the potential impacts on landscape associated with this section (i.e. RR-001), the following mitigation will be adopted:

- Individual mature trees will be marked prior to construction and avoided as deemed practicable by the Company during the setting out of the ROW and access roads; retained trees will be protected from damage during construction e.g. by erecting fencing and warning barriers (17-33)
- Initial biorestoration will be undertaken in the first growing season after completion of construction (17-34)
- Compensation planting will be undertaken to off-set the removal of trees from non forest-fund land (17-30)
- Compensation will be paid to offset the loss of trees from forest-fund land in accordance with national legislation (17-44)
- The Project will carry out annual monitoring and maintenance of planted or re-planted trees until the trees have become successfully established (OP51).

Ongoing maintenance and survey activity will require movement of vehicles along the permanent easement, which will lead to a permanent track being established along the ROW and will cause a permanent visual impact. For most pipe sections, this impact will also be of low significance.

10.4.5 *Residual Landscape and Visual Impacts*

Re-route RR-001 traverses the Mtskheta LPZ between RR-001 KP6.5 and KP7.6 and is very close to (but outside) the TNP. With implementation of the proposed mitigation measures, it is considered that the residual impact will be reduced from medium to low significance except for the short section of RR-001 within Mtskheta LPZ, where the residual impact is estimated to be of medium significance.

The other pipe sections will have negligible visual impacts during construction after reinstatement. 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.

10.5 Surface Water Resources

A discussion of potential impacts on surface water resources and the mitigation measures to be adopted during construction of the WREP-SR Project is provided in this section. Impacts associated with any spillage of oil during de-oiling or removal from service activities are addressed in Chapter 12 Hazard Analysis and Risk Assessment, as they are an unplanned event.

10.5.1 *Aspects of WREP-SR Project that Could Affect* Surface Water

Each stage of the WREP-SR Project has the potential to impact on surface water resources. Key activities include:

- Releases of potentially hazardous materials or contaminants (e.g. fuel, hazardous waste, chemicals) (A6, A7, A39)
- Soil erosion (A3)
- Disruption to flow rates (A11, A16)

- The loss of amenity of the waterways (e.g. contaminants entering watercourses used for animal watering, household utility water and irrigation canals) (A36)
- Extraction of river water for use as hydrotest water (A12)
- Discharge of pipeline hydrotest water into watercourses (A10)
- Discharge of storm water from the pipeline trench (A10)
- Discharge of black and grey water (A14)
- Disruption of flow during open-cut crossings (A11)
- Riverbank and river bed disturbance (A11)
- Use of vehicles in watercourses (A11, A39).

10.5.2 *Key Sensitivities*

The most sensitive rivers are those where there are downstream receptors that may be affected by accidental spills or releases, as summarised in Table 10-6. The sensitivity of these rivers has been determined using Table 3-6 in Chapter 3 Methodology.

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. 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.

Table 10-6: Rivers with Sensitive Downstream Receptors

Approx Section KP	River	Downstream Receptors	Sensitivity
RR-001 KP2.5	Jachviskhevi stream	r. Mtkvari and irrigation users	D
RR-001 KP0.1	Jokhtaniskhevi stream	r. Mtkvari and irrigation users	B
Supsa crossing at KP 371–373	Supsa River	the Black Sea and associated ecosystems	C

10.5.3 *Impacts on Surface Water Resources*

There are no planned continuous discharges to surface waters. Hydrotest water may be released over a few days at each discharge location (see Section 10.5.4 – Management of hydrotest water)

Sediment release

The principal hydrological impacts associated with the construction of the pipeline sections are anticipated to be those associated with the release of sediment. Sediment is considered a water pollutant because it reduces light levels within the water column and at the channel boundary, and can therefore impact freshwater ecosystems. High levels of suspended sediment also cause deposition and clogging within river gravel bars which are often important habitats, especially for fish spawning. Clogging can therefore be highly detrimental to fish communities by, for example, 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 width, 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.

The presence of high levels of suspended sediment concentration can also render potable water supplies unusable. In Georgia, many of the rivers and streams already contain high sediment loads, thus reducing the significance of additional quantities of sediment introduced during construction. Those watercourses that are considered to be most at risk are recorded in Table 10-6.

Surface water contamination from fuels, oils and chemicals

There is a potential for pollution from chemical contaminants at all stages of the WREP-SR Project. Spillage of fuel, lubrication oil or wastewater may occur at watercourse crossings and also along access roads. This may occur during all stages of construction, but particularly during hydrotesting of the new pipe sections and de-oiling and removal from service of the redundant pipe sections. Contaminants released by construction phase plant could migrate downstream to key receptors such as the Mtkvari River, Tbilisi Reservoir or areas with high biodiversity value or rare species. Migration to these key receptors could take place very quickly - in a matter of a few hours in some cases. River crossings where the risk of impact on downstream receptors could be significant have been recorded in Table 10-6.

Although the likelihood of a major loss of crude oil to a watercourse from the WREP pipeline during de-oiling is considered to be very low, the potential impacts of such a loss could be wide ranging and severe. It is possible that a loss of oil to surface water systems could compromise sensitive habitats, drinking water supplies, industrial water supplies and settlements. This is discussed further in Chapter 12 Hazard Analysis and Risk Assessment (unplanned events).

Flow rates and flooding

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 and the dilution of downstream discharges.

Flow rates may be affected by water abstraction e.g. for hydrotesting and by temporary damming or diversion which sometimes necessary during installation of open-cut river crossings to reduce sediment release and to create a drier/safer working environment.

Washout and scour

Risks to pipeline integrity associated with the hydrological regime of the rivers crossed by the re-route sections of the WREP pipeline can be summarised as follows:

- Highly variable flow rates and the nature of river bed materials affects river dynamics in terms of bank erosion and bed scour potential. These factors influence the burial depth beneath the bed of the river that is required to protect the pipeline's integrity
- Active lateral and vertical erosion are prevalent within many of the watercourse channels crossed by the WREP
- Potential for sand and gravel extraction (by the Project or others) from the river bed and banks leading to channel instability and erosion that has potential to impact upon pipeline integrity.

Many of the rivers crossed by the WREP pipeline are seasonally active and capable of eroding their banks and bed and there is some potential for washout and scour to occur at certain river crossings that could compromise the functioning of the pipeline. Lateral mobility and bed scour are possibilities at a number of river crossings but most of these are not affected by the WREP-SR Project.

Impact summary and assessment of significance

Table 10-7: Potential Impacts on Surface Waters

Issue		Potential Impact	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A3	Soil erosion following removal of vegetation and/or disturbance of ground	Sediment contamination of surface waters	C4 Medium	3-24, 10-14, 11-05, 10-12, 3-05, 3-03, 3-07, 3-30, 4-07, 4-12, 10-16	C2 Low
A10	Disposal of trench-water and hydrotest water	Surface water contamination by sediment or chemicals	C4 Medium	10-09, 10-15, 3-05, 10-08, 3-17, 10-10, 10-02, 3-21, 10-11, 10-19, 10-22, 10-16, 10-06	C2 Low
		Erosion of receiving area	C4 Medium	3-17, 3-21, 10-02	C2 Low
A6	Disturbance of known/unknown contaminated land	Mobilisation of contaminants with associated risk of polluting surface waters	B2 Low	6-01, 7-05, 6-18	B1 Low
A11	Impeded flow of river or stream	Reduced flow may restrict use by local people	D3 Medium	11-03, 11-01, 11-04, 10-15, 10-18b	D2 Low
A12	Use of water from river or channel	Reduced flow may restrict use by local population	D3 Medium	10-09, 15-03, 11-03, 11-01	D1 Low
A13	Flooding caused by impeded river or ground surface flows	Sediment release	D3 Medium	13-01, 11-04, 13-02, 13-03, 16-01	D2 Low
A39	Accidental release of chemicals/oils	Surface water contamination by accidental spillage or uncontrolled discharge	D5 High	6-03, 6-05, 6-06, 6-09, 6-20, 6-12, 10-18a	D1 Low
A7	Production and disposal of solid & liquid waste		D3 Medium	6-03, 7-02, 7-03, 7-04, 7-10, 7-12, 7-13, 7-14, 7-15, 10-10, 14-04, 14-09	D1 Low
A14	Production of black and grey water		D3 Medium	10-10	D1 Low

* assessed using Table 3-6 and Table 3-7

Table 10-8: Potential Impacts on Surface Waters at Sensitive Locations

Approx Section KP	Watercourse	Potential Impact	Potential Impact Significance*	Mitigation	Residual Impact Significance*
RR-001 KP2.5	Jachviskhevi stream	Sensitive downstream receptors (Mtkvari River and irrigation users) may be affected by any fuel and oil spills or sediment release during construction	D4 High	10-16	D3 Medium
RR-001 KP0.1	Jokhtaniskhevi stream	Sensitive downstream receptors (Mtkvari River and irrigation users) may be affected by any fuel and oil spills or sediment release during construction	B4 Medium		B3 Low
KP 371-373	Supsa River	Mud breakout from HDD resulting in increased sediment in river adversely affecting downstream receptors	C3 Medium	6-26, 9-03, 7-16, 10-16, D12-06	C3 Medium

*Assessment based on Tables 3-6 and 3-7

10.5.4 *Mitigation for Surface Water Impacts*

River and stream crossing points have already been determined through pipeline routing surveys which aimed to select crossing points that will avoid unnecessary impacts on sensitive hydrological and ecological features. River crossing design has been discussed in detail in Section 5.4.13, and includes design measures that will reduce impacts on the hydraulic regime of the rivers.

Non-open cut crossings (horizontal directional drilling) are proposed at the River Supsa. All other watercourses will be crossed using open cut techniques and the pipe will be buried beneath the river bed; none of the pipe will remain above ground.

Sediment release

Seasonally high loads of suspended solids are a common natural occurrence in many of the rivers in Georgia. However, there is a need to ensure that these are not increased significantly as a result of construction operations.

Mitigation measures to reduce erosion and therefore the risk of sediment release are addressed in Section 10.3.4. General measures that are specifically designed to protect surface waters from sediment contamination are as follows:

- Watercourse crossing methods will be developed with the aim of minimising the mobilisation of sediments (11-05)
- Sediment control fencing, drainage channels and trench barriers will be installed where appropriate (10-12)
- Watercourse banks disturbed by Project crossings will be assessed individually in accordance with the Reinstatement Plan and will be restored to near original condition. 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, the use of break tanks or sediment mats to filter pumped water prior to discharge (10-15)
- Trench breakers will be installed where downhill flow within the backfilled trench may lead to erosion (3-07)
- 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)
- 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)
- During the construction of river crossings, daily visual monitoring of turbidity will be undertaken and supplemented as necessary by probe monitoring (10-16)
- 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 (10-18b)
- Washing of Project plant and vehicles in watercourses will be prohibited (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).

In order to reduce the risk of sediment contamination from discharged trench water or hydrotest water the Project will undertake the following:

- The direct discharge of trench water to watercourses will be avoided where practical, with exceptions requiring discharge through a filtering medium (10-02)
- The rate of discharge of water will be controlled to reduce the risk of soil erosion (3-17)
- Measures to minimise scour and reduce sediment load will be implemented at locations of discharges to watercourses or to land (3-21)
- At locations where water discharge causes scour or soil erosion, eroded areas will be reinstated (3-24).

Surface water contamination from fuel, oils and chemicals

Pollution prevention and control

Generic mitigation methods designed to reduce the risk of contaminant release include:

- The Pollution Prevention Plan will identify requirements and procedures for the storage of hazardous materials and contaminated soil, which will include the establishment of designated impermeable hazardous materials storage areas located at least 50m from any surface watercourse or seasonal water channel; minimisation of storage volumes and the segregation of potentially reactive materials (6-03)
- Diesel storage tanks 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 largest tank volume. Loading and off-loading connections will be located over secondary containment (7-10)
- Vehicles delivering fuel or hazardous liquids will carry appropriate spill kits to allow an initial response to any spill to be deployed (6-20)
- 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 (10-18a)

- 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)
- Water (including hydrotest water) will be tested prior to discharge and treated if necessary to meet the Project Environmental Standards (10-10)
- The applicable discharge permits will be obtained for any planned liquid discharges, prior to the discharge commencing (14-09).

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). 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).

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

In addition, the measures detailed in Section 10.3.4 to reduce the risk of soil contamination will also help protect surface waters from pollution (6-01 to 6-06, 6-09 to 6-18, 7-02 to 7-04).

Management of hydrotest water

Cleaning and hydrotesting will be carried out prior to pipeline commissioning. Details of how this will be carried out and the potential water sources to be used have been provided in Section 5.6.1. Since each new pipeline section will be subjected to hydrostatic pressure testing individually, the volumes of water required will not be as significant as they would be for a new build pipeline project. Before hydrotesting, the Contractor will prepare, and submit for Company approval, a hydrotest plan (10-06) that includes as a minimum:

- Proposed water abstraction points
- Quantity of water required per location
- Proposed water discharge points per location
- Proposed hydrotest strategy
- Confirmation of the recognised dispersion model that will be used to support the Hydrotest Discharge Environmental Risk Assessment
- Requirements for erosion/scour/sediment controls measures at each location
- Provisional sampling plan to support assessment of quality of water to be used for hydrotesting.

The following mitigation measures will apply to the management of hydrotest water:

- River flow will be assessed before and during abstraction. Abstraction rates will be based on the results of an evaluation of downstream water usage and extraction will not exceed 10% of the water flow at any time (15-03)
- A risk assessment will be undertaken before any chemicals are added to hydrotest water and prior to the discharge of hydrotest water (10-08)
- The displaced hydrostatic test water may be transferred to another section of pipe where feasible, or discharged at a suitable location. Hydrotest water will be re-used between sections, where practical, to minimise the volume required (10-09)
- Water (including hydrotest water) will be tested prior to discharge and treated to meet the Project Environmental Standards (10-10)

- The hydrotest water will be treated using diffusers to entrain oxygen (if necessary), 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)
- Measures to minimise scour and reduce sediment load will be implemented at locations of discharges to watercourses or to land (3-21)
- The rate of discharge of water will be controlled to reduce the risk of soil erosion (3-17).

Flow rates and flooding

Construction design of river and stream crossings will take account of the use requirements of downstream communities and will seek to ensure minimal interruption to flow by using measures such as pumping, channel diversions and fluming (11-01).

Within those areas which could be liable to flooding at the time of construction, further measures will be adopted to reduce the potential impact of the works in the event of heavy rainfall. The construction contractor will monitor weather forecasts and avoid creating temporary dams in watercourses if flooding is likely (13-01). Any temporary dams in watercourses will be removed as soon as pipe installation and reinstatement at that crossing is complete (11-04). Stored topsoil can create a barrier to surface water flow, therefore 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).

Mitigation methods designed to reduce the risk of impaired river flows include:

- River flow will be assessed before and during abstraction. Abstraction rates will be based on the results of an evaluation of downstream water usage and extraction will not exceed 10% of the water flow at any time (15-03)
- If temporary damming is required, a pre-construction engineering, social and environmental review will be undertaken including planning the work to minimise the duration of the flow interruption and determining the need for pump around to maintain flows (11-03)
- Construction design of river and stream crossings will take account of the use requirements of downstream communities and will seek to ensure minimal interruption to flow by using measures such as pumping, channel diversions and fluming (11-01)
- The land drainage system will be reinstated to achieve pre-existing functionality (16-01).

Washout and scour

The risks of washout and scour have been and will continue to be taken into account during the design and execution phase of the Project. An initial desk top appraisal of the design of each significant watercourse crossing has been undertaken, and will be further refined following site visits as the engineering design progresses as described in Section 5.4.13.

The Pollution Prevention Plan will identify the locations for discharge of hydrotest water and where possible trench water. Measures to minimise scour and reduce sediment load will be implemented at locations of discharges to watercourses or to land (3-21). 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).

Sensitive locations

The measures described above will be implemented at all relevant locations, including those identified in Table 10-8 as being particularly sensitive. Additional measures applicable at these locations are:

- During the construction of river crossings, daily visual monitoring of turbidity will be undertaken and supplemented as necessary by probe monitoring (10-16)
- Each major river crossing will have a site-specific design which will be set to account for the expected maximum flow rates (1:200 year storm event), sediment movement patterns, anticipated changes to the river bed contour and the predicted extent of lateral erosion (D12-06)
- The Supsa crossings will be installed by HDD. The drilling muds used will be water based (9-03)
- Drilling mud will be stored in impermeable, lined, bunded areas or tanks (6-26)
- The contractor will prepare a plan to respond to a release of drilling mud if this occurs during a non-open-cut crossing, including clean up and remediation for the release on land and liaison with downstream users in the event of a release to water (7-16).

Operations

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. Depending on river crossing monitoring results, additional maintenance measures, as deemed necessary by the Project, such as civil protection works which are necessary to maintain adequate depth of cover and set back, will be implemented.

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.

The risks and impacts associated with pipeline rupture and oil spill during construction is discussed in Chapter 12 Hazard Analysis and Risk Assessment (Unplanned Events).

10.5.5 *Residual Impacts on Surface Water Resources*

Following implementation of the above mitigation measures, the residual impact on hydrology is generally considered to be of low significance for most watercourses crossed by the re-route sections and as a result of hydrotesting.

For sensitive locations where downstream receptors are present and could be impacted by accidental spillage or sediment release, the residual impact has been assessed as of medium significance (when natural cycles mean background sediment levels would be low).

10.6 Groundwater Resources

A discussion of potential impacts on groundwater resources and the mitigation measures to be adopted during construction of the WREP-SR Project is provided in this section. Impacts on groundwater quality resulting from accidental events during pipeline de-oiling and pipeline rupture are discussed in Chapter 12 Hazard Analysis and Risk Assessment (unplanned). Mitigations outlined in Section 10.5 are also applicable to groundwater, therefore these issues are not discussed in detail in this section.

10.6.1 *Aspects of WREP-SR Project that Could Affect* Groundwater

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

- The pipe could act as a barrier to groundwater flows (A16)
- The trench of the new pipeline section could act as a conduit affecting groundwater flows (A16)
- Accidental release of potential contaminants (e.g. fuel, hazardous waste, chemicals) (A39).

10.6.2 *Key Sensitivities*

There are a number of drivers with respect to potential impacts on groundwater resources as follows:

- Groundwater vulnerability[4] due to sensitive, in some cases, shallow, water bearing geological deposits
- Proximity of settlements with abstractions
- The proximity of surface water courses/important habitats to the construction area underlain by shallow groundwater which could act as a migration pathway.

The above drivers have been considered during an assessment designed to identify locations with High Groundwater Sensitivity Table 10-9. Hydrogeological maps are provided in Appendix A3.

Table 10-9: Locations with High Groundwater Sensitivity

Hydrogeological Sensitivity	Other Key Sensitivity Drivers	Location Section KP (nearest AMs)
$Nm + p$ Pont Meotis impermeable continental sediments. High mineralisation Non-potable Low vulnerability	RR-001 Crosses R Jokhtaniskhevi, close proximity to Gldani settlement and Tbilisi National Park	RR-001 KP5.5-7.2 (AM 68.3–AM 69)
$q\delta P\varepsilon$ Palaeozoic intrusives, namely quartz diorites and gabro-diorites Highly potable and utilised High vulnerability	None identified	RR-004a – entire length
alQ_4, alQ_{3-1} Recent and Early Quaternary alluvial sediments High mineralisation High vulnerability	None identified	Supsa River crossings

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

10.6.3 *Impacts on Groundwater*

Groundwater quality

During construction and operation, spills, discharges or leaks of a variety of substances could have an impact on groundwater quality (Table 10-10).

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).

Table 10-10: Potential Contamination Hazards for Groundwater

Activity	Potential Groundwater Resource Impact
General Activities during Construction	
Vehicle, plant and equipment; fuel and oil leaks	Contamination of soil and/or groundwater by hydrocarbons
Storage, handling and disposal of hazardous materials	Contamination of soil and/or groundwater by variety of substances (lubrication fluids, solvents, paints, oils)
Production of solid wastes	Disposal, degradation and leaching of wastes releasing contaminants to groundwater.
Disposal of waste water and sewage	Disposal of waste water if to ground, may result in contamination of groundwater by micro-organisms, detergents, nitrates
Specific to Construction of Pipeline	
Cleaning and hydrostatic testing of pipeline sections	Possible contamination of groundwater by hydrotest chemicals (if used), or by imported test water of different quality to local ambient groundwater (salinity, redox etc.)
De-oiling of redundant WREP pipe sections	Release of crude oil to groundwater environment resulting in contamination of groundwater by hydrocarbons, and modification of groundwater pH/redox conditions (mobilisation of Fe, Mn; generation of methane, H_2S etc.) Subsurface migration of free phase hydrocarbons, resulting in: Migration of vapour phase to inspection chambers, confined spaces, dwellings etc. Direct impact on abstractions or surface water as discussed in Chapter 12, Hazard Analysis and Risk Assessment (Unplanned).
Specific to Operation of Pipeline	
Leakage or rupture of pipeline	As above and discussed further in Chapter 12, Hazard Analysis and Risk Assessment (Unplanned).

The areas along the pipeline re-route sections 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 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 characteristics of the water bearing geological formations beneath the re-route sections have been detailed in Section 7.6.

Groundwater flow

Physical presence of pipeline

The pipeline sections will be buried, with the top of the pipe at least one metre below ground level and the pipeline typically lying at between one and two metres below ground level. Along the majority of the route sections, where groundwater is expected to be deeper than this, the pipeline will lie above the water table and the physical impact on groundwater flow is therefore expected to be negligible.

Pipe trench as a rapid flow conduit

The backfilled trench material, even if compacted, may have a higher permeability than the undisturbed strata. Thus, the pipeline trench may act as a 'rapid flow' conduit for groundwater if:

- The groundwater is shallow or the area is subject to high precipitation rates
- The terrain has a gradient
- The soils/subsoils are of low permeability.

This, in turn, may lead to:

- Subsurface erosion/outwashing of fines from the backfill material
- Lowering of groundwater levels along the trench at higher terrain elevations
- Waterlogging and/or appearance of springs where water discharges from the trench at lower elevations.

Derogation (lowering of groundwater levels) due to abstraction and dewatering

At locations where excavations intercept the water table, it may be necessary to install a temporary 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. The water that is sucked out of the ground is discharged either to ground or a watercourse.

Impact summary and assessment of significance

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

Table 10-11: Potential Impacts on Groundwater Resources

Issue		Potential Impact	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A15	Abstraction of groundwater (if required)	Reduced quality or quantity of established groundwater sources (springs, wells etc.)	C2 Low	15-01, 15-02, 15-05, 15-04	C1 Low

Issue		Potential Impact	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A39	Accidental release of chemicals/oils	Groundwater contamination	C5 High	6-03, 6-05, 6-06, 6-09, 6-20, 6-12, 6-27	C1 Low
A7	Production & disposal of solid & liquid waste	Potential for groundwater contamination if disposal uncontrolled	C3 Medium	7-02, 7-03, 7-01, 7-04, 10-08, 3-17, 10-10, 14-03	C1 Low
A14	Production of black and grey water	Groundwater contamination by accidental or uncontrolled discharge	C3 Medium	10-10	C1 Low
A6	Disturbance of known/unknown contaminated land	Mobilisation of contaminants with associated risk of polluting groundwater	C3 Medium	6-01, 7-05, 6-18	C1 Low
A16	Altered drainage pattern	Trench can act as conduit for groundwater, draining higher areas and flooding lower areas	C2 Low	3-07	C1 Low

* assessed using Tables 3-8 and 3-9

10.6.4 *Mitigation of Impacts on Groundwater*

Groundwater quality

The following commitments will be adopted to mitigate adverse impacts on groundwater quality:

- The storage of hazardous materials in areas of known groundwater vulnerability will be carefully controlled under pollution prevention procedures (6-27)
- Water (including hydrotest water) will be tested prior to discharge and treated to meet the Project Environmental Standards (10-10)
- 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).

In addition, the following measures that are detailed in Section 10.3.4 will also reduce the risk of groundwater contamination: 6-01, 6-03, 6-05, 6-06, 6-09, 6-12 – 6-18, 6-20 and 7-01 – 7-05.

The Emergency Response Plan will detail actions to be taken if significant quantities of a contaminant are released to the subsurface. The Oil Spill Response Plan will detail locations of spill response equipment, locations of sensitive receptors (such as areas of high groundwater vulnerability) and actions to be taken in the event of a spill. An Environmental Risk Assessment has been undertaken for de-oiling operations and will be used to determine the location of oil spill response equipment (see Chapter 12).

Impacts on groundwater during the de-oiling activities are only likely to result from an unplanned event (oil leak). This issue is discussed in Chapter 12, Hazard Analysis and Risk Assessment (unplanned).

Groundwater flows

Trench breakers will be installed where downhill flow within the backfilled trench may lead to erosion (3-07).

Groundwater will not be used for pipeline hydrotesting unless an alternative source is not practicable (15-01). 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 and in accordance with the abstraction permit conditions (15-02). Water features such as abstractions (boreholes, wells and 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). 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).

10.6.5 *Residual Impacts on Groundwater*

Following implementation of the mitigation measures outlined above, the significance of the residual impacts on groundwater quality and flows (both impeded and preferential) during construction is considered to be of low significance. For de-oiling activities the residual impact is considered to be of medium significance due to the potential severity of any loss of containment. However, with the implementation of proposed mitigation measures, the probability of a release during de-oiling is considered to be very low.

It is difficult to assess the significance of the residual impact associated with Project groundwater abstraction at this stage, as it will vary on a case-by-case basis. However, with the implementation of the mitigation proposals outlined above, the residual impact is likely to be of low significance.

10.7 Ecology

A discussion of potential impacts on ecology and the mitigation measures to be adopted during construction of the WREP-SR Project is provided in this section. Details of reinstatement methods to be employed have already been provided in Section 5.7 in the Project Description chapter and should be referred to when reading this section.

10.7.1 *Aspects of WREP-SR Project that Could Affect* Ecology

The aspects of the Project that have the potential to impact on protected areas, flora and fauna are:

- ROW preparation which requires the clearance of trees and herbaceous vegetation from the working area and may cause habitat severance (A17)
- The widening of existing access roads and creation of new access roads which also necessitates vegetation clearance and may create a barrier to animal movement (A17, A20)
- Ground disturbance caused by the removal of topsoil, trench excavation and driving along the ROW which may disturb animals and could lead to the destruction of underground burrows and nests (A19)
- Noise and light which may disturb animals and cause changes in behaviour and/or breeding success (A19)
- Changes to soil properties due to compaction and during storage which may affect subsequent reinstatement of the temporary works areas (A17)

- Vehicle movements which may introduce competitive plant species or animal/plant diseases, particularly through the transfer of soil on tyres and treads (A18)
- Dust which may cause respiratory problems in animals (A19)
- Spoil disposal, which can cause the smothering of native flora and fauna (A17, A19)
- Spillages which may also affect reinstatement (A17)
- Abstraction of water from streams and rivers for hydrotesting that may reduce flow and cause stress or death to aquatic organisms (A19)
- The release of sediment into watercourses which may cause smothering of invertebrates and mortality of fish and invertebrates (A19).

10.7.2 *Key Sensitivities*

Protected areas within 10km of the WREP-SR Project are:

- Tbilisi National Park which is close to, but outside, Section RR-001
- The Kolkheti Wetlands IBA, National Park and Ramsar site which lie approximately 0.5km north of the Supsa river crossings and will not be directly affected.

The most sensitive habitats are the native oak forests that are found mainly in Sections RP-001a and RR-001, with scattered fragments elsewhere as listed in Table B-3 in Appendix B.

Table 7-11 lists plant and animal species that were recorded during field surveys of the WREP-SR Project works areas and are considered to have conservation value, primarily because they are vulnerable, rare, protected or endemic to the Caucasus region. The location of these species is identified in Section 7.7.4, Table B-3 and on the constraints maps in Appendix A. More detailed information about locations is provided in Section 5 of the Environmental Baseline Report.

Tbilisi National Park

The Tbilisi National Park (TNP) is adjacent to Section RR-001 and is not crossed by the proposed re-route. Optimal route selection in the wooded areas adjacent to the TNP involved detailed micro-routing studies and working width considerations to minimise forest disturbance and maximise the use of tree breaks, lower density forest and scrub and existing tracks. This process significantly reduced the amount of “new”/undisturbed corridor that will be needed for the re-route through this area.

Installation of Section RR-001 will cause minor loss of habitat and habitat fragmentation, but this will be offset by the restoration of the existing running track on the redundant sections of the pipeline (see Section 10.7.4).

Kolkheti Wetlands IBA, National Park and Ramsar site

The Kolkheti wetlands lie to the north of the Supsa River crossings that are to be replaced as part of the WREP-SR Project. The wetlands have multiple national and international designations, each of which has different, but overlapping boundaries. The closest boundary of the protected areas to the works area is at a distance of *c.*0.5km.

The wetlands will not be directly affected by the works but hydrological connectivity is likely and some of the resident birds may hunt around the river crossing area.

Plant and animal species of conservation value

Plant species that were recorded during surveys of the WREP-SR Project area and are considered to have conservation value are listed in Table 10-12. All the GRL plant species recorded are trees; all CITES species recorded are orchids.

Table 10-12: Species of Conservation Value

Scientific name	Common name	Location
Georgian Red List (GRL) Species (Flora)		
Castanea sativa	European chestnut	AR223, AR225
Juglans regia	Walnut	AR223, AR63
Pyrus demetrii	Demeter's pear	RP-001a KP1.1 and KP2.72 RR-001 – various locations
Pterocarya pterocarpa	Caucasian wingnut	Left bank of Supsa Export pipeline crossing
Quercus imeretina	Imeretian oak	AR223, AR225
Taxus baccata	Yew	AR225
Ulmus minor	Smooth-leaf elm	RP-001a KP2.5 (AM 54–55) AR52, AR54, AR55 RR-001 KP2.0 (AM 65) RR-001 KP3.5–7.6 (AM 66-69) AR63, AR63a, AR64.5, AR64.5a, AR66, AR66a, AR69a AR to BVS28 AR225
Georgian Red List (GRL) Species (Fauna)		
Lutra lutra	European Otter	Supsa WREP crossings
Testudo graeca	Mediterranean spur-thigh tortoise	RP-001a, RR-001
CITES Species		
Anacamptis coriophora (syn. Orchis coriophora)	Bug orchid	AR225
Anacamptis pyramidalis	Pyramidal orchid	RR-001 (numerous locations), AR63, AR63a, AR64.5
Cephalanthera longifolia	Cephalanthera orchid or Narrow-leaved helliborine	RR-001 KP2.4-3.7 (AM 65-67) AR225
Cyclamen coum	Eastern cyclamen	AR225
Dactylorhiza romana subsp. *Georgica*	Dactylorhiza	AR225
Epipactis leptochila	Narrow-lipped helleborine	RR-001 KP5.75
Gymnadenia conopsea	Fragrant orchid	RP-001a KP0.5–1.5 (AM 52–53)
Limodorum abortivum	Violet limodore	RR-001 (various locations)
Neottia nudus-avis	Bird's nest orchid	AR225
Ophrys oestrifera (syn Ophrys fuciflora)	Late spider orchid	RR-001 (various locations)
Orchis morio (syn Anacamptis morio)	Green-winged orchid	RR-001 (numerous locations including 2 large populations between KP0.45 to 1.1)

Scientific name	Common name	Location
Orchis purpurea subsp. *caucasica*	Lady orchid	AR225
Platanthera bifolia	Lesser butterfly orchid	AR225
Serapias vomeracea	Long-lipped serapias	AR223, AR225
Caucasian Endemic Species		
Iris carthaliniae	Iris	Near AR52
Iris colchica	Colchic iris	AR225
Paeonia caucasica	Caucasian peony	RR-001 KP7.8 (AM 69)

Only two protected animal species were recorded during the surveys: *Lutra lutra* (European Otter GRL) and *Testudo graeca* (Mediterranean spur-thigh tortoise GRL & IUCN Iv). However *Aquila heliaca* (Eastern Imperial Eagle – GRL, IUCN Iv) is known to nest in the TNP and is likely to hunt on the pipeline. The burrow dwelling spur-thighed tortoise (*Testudo graeca*) is widespread along the route. Signs of the European otter were recorded at the Supsa WREP crossing during the 2011 survey; no signs were recorded during the 2015 survey.

Mature hollow trees adjacent to or within the ROW or access roads, including those at RR-001, AR66a, AR69a and AR225 provide suitable habitat for roosting bats. A cave near AR69a was found to contain seven wintering greater horseshoe bats (*Rhinolophus ferrumequinum* – BERN, CMS).

10.7.3 *Impacts on Ecological Resources*

Habitat and population loss and severance

There will inevitably be some loss of natural habitat and native flora as a result of preparing the ROW and widening/constructing access roads. This will cause a temporary severance of habitat and loss of forest structure which may cause secondary impacts on animals due to loss of breeding sites and foraging areas. The bare ground along the ROW may be a barrier to animal movement and can lead to increased predation of animals trying to cross the area as they may be unable to hide from predators. Felling of hollow trees may cause loss of bat shelters.

Further habitat could be lost or degraded if surplus spoil is disposed of outside the ROW in areas of natural habitat or if there is accidental spillage of fuels, oils or other hazardous materials.

Habitat loss and severance will be temporary except in areas where it is necessary to maintain a running track to facilitate access for pipeline monitoring and maintenance.

Successful biorestoration of the temporary works areas will be impeded if soil compaction is not relieved or if the soil structure or nutrients are lost during storage. It is important that topsoil is not lost from the ROW as it contains seeds, bulbs and other propagules of native flora that will contribute to biorestoration. Conversely it is important that competitive weed species and diseases are not introduced to the works areas on the tyres or treads of construction plant and vehicles as they could out-compete the native flora or cause the spread of plant (and animal) diseases.

Fauna (excluding fish)

The main impact on fauna will be the temporary noise and visual disturbance caused by construction activities and the potential destruction of breeding sites and young. Construction activities and noise will be regulated as described in Section 10.9.4, but some

temporary disturbance is unavoidable. It is, however, anticipated that all fauna will re-colonise or re-use the area of construction once works are completed.

The significance of disturbance depends on a number of factors including the habitat, the species and its ecology, the time of year, amount and duration of the disturbance and the existing levels of disturbance. It is likely that large mammals and birds will temporarily move away from the construction area, although a few small mammals, reptiles and invertebrates may be killed or injured if they are not able to move away quickly.

The periods when fauna will be most affected by disturbance are when they are hibernating or breeding.

Testudo graeca (spur-thighed tortoise) inhabits dry open areas, and was recorded in RR-001 during field surveys. It is also likely to be present in RP-001a. Mating begins shortly after the animals emerge from hibernation, and females may lay several clutches of eggs in a year from spring to summer. Individual animals are vulnerable to vehicles and machinery, both during the active season (as they move very slowly) and in winter when they may be found hibernating beneath dense vegetation such as at the bases of trees and shrubs. Egg clutches would also be vulnerable to ground clearance works. Overall, the species is widespread in the region crossed by the proposed pipeline and therefore population levels are unlikely to be at risk from construction. Avoiding impacts on this species will be a high priority during construction and operation

The felling of hollow trees during ROW preparation will cause disturbance of bats if any are roosting in the hollows.

There are no major terrestrial migration routes crossed by the pipeline and it is likely that migratory birds would move away from the construction area. Therefore, no significant impact on migratory animals is expected.

Aquatic animals may be adversely affected by reduced water flow in rivers and streams (e.g. due to temporary damming or abstraction of hydrotest water) and by the accidental release of fuel/chemicals or sediment.

Fish

The river Jachviskhevi will be crossed using an open-cut crossing method. 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 river Supsa crossings will be installed by horizontal directional drilling so no works will be undertaken in the river channel.

The main potential impacts on fish from construction of open-cut 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 if installed poorly.

The peak fish-spawning activities typically occur between May and June; 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 during trenching or backfilling into the river at this time of year could smother fish eggs and other benthic fauna.

Sediment-laden run-off from temporary work areas and discharge of water from the pipe trench may cause sub-lethal and lethal effects on fish and other aquatic organisms. Increased levels of suspended sediment may reduce prey availability (due to smothering of benthic invertebrates), reduce the ability of fish to hunt for prey or avoid predators (due to lower visibility) and affect health e.g. by clogging gills. 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. 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 likely to be small in comparison with the natural levels of sediment 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 effects and this impact is 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 used will be water based (9-03) 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 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.

There are some concerns that noise and vibration from HDD operations may have an adverse effect on migratory fish. Underwater noise during HDD operations has been described by Parvin *et al.* (2008) as being from two sources:

- Low frequency grinding noise (probably resulting from the cutting of substrate material by the drill head,
- Noise generated by pumping the drilling fluid through the drill head and back along the return pipe.

Different species of fish exhibit different physical characteristics which affect their ability to detect sound (see Popper & Fay, 1993). Species can therefore be characterised as hearing specialists or hearing generalists depending upon their ability to hear sounds at different frequencies (e.g. Hawkins, 1981; Popper *et al.*, 2003 – referenced in Parvin *et al.*, 2008). For example, Atlantic salmon (*Salmo salar*) are considered to have relatively poor hearing capabilities and are therefore described as ‘hearing generalists’ whereas some other species, for example the American shad (*Alosa sapidissima*), have more extensive hearing ranges, even into the ultrasound (>20kHz) frequency range (Higgs *et al.*, 2004). Different

fish species will therefore respond in different ways (or not at all) to sound generated by HDD activities depending, at least in part, on whether or not their hearing apparatus are able to detect the sound.

Two GRL species of migratory fish have been recorded in the river Supsa—Colchic sturgeon (*Acipenser colchicus*) and Beluga (*Huso huso*). Following a search of available literature there appears to be a distinct paucity of information with regard to the hearing capabilities, and therefore the sensitivity to sound, for all sturgeon species. This lack of information is also acknowledged by one of the leading authorities on hearing and sensitivities to sound in fish (see Popper, 2005). This notwithstanding there is evidence that provides some indication as to the hearing capabilities, and therefore sensitivity to sound, for some sturgeon species.

Sturgeons possess a swim bladder but do not exhibit any additional auditory structures which would enhance their hearing capabilities. It is assumed therefore that their hearing sensitivity is low (Meyer *et al.*, 2010). Studies undertaken by Lovell *et al.* (2005) and Meyer *et al.* (2010) indicate a responsiveness of several sturgeon species to sound frequencies ranging from 100 Hz to 800 Hz. The species studied were all from the Acipenser genus but did not include *Acipenser colchicus*. No publications concerning the sensitivity to sound in *Huso huso* were found.

The physiology of the hearing apparatus and the few existing observations of sensitivity to sound for some sturgeon species indicate that they are likely to be classed as hearing generalists. Atlantic salmon (*Salmo salar*) are also hearing generalists and significantly more data are available for this species. In the absence of data specific for sturgeon the following discussion is focussed on Atlantic salmon with the tentative presumption that if sound originating from HDD activities is unlikely to adversely impact upon this species then this is also likely to be the case for the two sturgeon species of concern, *Acipenser colchicus* and *Huso huso*.

Atlantic salmon have been shown to exhibit a response to low frequency sound within the range of 32 to 270 Hz, with sensitivity to sound most pronounced between 100 and 200 Hz (Hawkins & Johnstone, 1978). Hawkins (1981) commented that salmon peak hearing threshold occurs at approximately 160 Hz (range of approximately 95 to 300 Hz) and at 95 dB re 1 µPa (range of approximately 95 to 135 dB re 1 µPa). Knudsen *et al.* (1994) similarly showed that juvenile salmon cannot detect frequencies above 380 Hz and that their sensitivity to frequencies above 150 Hz is very low and did not evoke an awareness or avoidance response in the fish. However, frequencies of 10 Hz, at certain intensities, can invoke a positive avoidance response (Knudsen *et al.*, 1994). Evidence suggests therefore that Atlantic salmon cannot hear sound at frequencies above 380 Hz and furthermore that sounds at frequencies above 150 Hz are unlikely to result in any type of response from this fish species.

Nedwell *et al.* (2005 and 2007) developed a metric (dB_{ht}(*Species*)) as a means of quantifying the potential for noise to have a behavioural impact on different fish species underwater. Essentially this accounts for differences if fish species' hearing ability such that sound from a given construction activity might have a level of 70 dBht (*Salmo salar*) for Atlantic salmon but 110dBht (*Alosa fallax*) for Twaite shad for example. The UK Government has published assessment criteria (see Nedwell *et al.*, 2007) for evaluating the potential impact of construction noise and vibration as follows:

- 100 dBht (Species) and over = 100% avoidance
- 90 dBht (Species) = strong avoidance reaction by most individuals
- 75 dBht (Species) = mild avoidance reaction occurs in a majority of individuals
- 0 – 50 dBht (Species) = low likelihood of disturbance.

In a study by Subacoustech Ltd (Parvin *et al.*, 2008), HDD processes were outlined as:

1. Drilling a pilot hole;
2. Reaming the bore out to the required diameter;
3. Performing a cleaning run through the bore once at the final diameter;
4. Pulling the product pipe through the final hole.

Sound levels were recorded in the River Wye (England) during each of these activities. While the actual sound pressure levels recorded varied between 111 and 145 dB re 1 µPa, the weighted level for Atlantic salmon ranged between 0 and 40 dBht. This indicates therefore that HDD operations in the River Wye had a low likelihood of disturbance for Atlantic salmon, and by extrapolation, therefore also sturgeons. Furthermore, migratory fish such as Atlantic salmon are known to have a strong compulsion to return to their spawning grounds and therefore it is possible that they will not show the same sensitivity or reaction to sound during this period. Ambient noise levels in any river are also likely to exhibit considerable variation depending on the flow conditions and if noise and vibration from HDD operations are assessed as being below the ambient levels in the river then it could be considered unrealistic to anticipate any adverse impact with respect to the behaviour of migrating fish.

Noise levels resulting from the proposed HDD operations at the river Supsa crossings are not known but it is likely they will not differ significantly from those measured in the River Wye as discussed above.

Impact summary and assessment of significance

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

Table 10-13: Potential Impacts on Ecological Receptors

Issue		Potential Impact	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A17	Loss of natural habitat/ vegetation	Reduced biodiversity	B3 Low	2-02, 4-09, 19-10, 30-23, 19-05, 18-01, 17-05, 17-10, 17-15, 3-09, 17-20, 3-14, 17-21, 17-08, 17-07, 17-23, 17-51, OP51	B1 Low
		Modified habitat structure			
		Loss of breeding & foraging areas			
		Habitat severance			
A9	Disposal of surplus subsoil	Smothering of native flora and fauna	B2 Low	1-12, 9-02, 9-04, 1-11, D5-066	B1 Low
A2	Soil compaction	Impaired re-establishment of vegetation after construction	B4 Medium	2-02, 2-05, 4-02, 2-03, 2-07, 2-01	B2 Low
		Localised habitat changes	B3 Low		B2 Low

Issue		Potential Impact	Potential Impact Significance*	Mitigation	Residual Impact Significance*
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	C3 Medium	4-09, 4-02, 4-04, 4-08, 3-11	C2 Low
A39	Accidental release of chemicals/oils	Stress/mortality of flora and fauna	B3 Low	6-03, 6-05, 6-06, 6-09, 6-20, 6-12	B2 Low
A7	Production & disposal of solid & liquid waste	Mortality of flora and fauna	B3 Low	4-14, 6-03, 6-21, 7-10, 7-12, 7-14, 10-08, 3-17, 10-10	B1 Low
A18	Introduction of competitive plant species or diseases	Poor re-colonisation by local flora following reinstatement	B3 Low	2-02, 18-01, 28-11, 18-05	B1 Low
		Modified habitats due to non-native species establishment	B4 Medium		B2 Low
A19	Disturbance or harm to wildlife	Reduced breeding potential and population	B2 Low	2-02, 19-06, 19-05, 19-04, 19-03, 19-08, 19-10, 21-04, 21-01, 17-22, 19-11a, 19-11b, 19-11c, 19-11d, 19-11e, 19-15	B2 Low
		Changed behaviour			
		Increased predation			
		Injury or death			
A25	Noise emissions from vehicle movements, construction operations	Disturbance affecting breeding and/or behaviour	B2 Low	25-11, 25-05, 25-03	B2 Low
A24	Dust generation, particularly from vehicle movements and storage of excavated materials	Respiratory problems for animals	B2 Low	2-02, 24-01, 24-02, 23-05, 23-06, 4-09, 24-05	B2 Low
A26	Vibration from vehicle movements and construction operations	Disturbance affecting breeding and/or behaviour	B2 Low	25-16, 37-08, 25-14, 25-15	B2 Low
A20	Impeded movement of wild animals, domestic herds and people due to open trench or spoil storage mounds	Disruption of animals movements affecting their ability to forage	B2 Low	20-01	B2 Low
A37	Use of local road network by construction traffic	Risk of injury or death	B2 Low	19-07	B2 Low
A21	Open excavations (including open trench)	Injury to fauna from falling into excavations	B2 Low	21-01, 21-02	B2 Low
A12	Use of water from river or channel	Reduced flow may affect survival of aquatic organisms	C3 Medium	10-09, 11-03, 15-02, 15-03, D5-079	C1 Low

Issue		Potential Impact	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A11	Impeded flow of river or stream	Sediment release causing smothering of invertebrates and mortality of fish	C3 Medium	10-15, 11-05, 10-16, 10-09, 10-18b, 3-07	C2 Low
		Reduced flow may affect survival of aquatic organisms	B4 Medium		B1 Low

* Assessment Tables 3-10 and 3-11

Table 10-14: Potential Impacts on Sensitive Receptors

Location	Issue	Potential Impact	Potential Impact Significance*	Mitigation	Residual Impact Significance*
RR-001 KP0.0 – KP5.0	Route and access roads are very close to Tbilisi National Park	Loss/severance of valued habitat and forest structure Loss of biodiversity including GRL species	C4 Medium	17-25, 17-30, 17-44, 17-34, 17-40, 19-17	C2 Low
RR-001 KP7.0, AR66a, AR69a, AR225	Mature trees adjacent to or within the ROW or access roads that are hollow provide suitable habitat for roosting bats	Disturbance of bats roosting in the hollows of trees during ROW preparation	C3 Medium	17-15, 17-21, 17-23, 17-30, 17-33, 17-44,19-10, 19-15, 19-18, 19-19	C2 Low
See Table 10-12	Range of habitats supporting protected species (IUCN, GRL, CITES etc.)	Loss/disturbance of GRL/IUCN species and modified forest structure	D3 Medium	17-23, 17-25, 17-39, 17-33, 17-08, OP51, 17-15, 17-51,19-03, 19-17	D2 Medium
		Loss/disturbance of high conservation value, herbaceous species (CITES and endemic)	C3 Medium	17-22, 17-45, 17-46, 17-47, 17-48, 17-49	C2 Low
		Loss/disturbance of Caucasian endemic and other rare species	C3 Medium	17-25, 17-10, 17-15, 17-23	C2 Low
Supsa WREP crossing	Small remnant of riparian forest; otters (GRL)	Loss/disturbance of GRL species	D3 Medium	17-39, 19-16, 8-04, 17-15	D1 Low

* Assessment Tables 3-10 and 3-11

10.7.4 *Mitigation of Ecological Impacts*

As discussed in Chapter 5 Project Description, a detailed Project Reinstatement Specification, a Reinstatement Management Plan and Ecological Management Plan will be

prepared. Locations where the species of concern are known to exist are identified in Table B-3 in Appendix B.

Habitat degradation and loss

General

Site Specific Ecological Management Plans will be developed for priority areas. The Contractor will incorporate the requirements of these plans into site-specific method statements, which shall be agreed with the Company prior to construction (19-10). Pre-construction ecological surveys will be undertaken to record details of rare species (GRL, IUCN, CITES, Caucasian endemic) that will be lost; this information will be used in development of biorestoration measures (17-23).

The ROW and any other working areas will be checked prior to vegetation clearance and topsoil stripping to search for any IUCN Red List or Georgia Red List (GRL) animals (19-11a). If any IUCN Red List or GRL species are found on the ROW or other working area outside of the breeding or hibernating season, they will be moved a safe distance away from the ROW and released into suitable habitat in accordance with the methods in the Site Specific Ecological Management Plans (19-11b). If any IUCN Red List or GRL species are found hibernating on the ROW or other working area during the hibernating season (October to March inclusive) they will be carefully moved to a new hibernating site a safe distance from the ROW in accordance with the methods in the Site Specific Ecological Management Plans (19-11c). If any IUCN Red List or GRL species are found nesting on the ROW or other working area they will be left undisturbed until a Company assessment has been carried out taking into account whether the species can be moved or whether it should remain in place until breeding has been completed and the young have moved away from the nest. (19-11d). The Company will produce a detailed Method Statement for the safe methods of moving any IUCN Red List or GRL species or other animals that cannot move easily away from the ROW, and suitable exclusion zones where required (19-11e).

Vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency) (2-02) to avoid encroachment on wildlife habitat. The ROW 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). Where the ROW is through woodland with high biodiversity value, the working width will be reduced (subject to constructability constraints) with the aim of minimising impacts on these areas (17-21). The sale of bulbs from the ROW will be strictly prohibited (17-22).

Ecologists will accompany the construction crews when they are setting out the centreline and clearing vegetation along the ROW. The ecologists will check that routing constraints are adhered to and will participate in decisions concerning fine-tuning of the route e.g. to avoid mature trees, species that are on the Georgian Red List or Caucasian endemic species. At the locations listed in Section 7.7 of the ESIA protected species (e.g. GRL, IUCN) will be identified marked prior to construction and will be avoided where deemed practicable by the Company during the setting out of the ROW (17-25).

Most of the ecological impacts resulting from pipeline construction will be temporary provided that all disturbed areas are reinstated quickly and effectively after construction in accordance with approved plans. One of the GRL species that is widespread throughout the sections is *Ulmus minor* (smooth leaved elm), which sends out suckers and therefore regenerates after felling unless the roots are removed. This species is therefore likely to re-establish well along the margins of the ROW. However, it should be noted that no trees will be allowed to establish directly over, or in close proximity to, the new pipeline or the redundant sections as their roots can compromise pipe coatings and integrity. Therefore, although tree removal will be minimised and compensation planting will be undertaken to off-set the essential removal of GRL trees, there will be some loss of mature trees and further fragmentation of remnant forest habitat in some areas.

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

If disposed of carelessly, surplus subsoil can smother flora and fauna. Excavated subsoil will be stored on the ROW or in agreed temporary storage areas; if disposal is necessary, it will be transported to an approved disposal site (1-11). Trench spoil will be spread evenly beneath the topsoil and not left on the surface (1-12). 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). No side-casting of excess spoil outside the working area will be permitted (9-04). All potential subsoil disposal sites and disposal plans will be subject to an environmental and social review to confirm their suitability prior to their adoption (9-02).

An inventory will be made of all trees that are likely to be felled during the Project, including Red Data Book species, in accordance with the requirements of national legislation (17-15). Compensation will be paid to offset the loss of trees from forest-fund land in accordance with national legislation (17-44). Compensation planting will be undertaken to off-set the removal of trees from non forest-fund land (17-30).

Temporary works areas will be reinstated to near original condition (as compared to pre-construction survey reports or adjacent areas) (17-05); reinstatement will be undertaken as early as practical and in accordance with the Project Reinstatement Specification (4-09).

The running track along redundant re-routed sections of pipeline will be reinstated in accordance with the Project Reinstatement Specification following removal from service, except where access is required e.g. by patrols or local users. Biorestoration measures will be defined for each of these sections in site-specific ecological management plans (17-20).

The re-establishment of vegetation will be monitored following reinstatement until it has reached Project near- and long-term re-vegetation targets. 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 an experienced ecologist to be unsuitable for the area (17-10). Local people will be actively discouraged from using the new and redundant ROW as an access road (through use of signage, public education, leaflets etc.) (3-09).

Tbilisi National Park

The pipeline sections have been routed to avoid direct impacts on Tbilisi National Park and to maximise use of previously disturbed areas. AR63a is an existing vehicle track that runs adjacent to the designated area. Since the ecological surveys were undertaken, the route of AR63a has been slightly changed to completely avoid TNP. An ecological survey of the new-build section of AR63a will be carried out by the Company prior to commencement of construction activities in order to determine the presence of sensitive vegetation or fauna and develop mitigation measures if required. This will be completed when the plants are most visible i.e. during or after the flowering season (17-40).

Georgian Red List Species

In order to mitigate for potential impacts on GRL species, the following mitigation measures will be applied:

- Where the ROW is through woodland with high biodiversity value, the working width will be reduced (subject to constructability constraints) with the aim of minimising impacts on these areas (17-21)

- An inventory will be made of all trees that are likely to be felled during the Project, including Red Data Book species, in accordance with the requirements of national legislation (17-15)
- Compensation planting will be 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)
- The Project will carry out annual monitoring and maintenance of planted or re-planted trees until the trees have become successfully established (OP51).

Access road widening will be managed to avoid loss of trees where possible.

Other mitigation measures to be applied at specific locations are as follows:

- The remnant forest on the left bank of the river Supsa will be retained and protected from encroachment of construction activities (17-39)
- Individual mature trees will be marked prior to construction and avoided as deemed practicable by the Company during the setting out of the ROW and access roads; retained trees will be protected from damage during construction e.g. by erecting fencing and warning barriers (17-33)
- Where Demeter's pear (*Pyrus demetrii* - GRL) cannot be avoided new stock will be raised from locally collected seed and planted at a ratio of 10:1 in nearby suitable habitat, outside the WREP SR Project impact zone. Replanting should be undertaken in late October/early November (i.e. before winter frosts) using saplings that are at least 25cm tall and 2-years old (17-51).

High conservation value, herbaceous plants (CITES, Caucasian endemic species)

At temporary works areas where high conservation value, spring flowering species have been recorded, pre-construction surveys will be undertaken between late April and late May to confirm their presence and mark populations (17-45). Small populations (less than 50 specimens) of high conservation value species will be translocated to suitable habitat outside the working area if disturbance cannot be avoided (17-46). Large populations (more than 50 specimens) of high conservation value species will be avoided during setting out if possible and protected from disturbance during construction. Where large populations cannot be avoided, and 50% or more of the recorded population is likely to be disturbed by WREP-SR activities, 20% of the entire population will be translocated to the nearest suitable habitat outside the project impact zone (17-47).

Translocated populations of high conservation value plants will be monitored to assess adaptation success; surveys will be undertaken twice a year during the flowering and fructification phases for at least three years (17-48). If monitoring surveys indicate failure of the translocated populations of high conservation value plants, a mitigation plan will be developed and implemented. This plan will include collection of seeds from wild source populations occurring close to the project-affected sites, propagation of seedlings at ex situ conservation centres (botanical gardens) and re-introduction to suitable nearby habitats (17-49).

The sale of bulbs removed from the ROW will be strictly prohibited (17-22).

Reinstatement

Successful biorestoration of the temporary works areas by native species will depend, at least partially, on the preservation of topsoil and its structure, fertility and seed bank during construction. The mitigation measures for impacts on soil resources and soil compaction that are described in Section 10.3.4 will therefore aid the establishment of vegetation after construction. To reduce compaction, measures 2-01 – 2-03, 2-05, 2-07 and 4-02 will apply. To retain soil structure, fertility and the entrained seed bank, measures 4-09, 4-02, 4-04, 4-08 and 3-11 will apply.

No invasive species, or species that are considered likely to out-compete the indigenous plant species will be used in seed mixes for erosion control or biorestoration (18-01). With careful selection of the seed mix, the residual impact on biodiversity will be low. 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 practicable, it is free from soil and plant material (18-05). Environmental and social issues will be included in workforce and visitor induction training (28-11).

Initial biorestoration will be undertaken in the first growing season after completion of construction (17-34). A monitoring plan will be developed to determine the success of re-vegetation and biorestoration activities, including the appropriateness of species composition (3-14). The re-establishment of vegetation will be monitored following reinstatement until it has reached Project near and long term re-vegetation targets. 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 an experienced ecologist to be unsuitable for the area (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).

Terrestrial animals and birds

The periods when fauna will be most affected by disturbance are when they are hibernating or breeding. Clearance of some sections of the ROW and widening of the access roads will begin during the winter months when some species will be hibernating but few, if any, will be breeding. However construction will continue throughout the spring and summer months which could cause disturbance to breeding animals. Any disturbance caused by construction activities during the breeding season could lead to the direct destruction and/or the desertion of nests, eggs and dependent young. This could lead to a reduction in breeding success of the species concerned during the construction period, which would have greatest significance for the species whose populations are already rare or in decline.

The main species of conservation importance that might be affected is the burrow dwelling spur-thighed tortoise (*Testudo graeca*) (GRL, Iv) (Figure 10-2). If *Testudo graeca* (spur-thighed tortoise) is found within the work site, individuals will be moved 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).

Figure 10-2: Spur-thighed Tortoise

A preconstruction survey will be carried out (during April, May or June) by the Company and will seek to identify the presence of Imperial Eagle nest sites within the vicinity of the ROW where construction activities have the potential to impact them. If any nests are identified, a site-specific ecological management plan will be developed (19-17). Work will be planned to occur outside the nesting and breeding season (nominally April to June) the exact timing of which will be determined following a pre-construction survey. If work must be undertaken within the nesting season it will only be done following a site assessment and approval by the Company.

Figure 10-3: Imperial Eagle

A pre-construction night bat emergence surveys will be carried out in June–July or late August–early September at locations where potential bat shelters were identified to determine bat species composition and abundance. If protected species of bats are found to be roosting in any structures or trees that will be removed, a mitigation strategy will be designed with the aim of reducing bat disturbance (19-15). Emergence surveys to determine bat species and abundance will be carried out in June–July and September.

Where possible, potential roost trees will be removed during winter (late November – mid/late February) when bats are unlikely to be present. No removal will take place in late April to early October when bats are most active. Removal is inadvisable in March–April and the second half October (19-18), when bats are active during short warm periods and may take temporary shelter in hollow trees. If removal of potential bat roosts in sub-optimal periods is unavoidable, the following actions will be taken:

- Bat specialist to be present during removal
- Ecologist to inspect removed trees with hollows
- Translocate any bats to suitable habitat away from construction areas
- Provide artificial bat shelters (compensation) at 1:3 ratio after reinstatement (19-19).

The banks of the river Supsa will be kept free of Project-related obstructions during construction so that otters can move freely up and down the river (19-16). Lights will be shrouded or directed with the aim of reducing off-site light spill at construction sites (8-04).

Clearance of the ROW, particularly in more vegetated areas, may present a temporary barrier to movement for some fauna such as small mammals, amphibians and reptiles. In addition, animals may fall into the open trench and die if they cannot escape. This is not likely to cause a significant effect on the population of any species but to minimise the risk. The length of open excavations will be restricted to 3km of continuous trench in any one section (21-01). Each section of open pipeline trench will have sloped ends or other mechanisms to aid egress from the trench (21-02). Animals may seek shelter within pipe sections therefore welded pipe strings will be capped to prevent entry (19-04). Following consultation with local communities gaps will be left in soil stacks and pipe strings at strategic locations to allow passage of people, wildlife and livestock where the Project considers it safe to do so (20-01).

A number of mitigation measures that are described in other sections of this chapter will reduce the risk of animal disturbance and/or harm to a low level. These are summarised as follows:

- Noise: measures 25-11, 25-05 and 25-03 in Section 10.9.4
- Vibration: measures 25-14 - 25-16, 37-08 also in Section 10.9.4
- Respiratory impairment from dust: measures 2-02, 23-05, 23-06 and 24-01, 24-02, 24-05 in Section 10.8.4
- Accidental spillage of hazardous materials: measures 6-03 - 6-12, 6-20, 6-21, 4-14, 7-10, 7-12 and 7-14 in Section 10.3.4
- River flow: measures 15-02, 15-03 and D5-079 in Section 10.5.4
- Surface water contamination by sediment or chemicals: measures 10-08, 10-10 and 3-17 in Section 10.5.4.

Waste foodstuffs can encourage vermin if not adequately managed. The Waste Management Plan will include procedures for the disposal of food and other organic wastes. The vermin population will be monitored and controlled so that it does not become a disturbance or disease risk.

Wildlife sensitivity to disturbance will be included in workforce training (19-06). 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). The trench will be checked regularly for wildlife (particularly in sensitive locations), e.g. where tortoises are found (21-04).

All drivers will undergo safety and environmental and social awareness training to reduce the potential for accidents and disturbance; driving performance will be assessed and monitored with additional training provided if necessary (19-07).

Aquatic flora and fauna

Aquatic organisms may be adversely affected by reduced water level in rivers and by smothering in the event of sediment release. Measures 10-09, 3-07, 11-03, 10-15, 11-05, 10-12, 10-16 and 10-18b that are described in Section 10.5.4 will reduce adverse impacts to a level that is considered to be of low significance.

10.7.5 *Residual Impacts on Ecology*

Once the pipeline ROW has been reinstated and planted, there will be the permanent loss of about 4ha of vegetation that will be used as a running track by ROW patrol vehicles. Some of these areas are the existing WREP running track and others are grassland with minimal biodiversity interest. The residual impact is therefore determined to be low.

The residual impact on habitats, rare or protected plant species and on terrestrial fauna and aquatic species (fauna and flora) during construction will be low except for the loss of GRL trees which is assessed as being of medium significance.

Once the pipeline is operational, there may be occasional localised disturbance from the pipeline inspection team, but this will be of negligible significance. The residual impact is classified as low.

10.8 Air Quality and Greenhouse Gas Emissions

A discussion of the potential air quality impacts and associated mitigation measures to be adopted during construction of the WREP-SR Project is provided in this section.

No impacts are envisaged during operations. Additional pump stations are not required and there will be no change to existing operations (i.e. no planned increase in throughput) over that assessed in previous EIAs, therefore operational impacts are not considered further in this section. Greenhouse gas (GHG) emissions are considered in Chapter 11 Cumulative and Transboundary Impacts.

10.8.1 *Aspects of WREP-SR Project that Could Affect Air Quality and Greenhouse Gas Emissions*

Key air quality issues and potential emission sources connected with the construction and commissioning phase are considered to be:

- Dust generated during the construction phase (A24)
- Emissions associated with traffic and equipment during construction (A23)
- Fugitive emissions of hydrocarbons and venting of nitrogen during the de-oiling and tie in process for each pipeline section (A23).

The evaluation focuses on the following pollutants:

- Nitrogen oxides (NO_x) - (nitrogen dioxide (NO_2) and nitric oxide (NO))
- Sulphur dioxide (SO_2)
- Carbon monoxide (CO)
- Carbon dioxide (CO_2)
- Particulate matter (PM)[5]
- Volatile organic compounds (VOCs)[6]
- Disturbance dust[7].

CO_2, CO, NO_x, SO_2, PM and VOC are generated in varying amounts as a result of burning fossil fuels and are often termed ‘combustion gases’. Particulate matter is also produced naturally from wind-blown dust and sea salts. With the exception of carbon dioxide (CO_2) and disturbance dust, such compounds have the potential to impact on health if concentrations are present at elevated levels above relevant air quality criteria. Sulphur dioxide, nitrogen oxides and dust also have the potential to impact on vegetation.

A summary of potential project-related sources of each pollutant is summarised below in Table 10-15.

Table 10-15: Potential Project-Related Pollutant Sources

Component	Potential Project-Related Source
Dust or particulate matter (PM)	Construction activity including excavation, earthworks, vehicle movements and wind passing over open ground or dusty materials.
Fine particulate matter (PM_{10}) - diameter of less than 10 microns	Construction activity (as above).

[5] Particulate matter is used in this context to describe inhalable particles generally PM_{10} and below.
[6] 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.”
[7] Disturbance 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 etc.)

Component	Potential Project-Related Source
Oxides of nitrogen (NO_x) including nitrogen dioxide (NO_2)	Combustion sources including vehicles and construction equipment. Indirectly produced at off-site power stations (along with other emissions) by the consumption of electricity.
Carbon monoxide (CO)	Combustion sources including vehicles and construction equipment.
Sulphur dioxide (SO_2)	Produced in limited quantity from petrol and diesel combustion.
VOC including benzene (C_6H_6)	Main source is from the combustion of petrol and diesel from vehicles and equipment or vapour loss of petrol used in vehicles.
Carbon dioxide (CO_2) and methane (CH_4)	Produced by the combustion of fuels in construction equipment and vehicles.

10.8.2 *Key Sensitivities*

Dust is likely to have greatest impact where houses and schools are close to the ROW or access roads. Such locations are identified in Table 10-16.

No locations have been identified where other potential project-derived air quality components are likely to be more significant than the concentrations already present in the surrounding area (i.e. the concentrations of project-derived air quality components are not expected to significantly increase ambient concentrations).

Table 10-16: Dust Sensitive Locations

Approx. KP/AR	Locations particularly sensitive to dust	Sensitivity*
RP-001a KP1.0 (AM 53)	Stone house/farm 40m from the proposed route	D
AR63	Houses 10-80m from the access road	C
AR63	Cemetery 40m from the access road Industrial units 80–300m from the access road	B
RR-001 KP0.0, AR63	Houses within 70m of the tie-in area and along AR63	D
RR-001 KP2.0	Two summer houses within 30m of ROW	D
AR65	Houses along AR65 within 10-20m	D
BVS28	Houses occupied by IDPs, 80m from the access road	C
AR to PRS1	Access via 20km of village roads. Passes through several villages: Korbouili – within 5m of many houses, 10m of Korbouli school #1, 15m of a new school under construction, 20m of Korbouli school #2 and an open market with small shops either side of the road. Shomakheti – within 10m of Shomakheti school. Usakhelo village - for about 1km. Residential houses are very close to the road. Within 20m of Usakhelo school. Zeda Usakhelo/Tsiteli Eklesia settlement - within 50m of village cemetery.	D
AR223	Mandaeti: schools, shops and houses within 20m of the access road	D
AR225	Houses within 80m of the access road	C
AR373	Houses, farm and a shop along the access road	D

* Sensitivity assessed using Table 3-12

10.8.3 *Impacts of Construction Emissions*

Combustion gases

Gaseous emissions from construction vehicles and equipment will consist primarily of combustion gases from additional transport and traffic during construction and the operation of construction equipment. The most important of these with the potential to impact on local air quality are NO_x and PM_{10}. Standard construction vehicles and equipment will be employed which typically includes compressors, earthmoving equipment, pipe laying machinery, tractors and small generator sets to provide electrical power.

Projected emissions from construction equipment are summarised in Chapter 5 Project Description. The values given are per month of construction (where emission data is available).

Each pipeline section will take a variable time to construct dependent upon its length and complexity. However, construction is likely to take from between 2 and 6 months although not all the equipment will be running all the time or every day. An estimate of total emissions from construction activities is provided in Table 5-9.

The release of combustion gases during construction may result in a minor increase in concentrations of airborne pollutants. Combustion gas dispersion associated with construction activities has not been directly assessed as it is not anticipated that releases will be significant and they will be spread over a wide area. Given the expected good ambient air quality in the WREP-SR Project area compared to applicable air quality standards, it is considered highly unlikely that WREP-SR Project derived combustion gas emissions will lead to an exceedance of EU and WHO standards for the protection of health (Chapter 6).

Welding activities may additionally produce minor releases of metal and oxides of nitrogen but these will be very small, highly localised and rapidly dispersed.

De-oiling, fugitive emissions and venting

Fugitive emissions will occur from the refuelling of vehicles both at filling stations and from on-site fuel trucks. However, the vehicles and machinery that will be used are typically diesel powered and would be expected to have lower fugitive losses in comparison to alternative fuels such as petrol. The use of diesel fuel will therefore minimise the evaporative losses of hydrocarbons. If petrol powered vehicles and plant are occasionally used the fugitive losses from refuelling will be minimal.

Fugitive emissions during de-oiling will be very small and limited to small, short-term vapour releases during transfer of oil via break tanks (see Table 5.9).

Nitrogen gas will be used during pipeline de-oiling and commissioning and will be vented to the atmosphere on completion of the operations. Nitrogen constitutes 78% of air and will dissipate quickly from the point of emission.

Greenhouse gas emissions

Combustion of diesel in the construction equipment and vehicles produces greenhouse gases such as carbon dioxide, methane and volatile organic compounds. Fugitive emissions resulting from refuelling will also result in the localised release of VOCs. The quantity of greenhouse gases emitted from the local, temporary construction activities is considered to be very small in relation to national GHG emissions.

Dust/particulate matter generation

Construction activities and vehicle movements can cause dust agitation in addition to that already caused by the wind. Dust will be generated as a result of vehicle movements and typical construction activities (e.g. stripping, levelling and compacting). Dust emissions will be temporary, restricted to permitted working hours and will vary in frequency (i.e. they will not be continuous).

Once airborne, dust will travel down wind before settling. The distance travelled depends primarily on wind speed and particle size. For example, smaller particles and strong winds result in greater dilution effects but mean that the dust is deposited over a larger area. However, dust issues typically occur within a few hundred metres of their point of generation.

The potential impacts are disturbance to local residents and deposition on vegetation, organisms (for example bees which are particularly sensitive to dust) and surfaces. Whether dust deposition becomes a problem is a subjective issue and depends on a variety of factors including the sensitivity of nearby locations, the repetitive nature of any deposit occurring and the nature of the particulate itself. Due to this subjectivity there are no statutory limits on dust deposition and the focus is on the prevention of disturbance and minimising airborne dust emissions where practicable. Social impacts from dust such as impacts on livelihoods (including crop productivity and honey production in bees) and community disturbance are discussed in Sections 10.12 and 10.11 respectively.

Impact summary and assessment of significance

Table 10-17 provides an assessment of the significance of air quality and greenhouse gas impacts before and after implementation of the proposed mitigation measures which are discussed in the rest of this section. Impacts on the locations identified as particularly sensitive to dust are assessed in Table 10-18.

Table 10-17: Potential Impacts on Air Quality and Greenhouse Gas Emissions

Issue		Potential Impacts	Potential Impact Significance	Mitigation Measures	Potential Residual Impact Significance
A24	Dust generation, particularly from vehicle movements and storage of excavated materials	Reduced air quality	C4 Medium	2-02, 24-02, 23-06, 24-01, 23-05, 4-09, 24-05, 24-06	C2 Low
A22	Use of energy	Emission of contaminants	B1 Low	22-02, 23-02	B1 Low
		Emission of greenhouse gases	B1 Low		B1 Low
A23	Release of gases and vapours to atmosphere from vehicle exhausts, welding, cleaning, de-oiling and testing of pipeline; and fugitive emissions from fuel storage and refuelling	Emission of air pollutants	B2 Low	22-02, 23-02, 23-03	B2 Low
		Increase in greenhouse gases	B1 Low	23-02, 23-08, 6-05	B1 Low
A7	Production & disposal of solid & liquid waste	Emission of GHGs from decomposition	B1 Low	7-01, 7-04	B1 Low

* assessed using tables 3-12/13

Table 10-18: Impact Assessment for Locations Sensitive to Dust

Approx KP/AR	Locations particularly sensitive to dust	Potential Impact Significance*	Mitigation	Residual Impact Significance*
RP-001a KP1.0	Stone house/farm 40m from the proposed route	D3 Medium	33-23, 30-26, 24-08, 23-05	D2 Medium
AR63	Houses 10-80m from the access road	C3 Medium		C2 Low
AR63	Cemetery 40m from the access road Industrial units 80–300m from the access road	B3 Low		B2 Low
RR-001 KP0.0, AR63	Houses within 70m of the tie-in area and along AR63	D3 Medium		D2 Medium
RR-001 KP2.0	Two summer houses within 30m of ROW	D3 Medium		D2 Medium
AR65	Houses along AR65 within 10-20m	D3 Medium		D2 Medium
BVS28	Houses occupied by IDPs, 80m from the access road	C3 Medium		C2 Low
AR to PRS1	Access via 20km of village roads. Passes through several villages: Korbouili – within 5m of many houses, 10m of Korbouli school #1, 15m of a new school under construction, 20m of Korbouli school #2 and an open market with small shops either side of the road. Shomakheti – within 10m of Shomakheti school. Usakhelo village - for about 1km. Residential houses are very close to the road. Within 20m of Usakhelo school. Zeda Usakhelo/Tsiteli Eklesia settlement - within 50m of village cemetery.	D3 Medium		D2 Medium
AR223	Mandaeti: schools, shops and houses within 20m from the access road	D3 Medium		D2 Medium
AR225	Houses within 80m of the access road	C3 Medium		C2 Low
AR373	Houses, farm and a shop along the access road	D3 Medium		D2 Medium

* assessed using Tables 3-12/13

10.8.4 *Mitigation of Construction Emissions*

The main mitigation measures that will be adopted to reduce the impacts associated with air emissions are described below.

Combustion 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). Controlled or uncontrolled burning of waste will not be allowed (with the exception of Company approved incinerators) (7-01). Waste management practices will be subject to regular monitoring and auditing in accordance with the Waste Management Plan (7-04).

The workforce training will include advice on minimising energy consumption (22-02). Preferentially the Project will use fuel that has low sulphur content of 0.1%, where practical and available within Georgia (23-03). Mitigation measures to further minimise combustion emissions will include the minimisation of engine idling time and the use of properly sized equipment.

Fugitive emissions

The control of fugitive emissions has been taken into account during project design. 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). Cleaning and testing procedures will include safeguards which will aim to prevent the accidental release of nitrogen and discourage public access to areas in close proximity to sections filled with nitrogen (23-08).

Dust generation

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

- Vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency) (2-02)
- A strict speed limit will be enforced for Project vehicles using unmade tracks and the ROW in accordance with speed limits defined in the Contractor's Transport Management Plan (24-02)
- Vehicles carrying fine materials will be sheeted to help prevent dust blow and spillages (23-06)
- The contractor will be required to have an adequate supply of bowsers and to regularly damp down the ROW, access roads and village roads used by construction traffic during dry conditions; treated waste water should be used where possible (24-01)
- 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)
- Reinstatement will be undertaken as early as practical and in accordance with the Project Reinstatement Specification (4-09). The long-term impact of disturbance dust will decline as stripped areas of land re-vegetate. Due to the temporary nature of construction, dust emissions are not anticipated to have a long-term impact on local air quality.

Bees are particularly sensitive to dust. The Project will prepare an inventory of bee hives within 300m of the pipeline construction areas or access routes before the start of construction. An independent bee expert will be employed to determine any impacts on bees and/or honey production and develop appropriate mitigation measures (24-05). The Project will develop and implement a policy for the compensation of beekeepers adversely affected by Project impacts (24-06).

The implementation and effectiveness of dust prevention measures at the dust sensitive locations listed in Table 10-16 will be closely monitored (24-08). Properties that may potentially be affected by the Project will be consulted before and during construction (33-23). Communities located along Project access roads that will require additional consultation to be undertaken before and during construction will be identified (30-26). This latter commitment is designed to address issues such as community safety, noise and vibration but will also allow concerns over air quality, in particular dust, to be communicated to the Project.

10.8.5 *Residual Impacts on Air Quality and Climate*

Upon implementation of the above mitigation measures, the residual impacts associated with combustion emissions and greenhouse gas emissions will be of low significance.

Although a short-term increase in dust levels is unavoidable, they are considered to be generally of low significance as visual observations show that background dust levels are high during windy conditions and when existing vehicles travel along unmade tracks. However, where construction vehicles will be passing close to schools (AR to PRS1 and AR223) and houses the residual impact could be of medium significance due to the sensitivity of the receptors and their close proximity to the ROW or road. Particular attention will be paid to the implementation of the proposed mitigation measures at these locations.

10.9 Noise and Vibration

A discussion of the potential noise and vibration impacts and associated mitigation measures to be adopted during construction and commissioning of the WREP-SR Project is provided in this section.

No impacts are envisaged during operations. Additional pump stations are not required and there will be no change to existing operations (i.e. no planned increase in throughput) over that assessed in previous EIAs, therefore operational impacts are not considered further in this section.

10.9.1 *Aspects of WREP-SR Project that Could Affect* Noise and Vibration

Noise and vibration emissions may result from the following Project activities:

- Use of access roads by construction vehicles (A25, A26)
- The maintenance and use of vehicles, plant and equipment during construction (A25, A26)
- Use of pumps and compressors during hydrotesting (A25, A26)
- Drying and venting activities during testing and commissioning and removal from service of redundant sections of the WREP pipeline (A25, A26).

10.9.2 *Noise and Vibration Sensitive Receptors*

The pipeline re-route sections are generally routed through areas with very few noise and vibration-sensitive receptors. Particularly sensitive receptors are communities through which access roads are routed, which may have schools, hospitals or dwellings close to the road or access route as listed in Table 10-19. In addition, known archaeological monuments may be sensitive to vibration.

Mobile receptors, such as people and animals passing close to the works, generally have the ability to move away from the source of the noise, although this may be an inconvenience to them and could temporarily restrict the availability of land for grazing.

Table 10-19: Noise and Vibration Sensitive Locations

Approx KP/AR	Sensitive Noise Receptors	Noise Sensitivity	Vibration Sensitivity
RP-001a KP1.0 (AM 53)	Stone house/farm 40m from the proposed route	C	D
AR63a	Mamkoda village: house 290m from AR63a	C	-
AR63	Houses 10-80m from the access road	C	D

Approx KP/AR	Sensitive Noise Receptors	Noise Sensitivity	Vibration Sensitivity
AR63	Cemetery 40m from the access road Industrial units 80–300m from the access road Cattle farm 250m from the access road	B	-
RR-001 KP0.0, AR63	Houses within 70m of the tie-in area and along AR63	C	D
RR-001 KP0.0 (AM 63), AR63a, AR64.5	Summer houses (west of Mamkoda) within 220m	C	-
RR-001 KP2.0	Two summer houses within 30m of ROW	C	D
AR65	Houses along AR65 within 10-20m	C	D
AR66	Houses 190m from the access road	C	-
RR-001 KP3.0	Church on hilltop, 160m from the proposed route	B	-
RR-001 KP5.2, AR67	Monastery 130m	B	-
RR-001 KP6.8, AR69a	Monastery complex 220m from the proposed route and access road	C	-
BVS28	Houses occupied by IDPs, 80m from the access road	C	-
AR to PRS1	Access via 20km of village roads. Passes through several villages: Korbouili – within 5m of many houses, 10m of Korbouli school #1, 15m of a new school under construction, 20m of Korbouli school #2 and an open market with small shops either side of the road. Shomakheti – within 10m of Shomakheti school. Usakhelo village - for about 1km. Residential houses are very close to the road. Within 20m of Usakhelo school. Zeda Usakhelo/Tsiteli Eklesia settlement - within 50m of village cemetery.	D	D
AR223	Mandaeti: schools, shops and houses within 20m of the access road	D	D
AR225	Houses within 80m of the access road	C	D
AR373	Houses, shop and farm along the access road	C	D

* assessed using Tables 3-14/15 and 3-16/17

10.9.3 *Noise and Vibration Impacts*

Construction noise impacts

This assessment has been prepared using the most recent, typical noise data available for pipeline construction activities and the anticipated duration of such operations. Activities associated with standard pipeline construction methods have been cross-referenced with standard noise source data to give the most accurate estimate of site noise possible at this stage. These values have been calculated using the procedures described in BS 5228-1:2009. Table 10-20 shows typical noise levels that may be expected at various distances from the ROW.

Table 10-20: Typical Noise Levels Associated with Various Construction Activities

L_{AEQ} [8](DB) calculated from BS 5228 at varying distances from ROW					
Construction Activities	50m	150m	250m	350m	450m
Initial access & fencing	76	67	62	59	57
Site preparation & ROW	74	65	60	57	55
Topsoil stripping & site grading	82	72	68	65	63
Pipe haul & stringing	83	73	69	66	64
Cold pipe bending	73	63	59	56	54
Mainline welding	79	70	65	62	60
Trench excavation	79	70	65	63	60
Pipe lower and lay & tie-in	75	66	61	58	56
Backfilling	72	62	58	55	52

Due to the nature of the construction process, noise levels will fluctuate in line with operating periods for each item of plant and with the combination of machinery being used at any one time. Noise levels will also vary depending on time, and distance as the construction spread progresses along the pipeline route. Local residents will not, therefore, be continually exposed to the noise levels shown above for extended periods.

The majority of the pipeline trench is through ground that can be excavated by back hoe or trenching machine. Such materials include unconsolidated clays, sand, friable and weathered rock. There is therefore considered unlikely at this stage that any blasting will be required to construct any of the pipeline sections.

Construction traffic associated with the pipeline construction will be routed via main roads as much as possible (e.g. the main East-West highway and main roads to villages from this highway). Some minor roads and tracks will have to be used for access to the pipeline spread and have been defined as 'Project access roads' (see Table 5-4).

The increase in traffic movements within small rural villages may cause a noticeable increase in daytime noise levels but this effect will be localised and temporary.

Noise during commissioning and testing

Before the pipe sections are commissioned they will each be subject to a hydrostatic pressure test over a 24-hour period as described in Chapter 5 Project Description. Testing will not give rise to significant noise levels along the pipe section itself, but pumps and air compressors are needed to fill and pressurise the pipeline at the test ends. Noise levels during release of pressure from testing operations can be sudden and significant; however it is of short duration. Generators may also be required at selected locations along the route for security lighting at night. Typical noise levels for equipment used during commissioning (predicted using BS 5228-1: 2009) are shown in Table 10-21.

[8] 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.

Table 10-21: 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

Construction vibration impacts

House owners may complain about damage induced by vibration from construction traffic, such as cracks in walls and ceilings, separation of masonry blocks, and cracks in foundations. Although vibration levels are rarely high enough to be the direct cause of this damage, they could contribute to the process of deterioration from other causes particularly in buildings that are already damaged. Building components usually have residual strains as a result of uneven soil movement, moisture and temperature cycles, poor maintenance or past renovations and repairs. Therefore small vibration levels induced by road traffic may trigger damage by "topping up" residual strains.

It is difficult to establish a vibration level that may cause building damage. In some cases, when a building is subjected to vibration for many years, fatigue damage (i.e. that caused by repeated loading) may occur if the induced stresses in the building are high enough. In addition to damage caused directly by vibration, indirect damage may result from differential movements caused by soil settlement due to compaction (Hunaidi, O., 2000).

The condition of the road surface near a building has a very significant effect on the levels of vibration; vehicles on a smooth road surface create much lower levels of vibration than do similar vehicles travelling at similar speeds on an uneven surface. Poor road surfaces with badly filled potholes or service trenches will generate vibration, particularly if the traffic is fast moving and/or heavy.

Impact summary and assessment of significance

Table 10-22 provides an assessment of the significance of impacts on soil resources before and after implementation of the proposed mitigation measures which are discussed in the following section.

Table 10-22: Impact Assessment Summary for Noise and Vibration

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A25	Noise emissions from vehicle movements, construction operations	Construction activities causing disturbance, lack of sleep for shift workers, and loss of concentration for school children	C2 Low	23-02, 25-11, 25-01, 25-04, 25-05, 25-03, 33-01, 25-17, 25-08, 25-09	C1 Low
A26	Vibration from vehicle movements and construction operations	Damage to buildings (particularly those close to access roads already in state of disrepair) leading to claims for compensation	D2 Medium	33-01, 25-16, 37-08, 25-14, 25-15, 25-13, 23-02, 24-02	D1 Low

* assessed using Tables 3-16/17 and 3-14/15

Table 10-23: Noise Impact Assessment at Sensitive Locations

Approx KP/AR	Sensitive Noise Receptors	Potential Impact Significance*	Mitigation	Residual Impact Significance*
RP-001a KP1.0 (AM 53)	Stone house/farm 40m from the proposed route	C3 Medium	25-09	C2 Low
AR63a	Mamkoda village: house 290m from AR63a	C3 Medium		C2 Low
AR63	Houses 10-80m from the access road	C3 Medium		C2 Low
AR63	Cemetery 40m from the access road Industrial units 80–300m from the access road Cattle farm 250m from the access road	B3 Low		B2 Low
RR-001 KP0.0, AR63	Houses within 70m of the tie-in area and along AR63	C4 Medium		C3 Medium
RR-001 KP0.0 (AM 63), AR63a, AR64.5	Summer houses (west of Mamkoda) within 220m	C3 Medium		C2 Low
RR-001 KP2.0	Two summer houses within 30m of ROW	C3 Medium		C2 Low
AR65	Houses along AR65 within 10-20m	C3 Medium		C2 Low
AR66	Houses 190m from the access road	C3 Medium		C2 Low
RR-001 KP3.0	Church on hilltop, 160m from the proposed route	B3 Low		B2 Low
RR-001 KP5.2, AR67	Monastery 130m	B3 Low		B2 Low
RR-001 KP6.8, AR69a	Monastery complex 220m from the proposed route and access road	C3 Medium		C2 Low
BVS28	Houses occupied by IDPs, 80m from the access road	C3 Medium		C2 Low
AR to PRS1	Access via 20km of village roads. Passes through several villages: Korbouili – within 5m of many houses, 10m of Korbouli school #1, 15m of a new school under construction, 20m of Korbouli school #2 and an open market with small shops either side of the road. Shomakheti – within 10m of Shomakheti school. Usakhelo village - for about 1km. Residential houses are very close to the road. Within 20m of Usakhelo school. Zeda Usakhelo/Tsiteli Eklesia settlement - within 50m of village cemetery.	D3 Medium		D2 Medium
AR223	Mandaeti: schools, shops and houses within 20m of the access road	D3 Medium		D2 Medium
AR225	Houses within 80m of the access road	C3 Medium		C2 Low
AR373	Houses, farm and a shop along the access road	C3 Medium		C2 Low

* assessed using Tables 3-14/15

Table 10-24: Impact Assessment at Vibration Sensitive Locations

Approx KP/AR	Constraint/Issue	Potential Impact Significance*	Mitigation	Residual Impact Significance*
RP-001a KP1.0 (AM 53)	Stone house/farm 40m from the proposed route	D3 Medium	25-16, 37-08, 25-14, 25-15, 25-13, 23-02, 24-02	D2 Medium
AR63	Houses 10-80m from the access road	D3 Medium		D2 Medium
RR-001 KP0.0, AR63	Houses within 70m of the tie-in area and along AR63	D3 Medium		D2 Medium
RR-001 KP2.0	Two summer houses within 30m of ROW	D3 Medium		D2 Medium
AR65	Houses along AR65 within 10-20m	D3 Medium		D2 Medium
AR to PRS1	Access via 20km of village roads. Passes through several villages: Korbouili – within 5m of many houses, 10m of Korbouli school #1, 15m of a new school under construction, 20m of Korbouli school #2 and an open market with small shops either side of the road. Shomakheti – within 10m of Shomakheti school. Usakhelo village - for about 1km. Residential houses are very close to the road. Within 20m of Usakhelo school. Zeda Usakhelo/Tsiteli Eklesia settlement - within 50m of village cemetery.	D3 Medium		D2 Medium
AR223	Mandaeti: schools, shops and houses within 20m from the access road	D3 Medium		D2 Medium
AR225	Houses within 80m of the access road	D3 Medium		D2 Medium
AR373	Houses, farm and a shop along the access road	D3 Medium		D2 Medium

* assessed using Tables 3-16/17

10.9.4 *Mitigation of Noise and Vibration Impacts*

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 maximise fuel efficiency and help minimise emissions (23-02)
- 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, a location-specific risk assessment will be undertaken for activities undertaken between 7pm and 7am (25-01)
- During construction the local community will be informed of when and where noisy activities will occur prior to the activity taking place (25-04)

- Noise will be monitored periodically against the Project Environmental Standards (Appendix F) at sensitive locations (25-05)
- Project induction training will include instructions about minimising noise disturbance (25-03)
- The Project will avoid vehicle reversing where practical, and will preferentially use white noise[9] type reversing alarms (25-08)
- The Contractor will be required to develop and implement a Grievance Procedure to allow individuals to express grievances about Project-related activities and employees. A grievance register will be used to document all third party grievances, corrective actions and outcomes (33-01)
- During construction of the pipeline 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 Environmental Standards (Appendix F), measures will be implemented to aim to reduce noise levels (e.g. hoardings) (25-09).

During commissioning and testing:

- Planned releases of nitrogen and air during de-oiling to be addressed in method statements and include:
- Prior notification to residents who are potential receptors
- Provision of acoustic screens and/or silencers as deemed necessary by Company (25-17)
- During commissioning and testing, noise emissions from equipment will be minimised through use of acoustic insulation as deemed appropriate by the Project (25-11).

Vibration

Vibration sensitive locations will be determined by the Contractor and listed in their Pollution Prevention 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).

A survey will be undertaken to record the external condition of buildings in close proximity to 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 undertake the following:

- Equipment and vehicles will be regularly maintained in accordance with the manufacturer's recommendations to maximise fuel efficiency and help minimise emissions (23-02)
- Correct tyre pressures will be monitored and maintained (25-16)
- A strict speed limit will be enforced for Project vehicles using unmade tracks and the ROW in accordance with speed limits defined in the Contractor's Transport Management Plan (24-02)
- 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

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

particularly where fragile buildings are close to roads (subject to site specific survey) (37-08).

The Contractor will be required to develop and implement a Grievance Procedure to allow individuals to express grievances about Project-related activities and employees. A grievance register will be used to document all third party grievances, corrective actions and outcomes (33-01).

10.9.5 *Residual Impacts from Noise and Vibration*

The above mitigation measures, which reduce the impact of construction activity noise, will generally result in a low residual impact, except at certain sensitive receptors where noise from construction traffic may be of medium significance.

The residual impact associated with noise emissions from commissioning and testing will be of low significance and short duration.

Implementation of the proposed mitigation measures will reduce the risk and severity of building damage from vibration. The residual impact is considered to be of medium significance for sensitive receptors.

10.10 Cultural Heritage

Georgia has a long and complex history which is reflected in the depth and nature of its archaeological record. The original construction of the WREP pipeline in 1997 revealed many sites of cultural importance which have informed the design of the current project. Since the mid 1990's the protection of Georgia's Cultural Heritage has also been amplified, which has tended to increase the level of significance afforded to the corridor within which the WREP-SR runs. This particularly applies to the designation of the monuments associated with Mtskheta such as the Jvari monastery and the Svetitskhoveli cathedral, which are all designated as a World Heritage Site.

10.10.1 *Aspects of WREP-SR Project that Could Affect Cultural Heritage*

The aspects of the WREP-SR Project which could impact on heritage resources are:

- The removal of topsoil and subsoil during preparation of the ROW and access roads (A27)
- Trench excavation (A27)
- The visible presence of the works in the Landscape Protection Zone around the Mtskheta World Heritage site (A27).

10.10.2 *Key Sensitivities*

The sensitivity of each site and magnitude of impact have been assessed using Tables 3-18 and 3-19 in Chapter 3 and take account of the fact that conducting thorough cultural heritage surveys may have a positive, or beneficial impact by adding to the understanding of archaeology in the area, increasing public awareness and contributing to local records. Areas with known cultural heritage that are on or close to the proposed works areas are identified in Table 10-26.

Part of section RR-001 and associated access roads is within the landscape protection zone for the Mtskheta World Heritage Site and has been subject to an independent Heritage Impact Assessment (HIA). This was undertaken by ICOMOS Georgia during March/April 2016 in order to identify potential impacts of the WREP SRP on tangible historic resources (e.g. monuments), archaeology, landscape and intangible values.

10.10.3 *Impacts*

In many cases, detailed information on archaeological features only becomes available during the construction phase of a project due to the intrusive nature of the process. Therefore, the accurate assignment of consequence/severity prior to the construction phase is often not possible. The success of any pre-construction evaluation of a linear project such as this relies upon many factors including the above ground visibility of sites and the skills and knowledge of the survey archaeologists.

Activities associated with the construction of a pipeline 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. A linear project creates an increase in knowledge both in previously explored areas, and also 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 10-25 and Table 10-26 below, determine the consequence or severity 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 10-25: 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, 27-10, 27-05, 27-11, 39-01, 27-15, 27-17	A1 Low
		Discovery of unknown archaeology during construction	C4 Medium	27-05, 27-06, 27-07, 27-08, 27-09, 27-10, 27-11, 27-13, 39-01	C2 Low

* assessed using Tables 3-18/19

Table 10-26: Potential Impacts on Cultural Heritage at Specific Locations

Approx KP/AR	Sensitive Cultural Heritage	Potential Impact	Potential Impact Significance*	Mitigation	Residual Impact Significance*
AR52 CH52-1	Elevated land	Potential adverse effect on artefacts in the immediate vicinity if access road requires widening	B2 Low	27-05	B2 Low

Approx KP/AR	Sensitive Cultural Heritage	Potential Impact	Potential Impact Significance*	Mitigation	Residual Impact Significance*
AR55 CH55-1	Pottery fragments	Construction may have adverse effect on artefacts in the immediate vicinity	B2 Low	27-05	B2 Low
AR63 CH63-1	Pottery fragments	Potential adverse effect on artefacts in the immediate vicinity if access road requires widening	B2 Low	27-05	B2 Low
AR63 CH63-2	Settlement remains near road but not directly affected	Potential adverse effect on artefacts in the immediate vicinity if access road requires widening	B2 Low	27-05	B2 Low
RR-001 KP3.0 (AM66) CH-6	St George's Church on top of hill – 70m to SW of route – site not impacted by route.	Construction may have adverse effect on artefacts in the immediate vicinity	D1 Low	27-05	D1 Low
RR-001 KP3.0 (AM66) CH-7	Medieval village remains. Structural remains (stone walls) of the settlement can be seen on the surface, spread across a fairly large area to NE of the route. Route avoids site boundary but is very close – 3m at the closest point.	Construction may have adverse effect on artefacts in the immediate vicinity	B2 Low	27-05	B2 Low
RR-001 KP5.0 (AM68) CH-8	Medieval village remains. Route goes through northern boundary of site for approx. 350m	Construction may have adverse effect on artefacts in the immediate vicinity	B2 Low	27-05	B2 Low
RR-001KP5.5 –KP7.8 (AM68.5– AM71) CH-24	Pipeline route is within or close to historic landscape protection zone (LPZ) associated with the Mtskheta World Heritage Site.	Construction may have adverse effect on historic landscape or artefacts in the immediate vicinity	E2 Medium	27-05, 27-18	E2 Medium
AR69	Access road is the main road to Jvari monastery	Construction traffic may disrupt access to Jvari monastery for pilgrims and visitors	E2 Medium	27-19	E1 Low
AR 66 CH-5	Access road to be used for ROW construction. Cultural layer consisting of ash, obsidian artefacts and animal bones observed within cutting of existing track. Also a clay pit on the side of the existing track.	Potential adverse effect on artefacts in the immediate vicinity if access road requires widening	C3 Medium	27-05	C1 Low

Approx KP/AR	Sensitive Cultural Heritage	Potential Impact	Potential Impact Significance*	Mitigation	Residual Impact Significance*
AR223	Not surveyed	Potential adverse effect on artefacts in the immediate vicinity if access road requires widening	B2 Low	27-05	B2 Low
CH225-1	Flint	Potential adverse effect on artefacts in the immediate vicinity if access road requires widening	B2 Low	27-05	B2 Low
CH225-2	Pottery fragments	Potential adverse effect on artefacts in the immediate vicinity if access road requires widening	B2 Low	27-05	B2 Low

* assessed using Tables 3-18/19

10.10.4 *Mitigation*

Modern cultural resource management practice seeks to preserve archaeological deposits in situ and only excavate as a last resort. Archaeological excavation is a form of destruction in itself, as the only evidence for an excavated site lies in the observations and records made by the excavator at the time. 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.

An archaeological strategy for the Project has been created to allow for the progressive assessment and mitigation of the effects of construction of the re-route sections and widening of access roads. The principle contained in the strategy is that areas of potential impact will be examined and any necessary excavations conducted prior to construction. During construction, other archaeological sites may be identified and these will be archaeologically recorded.

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 below:

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.

Phase 1, 2 and 3 activities have been completed.

Known cultural heritage sites within 50m of the pipe centreline or other construction activity will be demarcated throughout construction (27-10).

Despite undertaking baseline surveys along all re-route sections, the possibility of unearthing archaeological artefacts during top soil stripping or trenching cannot be precluded. Therefore, a cultural heritage surveillance programme (watching brief) will be implemented during topsoil stripping and ROW trenching (27-05).

A framework for developing a Chance Finds Procedure will be included in the Cultural Heritage Management Plan. The procedure will outline the actions to be implemented in the event of a find during the topsoil stripping or trenching activities. A summary of the general stages in a Chance Finds Procedure is provided in Figure 10-4. If cultural heritage sites or artefacts are identified during construction, the archaeologists conducting the watching brief will advise on procedures to be followed by the Contractor (in line with the Chance Finds Procedure), and will be empowered to temporarily stop construction and manage the recording of finds (27-07).

If cultural heritage 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). The Company shall consider making minor adjustments to the route of the pipeline where to do so would 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 cultural heritage feature discovered during construction, construction activities will be suspended at the site until the excavation and recording required by the authorities has been carried out (27-09). The additional information that this will add to the archaeological record of Georgia will be a positive benefit.

Known cultural heritage sites will be marked out by the Cultural Heritage Monitor before construction begins (27-15). Areas of potential cultural heritage impact will be examined and any necessary excavations conducted prior to construction (27-17).

Schedules for work within the Mtskheta WHS LPZ and delivery of equipment and materials via the road to Jvari monastery (AR69) will be agreed in advance with Mtskheta Historic Monuments' stakeholders including NACHP, the Patriarchate of Georgia and community leaders (27-19). The schedules will take account of the feast days (see Section 7.10.7) and will seek to avoid adverse impacts on the movement and enjoyment of pilgrims and visitors to the monument. The schedules will be revised annually until construction, de-oiling and reinstatement activities are complete.

Issues relating to cultural heritage awareness (such as ownership of finds, notification of finds and protection of cultural heritage sites) will be included in induction training (27-11).

Known cultural heritage 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).

10.10.5 *Residual Impacts*

The WREP-SR Project has already added new information to the archaeological record of the area, during the Phase 1, 2 and 3 activities, and will continue to do so during the monitoring of pipeline construction (Phase 4). These results will increase 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.

The construction works will be visible within the Mtskheta LPZ, but this is mainly a temporary impact. Visibility will be reduced in the long-term as the area revegetates, but because of the sensitivity of this site the residual impact is considered to be of medium significance. The heritage impact assessment undertaken by ICOMOS Georgia reached the following conclusion:

> *The WREP SR Project does not contain high risks of direct impact on Outstanding Universal Value (OUV) attributes of Mtskheta WHS monuments. Construction process will have a temporary impact on the intangible values and is reducible. It can be concluded that implementation of WREP SR Project within Jvari Monastery LPZ is admissible, on condition that a specific heritage monitoring plan is integrated into construction works schedule and properly kept to.*

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

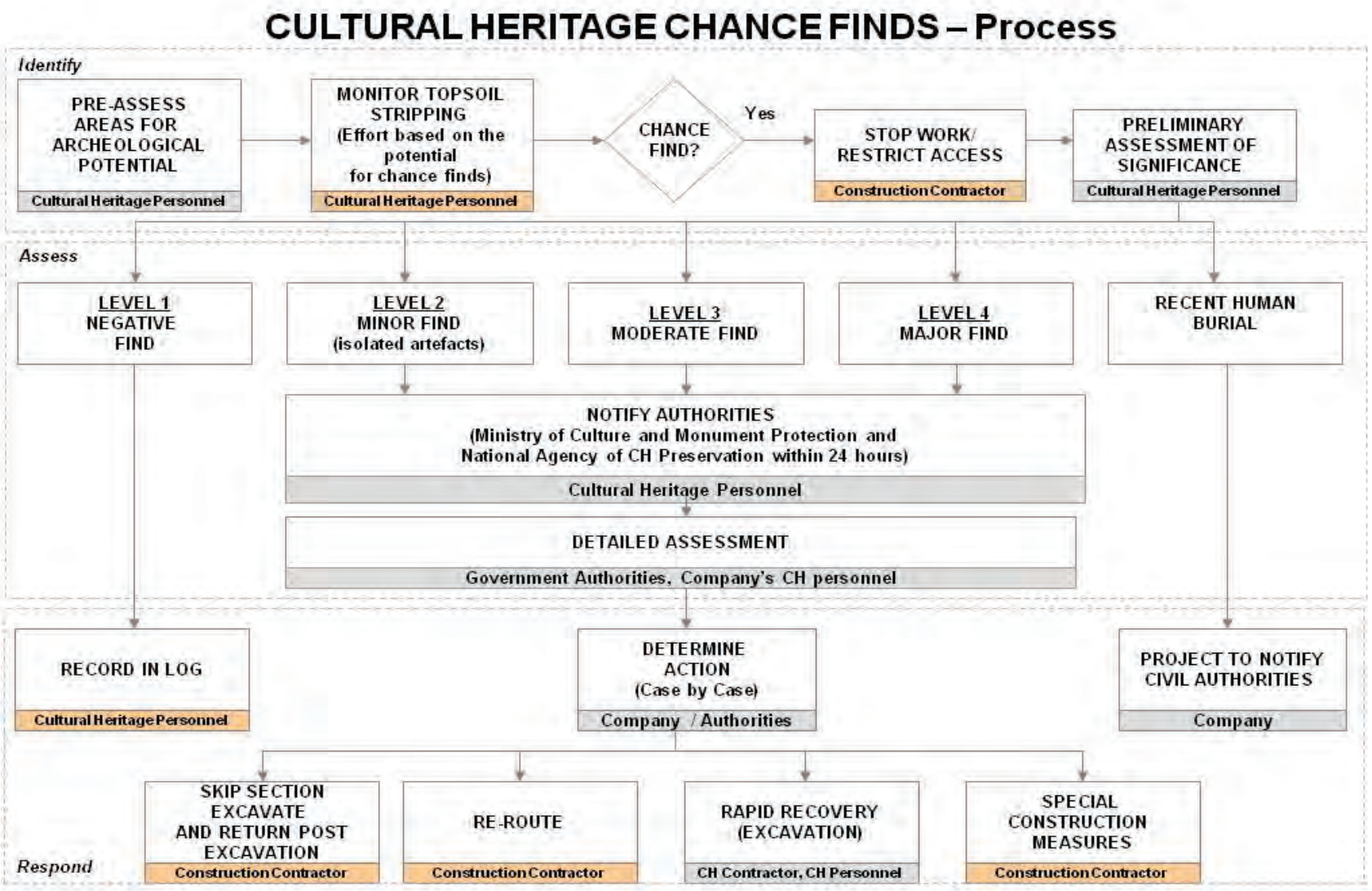

Figure 10-4: Cultural Heritage Chance Finds Procedure

10.11 Community Health, Safety and Security

A discussion of the potential impacts on community health and safety and mitigation measures to be adopted during construction of the WREP-SR Project is provided in this section. No impacts are expected in the operational phase other than the potential for ground settlement if the redundant sections of pipe corrode.

10.11.1 *Aspects of WREP-SR Project that Could Affect Community Health and Safety*

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

- Road widening or upgrading with use of vehicles unfamiliar to local people (A30)
- Road widening or upgrading resulting in temporary creation of ditches, borrow pits, spoil heaps and other hazardous changes to ground surface conditions (A30)
- Increased vehicle movements, especially heavy goods vehicles and small light utility vehicles (A30)
- Presence of pipeline laying equipment unfamiliar to local people (A30)
- Creation of open excavated areas such as trenches (A30)
- Accidental spillages of chemicals (A30, A31)
- Dust generation from earth moving, ground preparation and movement of vehicles (A31)
- Releases of vapours and gases from equipment and vehicles and pipeline testing (A31)
- Behaviour of security personnel (A30, A33)
- Increased noise and vibration levels from equipment (A31)
- Spread of illness within the workforce (A31)
- Disturbance of unexploded ordnance (A30)
- Ground settlement following removal from service of the redundant pipe sections (A30).

10.11.2 *Key Sensitivities*

The key sensitivities are:

- Current health status of local residents and workforce
- Access to healthcare services
- Knowledge of hazards and risks, posed by project-related activities and likely health consequences, among adults and children
- Level of experience of living/working in vicinity of a construction site
- Ability of adults to advise/supervise children in light of a good understanding of hazards/risks and behavioural adaptations needed to avoid hazardous situations
- Residents' acceptance of restrictions on normal 'day-to-day' activities imposed by non-local security personnel.

These sensitivities vary from community to community as discussed in Section 10.11.3 below.

10.11.3 *Potential Impacts on Community Health and Safety*

Most project–affected communities have experience of pipeline laying/pipeline repair from previous construction and refurbishment of the WREP and GOGC pipeline and subsequent

operations/maintenance activities. However this experience will not be equally distributed amongst the population of the communities.

The car 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.

Although health care provision has been improving in the Project-affected communities, 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 to health. Medicine affordability is a problem for many residents, which also adds to the health risk threat to someone in receipt of medical treatment.

Many WREP-SR activities singly, and collectively, increase the threats to community health and safety. The key types of impacts are:

- Increased risk of accidents causing injury or death to people resulting form increase in hazardous situations (excavations, trenches etc.)
- Increased risk of road/traffic accidents causing injury or death. Several of the access routes pass through Project-affected communities, some of which have schools or communal facilities very close to the route
- Increased risk of respiratory illnesses from changes in air quality, for example, prolonged exposure to fine particles (PM_{10}) in construction dust and diesel exhausts can lead to asthma, lung cancer and cardiovascular problems. There will be no prolonged exposure, but likely exposure levels may cause some respiratory problems
- Disturbance to sleep patterns from increased noise levels
- Increase in disease vectors such as rodents (if solid/liquid wastes are not managed adequately) with accompanying increased incidence of vector-borne diseases
- Potential conflict between security personnel and local community members resulting in injury to local people.

Table 10-27 provides an assessment of the significance of impacts on community health and safety before and after implementation of the proposed mitigation measures. These measures are discussed in the following section.

Table 10-27: Potential Impacts on Community Health and Safety

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A37	Use of local road network by construction traffic	Risk of accidents causing injury or death	D4 High	30-02, 30-04, 30-17, 24-02, 37-10, 19-07, 37-04, 30-21, 30-22, 30-23, 37-04, 31-02, 33-15, 37-09, 37-06 33-24,	D4 High

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A21	Open excavations (including open trench)	Risk of accidents causing injury or death to people (particularly if excavations become flooded)	D4 High	3-34, 21-01, 30-04, 30-09, 21-02, 19-04, 33-15, 33-19, 30-06, 30-02, 20-03, 30-22, 30-23, 20-01	D3 Medium
A24	Dust generation, particularly from vehicle movements and storage of excavated materials	Increase in risk of respiratory illnesses	C3 Medium	2-02, 24-02, 23-06, 24-01, 23-05, 4-09, 24-05, 24-06	C2 Low
A23	Release of gases and vapours to atmosphere from vehicle exhausts, welding, cleaning, de-oiling and testing of pipeline	Degradation of local air quality causing Increase in risk of respiratory illnesses	C1 Low	23-02, 23-08	C1 Low
A25	Noise emissions from vehicle movements, construction operations	Construction activities causing disturbance for those attending public events such as religious services, lack of sleep for shift workers, and loss of concentration for school children	C2 Low	23-02, 25-11, 25-01, 25-04, 25-05, 25-03, 33-01, 33-03, 25-17,	C1 Low
A39	Accidental release of chemicals/oils	Risk of illnesses through accidental ingestion of materials or via skin contact	D2 Medium	6-03, 6-05, 6-06, 6-09, 6-20, 6-12	D1 Low
A7	Production & disposal of solid & liquid waste	Increase in vermin (and risk of vector –borne diseases. Increased health threats from contamination of water and informal waste disposal practices such as burning	D2 Medium	7-02, 7-03, 7-01, 7-04, 10-08, 10-10	D1 Low
A31	Zoonotic and infectious diseases	Risk of zoonotic and infectious diseases to Project and community	D2 Medium	31-22, 31-06, 31-09, 31-20, 31-11, 6-22, 6-25	D1 Low
A5	Ground settlement following installation of new sections or corrosion of redundant sections	Increased community exposure to safety risk due to uneven ground	C2 Low	OP01	D1 Low
A23	Release of gases and vapours to atmosphere from vehicle exhausts, welding, cleaning, de-oiling and testing of pipeline	Risk of nitrogen asphyxiation if released accidentally during cleaning and de-oiling of pipeline	D3 Medium	23-02, 23-08	D1 Low

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A30	Community safety	Risk of conflict between community members and security personnel	D3 Medium	30-10, 30-12, 33-01, 33-15	D2 Medium
A31	Community health	Health risk as a result of delays in reaching a medical facility	D3 Medium	31-02	D2 Medium

* assessed using Tables 3-20 and 3-24

Table 10-28: Community Safety Impact Assessment at Sensitive Locations

Approx KP/AR	Sensitive Communities	Potential Impact Significance*	Mitigation	Residual Impact Significance*
RP-001a KP1.0	Stone house/farm 40m from the proposed route	C4 Medium	24-02, 30-04	C3 Medium
AR63	Houses 10-80m from the access road Cemetery 40m from the access road Industrial units 80–300m from the access road Cattle farm 250m from the access road	D4 High	24-02, 30-02, 30-04, 30-21, 37-04, 37-10, 33-03	D3 Medium
RR-001 KP0.0	Houses within 70m of the tie-in area and along AR63	C4 Medium	24-02, 30-04, 37-10	C3 Medium
AR65 and RR-001 KP2.0	Houses adjacent to road	D4 High	24-02, 30-02, 30-04, 30-21, 37-04, 37-10	D3 Medium
Road to Jvari monastery	Well used road with tourists and buses	D4 High	30-04, 30-21, 37-04	D3 Medium
BVS28	Restaurant and building occupied by IDPs, 80m from the access road	C4 Medium	24-02, 30-02, 37-10	C3 Medium
AR to PRS1	Access via 20km of village roads. Passes through several villages: Korbouili – within 5m of many houses, 10m of Korbouli school #1, 15m of a new school under construction, 20m of Korbouli school #2 and an open market with small shops either side of the road. Shomakheti – within 10m of Shomakheti school. Usakhelo village – for about 1km. Residential houses are very close to the road. Within 20m of Usakhelo school. Zeda Usakhelo/Tsiteli Eklesia settlement – within 50m of village cemetery.	D4 High	24-02, 30-02, 37-04, 37-06, 37-10	D3 Medium
AR223	Mandaeti village. Schools, shops and houses within 20m of the access road	D4 High	24-02, 30-02, 37-04, 37-06, 37-10	D3 Medium
AR225	Houses within 80m of the access road	C4 Medium	24-02, 30-02, 37-10	C3 Medium

Approx KP/AR	Sensitive Communities	Potential Impact Significance*	Mitigation	Residual Impact Significance*
AR373	Houses, shop and farm along the access road	D4 High	24-02, 30-02, 30-04, 30-21, 37-04, 37-10	D3 Medium

* assessed using Tables 3-20 and 3-24

10.11.4 *Mitigation*

Health

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' (33-15).

Pre-job fitness for task assessments will be implemented and will be repeated at regular intervals based on the employee risk profile (31-11).

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. Worker education and awareness programmes will be conducted and will include the health risks associated with smoking, alcohol and substance abuse (31-10).

The generation of dust will be controlled by implementation of the suite of measures described in Section 10.8. Exhaust emissions are likely to disperse rapidly in rural areas; equipment and vehicles will be regularly maintained in accordance with the manufacturer's recommendations to maximise fuel efficiency and help minimise emissions (23-02).

Measures for preventing infectious, zoonotic and vector-related disease transmission will be implemented (31-22). Medical waste will be disposed of via a licensed medical contractor or a Company approved incinerator (31-06). The Company will carry out a due diligence exercise to identify and manage the risk of anthrax (6-22). 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).

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 that an alternative access is in place and has been agreed with the hospital or clinic staff (31-02).

A risk assessment will be undertaken before any chemicals are added to hydrotest water and prior to the discharge of hydrotest water (10-08). A risk assessment will be undertaken when considering waste water discharge options and locations (31-05). Medical waste will be disposed of via a licensed medical contractor or a Company approved incinerator (31-06).

Mitigations to reduce the effects of health through poor handling of food include:

- A 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 non-compliance issues will be documented immediately in accordance with the food sanitation programme to be developed and implemented by the Contractor (31-09).

With implementation of the above measures adverse effects on community health is expected to be of low significance.

Road safety

In order to reduce risks associated with construction traffic moving through communities, a number of mitigations have been put in place as described below.

Access to properties will be maintained throughout construction (33-24).

All contractors and subcontractors will adhere to BP driving rules (37-09). All drivers will undergo safety and environmental and social awareness training to reduce the potential for accidents and disturbance; 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 disturbance to communities (37-10).

Access to the ROW will be restricted to the agreed access routes which are identified in Section 5.2.4 and shown on the constraints maps in Appendix A. To greatest extent possible, these have been selected to avoid villages.

A strict speed limit will be enforced for Project vehicles using unmade tracks and the ROW in accordance with speed limits defined in the Contractor's Transport Management Plan (24-02) to reduce the risk of collision and the severity of the consequence in the event of an accident. Temporary traffic control measures will be employed at road crossings and junctions (flagmen, temporary traffic lights) where a safety risk assessment has identified that traffic control measures will reduce the risk of traffic accidents (37-04).

At locations where schools are very close to a road used by WREP-SR, 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). This is particularly applicable to the villages along the access road to PRS1. Community Liaison Officers (CLOs) appointed by the Contractor will participate in, or deliver, safety awareness training to local communities at sensitive locations e.g. where there will be major excavations and/or Project construction traffic close to schools or markets (30-02).

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 contractor will be expected to use the designated access roads. The selection of any further access roads to Project working areas will aim to avoid sensitive receptors and will be subject to Company approval (30-22).

At road crossings, measures to control road traffic and vehicles exiting from the working areas will be implemented with the aim of ensuring vehicles join the road in a safe manner (30-21).

The significance of the impact road traffic accidents has remained high after the application of mitigation measures. These measures, whilst not substantially influencing the consequences of any incident, do however reduce the probability of an incident occurring, and thus reduce the overall risk posed to receptors.

ROW safety

The ROW will be clearly demarcated. Protective barriers will be erected at excavations, close to a community or that are flooded temporarily; 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 crosses locations identified with local communities as being heavily used by people, including herders (20-03). Warning posts and bunting will be erected to mark overhead cables and temporary crossing points (30-17). Following consultation with local communities gaps will be left in soil stacks and pipe strings at strategic locations to allow passage of people, wildlife and livestock where the Project considers it safe to do so (20-01).

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 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). Crossing points will be located with the aim of minimising inconvenience and additional journey time. Temporary traffic control measures will be employed at road crossings and junctions (flagmen, temporary traffic lights) where a safety risk assessment has identified that traffic control measures will reduce the risk of traffic accidents (37-04).

Community Liaison Officers (CLOs) appointed by the Contractor will participate in, or deliver, safety awareness training to local communities at sensitive locations e.g. where there will be major excavations and/or Project construction traffic close to schools or markets (30-02). Particular emphasis will be placed on talking to children and explaining the dangers of construction sites and open excavations.

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 (3-34). Water will be removed from flooded excavations where a risk assessment concludes that they present a safety risk; protective barriers and warning signs will be erected in areas of flooded excavations (30-09). Welded strings will be capped to prevent entry (19-04). Cleaning and testing procedures will include safeguards which will aim to prevent the accidental release of nitrogen and discourage public access to areas in close proximity to sections filled with nitrogen (23-08).

The significance of the impact of accidents at open excavations has remained high after the application of mitigation measures. These measures, whilst not substantially influencing the consequences of any incident, do however reduce the probability of an incident occurring, and thus reduce the overall risk posed to receptors.

Other community safety and security issues

During construction (and operations), due diligence will be applied to the 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). The Project will implement the Voluntary Principles on Security and Human Rights (30-10).

Operations phase

Sections of pipe that have been removed from service and left in-situ will be regularly monitored for indications of subsidence during operation (OP01).

The pipeline will be built to international safety standards and is very unlikely to rupture. Local residents will be advised of activities that could threaten the integrity of the pipeline, such as the extraction of aggregate. The pipeline will be patrolled daily and the inspectors

will intervene if any third party interference is identified under existing operations procedures.

10.11.5 *Disturbance*

Pipeline construction has the potential to cause disturbance and inconvenience to local communities. Causes may include:

- Noise and vibration from traffic and heavy machinery
- Dust from vehicles moving across the ROW or along unmade access roads
- Impeded or altered access routes for vehicles, pedestrians and animals.
- Damage to household or community infrastructure (fences, water pipe, etc.).

Mitigation measures to reduce disturbance from noise and vibration are addressed in Section 10.9 and measures relating to control of dust are given in Section 10.8. The maintenance of safe access routes across the pipeline is discussed above.

Within Gamdlistkaro, Zeda Beretisa and Usakhelo the nominated access roads run very close to the village cemeteries. Construction traffic could disturb funeral ceremonies, which is a potential source of friction between the Project and the local community.

A designated CLO will be the primary point of contact between the local communities and the Project. The Contractor will be required to develop and implement a Grievance Procedure to allow individuals to express grievances about Project-related activities and employees. A grievance register will be used to document all third party grievances, corrective actions and outcomes (33-01).

The Community liaison teams will maintain regular liaison with local communities before, during and after construction to ensure that disturbance of local communities (including local events e.g. weddings and funerals) by Project activities is minimised (33-03). This is of particular relevance to the use of AR63, where there is a cemetery in the vicinity of the access road.

10.11.6 *Residual Impacts*

Through the implementation of the above mitigation measures, impacts of the Project on community health and safety will be reduced as described below.

Many years of experience with pipeline security personnel in Georgia has shown that the potential for injury to a community member as a result of the actions of security personnel is very low. Concerns about the interactions between security personnel and local peoples' health and safety were not raised during consultations with stakeholders, including local residents of Project-affected communities. However, the potential for a serious incident to occur remains and therefore the impact was considered medium significance; with the application of mitigation measures, the likelihood of an incident occurring is considerably reduced.

With implementation of the above mitigation measures, other impacts on community health will be reduced in significance. A road traffic accident or an accident involving excavations remains the most likely cause of injury or death. Mitigation measures will reduce the risk of this type of impact, but it is considered that the risk will remain at a level that results in the impact being of high significance.

Injuries or death from unexploded ordnance and delays in receiving medical treatment can be minimised to levels that reduce the potential significance of the impact from high to low.

All other residual impacts are considered to be of low significance.

10.12 Land Acquisition and Land-Based Livelihoods

A discussion of the potential impacts of land acquisition on land–based livelihoods (that is livelihoods dependent on a defined and fixed area(s) of land), and mitigation measures to be adopted during construction of the WREP-SR Project, is provided in this section. Land acquisition will occur only in construction phase, but certain restrictions on land use will be applied to land in the ROW for the operational life of the pipeline.

10.12.1 *Aspects of Land Acquisition for the WREP-SR Project that Could Affect Land-Based Livelihoods*

The WREP-SR Project will make use of the following land areas during the 21 month construction period:

- A construction corridor generally 25m wide and approximately 11km long (27.5ha) (A32, A34)
- Use of approximately 47.5km of local bound and unbound roads for access, some of which will require widening or passing areas (A32, A24)
- Construction of 1.9km of new access roads (A32, A34).

The total land area required for construction (temporary use) is therefore c.35 hectares, excluding road widening which cannot be quantified at this stage.

BP, through GOGC, will acquire land servitude rights to a 50m by 13km corridor for a permanent easement and safety zone (65ha). Existing land users will be able to continue to use the land, subject to certain restrictions on building and excavations over the pipeline. These are set out in the land servitude documents.

During construction, use of the land that has been temporarily acquired by the Project may give rise to other issues which could have secondary impacts on land-based livelihoods:

- Soil compaction (A2) and/or modified soil structure (A4)
- Ground settlement following reinstatement (A5)
- Localised flooding caused by impeded surface water flows and/or compaction (A13)
- Disruption of irrigation and/or drainage infrastructure (A36)
- Impeded movement of domestic herds/flocks to due open trench, pipe string or spoil storage mounds (A20)
- Open excavations (A21)
- Loss of field boundaries (A34)
- Dust (A24).

On completion of construction, the pipeline corridor will be reinstated. Re-contouring will be sympathetic and in keeping with the surrounding landscape where this is not precluded by risk to integrity of the pipeline or erosion considerations. Temporary works areas will be reinstated to near original condition (as compared to pre-construction survey reports or adjacent areas). This will allow farmers to resume grazing over the ROW and undertake other agricultural activities that do not conflict with the land use restrictions that will be applied when the pipeline is operating.

During operations, there will be periodic security patrols either on foot or on horseback along the pipeline route which could cause damage to crops (A32).

10.12.2 *Key Sensitivities*

Key sensitivities are:

- Private plots which are an important resource for inhabitants of rural Project-affected communities as many inhabitants are self-employed in agriculture (almost 100% in some communities) and the products obtained from agriculture make an important contribution to incomes (food for own use and sale of surplus)
- State land that is primarily used for grazing and is an important communal resource
- Irrigation and drainage of agricultural land which is largely dependant on maintaining functionality of irrigation and drainage systems.

10.12.3 *Impacts of Land Acquisition on Land-Based Livelihoods*

Construction phase

The land required for construction of the pipeline affects approximately 88 private and 136 state land parcels. Therefore, economic displacement will occur for 88 households comprising ~352 individuals (assuming each private plot belongs to 1 household and an average household size of 4 people - see Chapter 8). Potential impacts on land owners/users and land-based livelihoods will primarily relate to temporary:

- Disruption to existing agricultural activities on acquired land and consequent reduction in incomes and household quality of life if no viable alternatives are available
- Loss of future crops over period of construction and consequent reduction in incomes and household quality of life if no viable alternatives are available
- Loss of access or restriction in access to land resulting reduction in incomes or land owners/occupiers expending more energy/time in maintaining incomes if no viable alternatives are available
- Disruption to investment plans of land owners/occupiers to boost production/exploit emerging market opportunities (if present)
- Disruption to irrigation supplies
- Impeded movement of livestock.

Operational phase

The impacts on livelihoods of the restrictions to be imposed on land use in the ROW will 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.

Vegetation growth will generally recover to its former levels within approximately one to three years after construction. As the ROW 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.

Table 10-29 provides an assessment of the significance of impacts on land acquisition on land-based livelihoods before and after implementation of the proposed mitigation measures which are discussed in the following section.

Table 10-29: Potential Impacts of Land Acquisition on Land-based Livelihoods

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A32	Loss/severance of agricultural land	Reduction in existing incomes and quality of life	D4 High	33-01, 32-01, 32-12, 39-01, 23-14	D1 Low
		Reduction in future crops and therefore incomes and quality of life	D4 High	33-01, 32-01, 32-12, 3-03, 39-01, 17-14	D1 Low
		Loss of/reduced access to land	D4 High	33-01, 21-01, 20-01, 30-06, 32-01, 32-12, 39-01	D1 Low
		Disruption of future planned investment and income generation	D4 High	33-01, 32-01, 32-12, 3-03, 39-01	D1 Low
		Reduced availability of family food and/or income from selling produce during construction	C3 Medium	32-12, 33-20	C1 Low
		Inconvenience to land users	D1 Low	33-01, 34-01, 39-01	D1 Low
		Income from payment for permanent easement	C1 Low	2-02, 3-09	C1 Low
		Permanent acquisition of private agricultural or grazing land in the pipeline land purchase corridor	C3 Medium	32-04, 32-07, 32-13	B2 Low
		Temporary occupation of private land during construction	B2 Low	32-03, 32-05	B1 Low
A2	Soil compaction	Reduced crop growth	C3 Medium	2-03, 2-02	C1 Low
A4	Loss of soil structure	Reduced agricultural productivity following reinstatement	C3 Medium	4-09, 3-11	C1 Low
A5	Ground settlement	Disruption to mechanical cultivation	C3 Medium	2-05, OP01	C1 Low
A13	Flooding	Reduced crop growth leading to reduced crops and income	C3 Medium	13-01, 11-04, 13-02, 13-03	C1 Low
		Inundation of land or property	C3 Medium		C1 Low
A36	Disruption of irrigation / drainage infrastructure	Reduced crop growth if irrigation/drainage channels disrupted leading to reduced crops and income	C3 Medium	35-05, 35-07, 35-06, 35-08, 36-03	C1 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, 33-03, 20-03, 32-17	B1 Low
A34	Loss of field boundaries	Loss of containment for farmed animals	C3 Medium	3-19, 32-01, 34-01, 37-10, 19-07, 30-18, 37-04, 37-07, 21-01, 30-04, 30-09, 21-02, 19-04	C1 Low
A24	Dust	Reduced photosynthesis and therefore productivity of crops	C2 Low	2-02, 23-06, 23-05	C2 Low
A21	Open excavations	Injury to farm animals and therefore loss of income	C2 Low	33-01	C2 Low

* assessed using Tables 3-20 and 3-21

Table 10-30 shows potential impacts on sensitive receptors in the vicinity of the proposed WREP-SR works.

Table 10-30: Impacts on Sensitive Land Use Receptors

Approx KP/AR	Sensitive Receptor	Potential Impact	Potential Impact Significance*	Mitigation	Residual Impact Significance*
RP-001a KP1.0 (AM53+150)	Stone house/farm 40m from the proposed route	Nuisance and land severance	B4 Medium	20-01, 33-23, 33-24	B4 Medium
RR-001 KP2.0	Two summer houses within 30m of ROW	Nuisance and land severance	B4 Medium		B4 Medium

* assessed using Tables 3-20 and 3-21

10.12.4 *Mitigation*

Mitigation measures to address potential impacts associated with soil compaction, loss of soil structure and ground settlement are addressed in Section 10.3.4 and those associated with potential flooding in Section 10.5.4.

A pre-construction survey will be undertaken to record the condition of access roads, laydown areas, rail offloading area and any special features along the pipeline ROW before construction to inform the reinstatement work (17-14). Compensation will be paid for temporary and permanent use of land in accordance with agreed rates for the Project (32-12). This will include:

- Temporary use of land for construction purposes
- Permanent acquisition or lease of land for construction and operation of the pipeline
- Crops over a two year period

- Any restrictions on use that may be applied to the ROW or areas adjoining the ROW such as quarrying or the erection of new buildings in close proximity to the pipe.

The Company will compensate for crop loss across the ROW and other construction areas during the construction period in a specific area. Compensation will be in line with local market rates (23-14).

BP Land Team staff members and Community Liaison Officers will represent the Project in terms of notifying land users of Project activities, carrying out inventories of affected assets, determining compensation amounts and acting as a central point of contact should any issues arise during construction. Pre-entry agreements including reinstatement requirements will be agreed prior to work affecting third party assets (35-09).

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). 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).

The Contractor will be required to develop and implement a Grievance Procedure to allow individuals to express grievances about Project-related activities and employees. A grievance register will be used to document all third party grievances, corrective actions and outcomes (33-01), including issues associated with agriculture. In general, there will be no transfer of land ownership to the Company at any stage during construction or operations (32-13).

If there is a need for additional land take outside that described in the ESIA the relevant authorities will be consulted and environmental and social assessments will be undertaken if required to obtain the relevant permits and consents (39-01).

Upon completion of subsoil and topsoil reinstatement, the contractor and Company personnel will inspect disturbed areas jointly to assess compliance with the standards set out in the Reinstatement Plan and Project Reinstatement Specification; remedial measures will be implemented, if necessary (3-15).

The Contractor will be required to maintain safe access across the pipeline works to enable farmers to move freely between land parcels. In order to minimise disruption to movement, the Contractor will be required to adopt the following measures:

- The Project will consult with local government authorities, landowners and land users, including graziers, before restricting access to land (32-01)
- The length of open excavations will be restricted to 3km of continuous trench in any one section (21-01)
- Following consultation with local communities gaps will be left in soil stacks and pipe strings at strategic locations to allow passage of people, wildlife and livestock where the Project considers it safe to do so (20-01)
- Bridges will be provided across open trenches and welded pipes at locations where people need to cross and 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)
- Properties that may potentially be affected by the Project will be consulted before and during construction (33-23).

Access to properties will be maintained throughout construction (33-24).

Other key principles for mitigating impacts on land users include:

- Parking of Project-related vehicles will be restricted to designated areas (32-03)
- 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 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)
- The Company Land Acquisition Team, environmental representative and the construction contractor will carry out an exit inspection of all land used during construction with the owner and/or previous land user (32-05)
- The Project will inform landowners/users about any restrictions that apply to land over/close to the new pipeline (32-07)
- If any impact 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)
- 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 Community liaison teams will maintain regular liaison with local communities before, during and after construction to ensure that disturbance of local communities (including local events e.g. weddings and funerals) by Project activities is minimised (33-03).

During the operational phase, the mitigation measures agreed by approval of the 1996 EIA for refurbishment and construction of WREP will apply (see Commitments Register in Appendix E). Local residents will be advised of activities that could threaten the integrity of the pipeline, such as the extraction of aggregate (OP140).

10.12.5 *Residual impacts*

Implementation of the above mitigation measures will ensure that:

- Livelihoods are maintained at levels prior to land acquisition
- Inconvenience relating to access to land will be reduced but cannot be completely eliminated.

With implementation of the proposed mitigation measures residual impacts of land acquisition on land-based livelihoods are considered to be of low significance except for the inhabitant/temporary user of the earth dwelling where the residual impact is considered to be of medium significance. The very close proximity of this dwelling to the ROW means that mitigation measures will have very limited effect.

10.13 Economy, Employment, Skills and Livelihoods

A discussion of the potential impacts on economy, employment, skills and livelihoods (non land-based livelihoods), and mitigation measures to be adopted during construction of the WREP-SR Project, is provided in this section.

10.13.1 *Aspects of WREP-SR Project that Could Affect Economy, Employment, Skills and Livelihoods*

The detailed labour requirements for the Project will not be known until the appointment of the contractors. This section therefore includes a preliminary assessment of the number of

workers that will be required which should be regarded as indicative only, and will change prior to commencement of the Project.

It is currently estimated that approximately 350 people will be employed at the peak period, in 2017, during construction of the Project.

The Project will provide direct service opportunities for companies at the regional, and possibly national, levels. However actual purchasing decisions will be contingent upon local suppliers offering sufficient quality and reliability to meet the standards, set by BP.

Other project activities that have the potential to affect livelihoods are:

- Emissions to air causing a decline in air quality (especially dust) affecting crops and behaviour and health status of bees kept in domestic hives for honey production (A28, A33)
- Temporary severance restricting access to natural resources such as wood from forests (A28, A32, A33).

10.13.2 *Key Sensitivities*

Key sensitivities are:

- High expectations among Project-affected 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
- Job availability for women.

10.13.3 *Impacts on Economy, Employment, Skills and Livelihoods*

Baseline social surveys show that unemployment, and the poverty that accompanies it, is a key concern amongst the project-affected communities. Limited local employment and procurement opportunities will be available to these communities, and to a lesser extent to workers and companies at the national level. Impacts of land acquisition on land based livelihoods are addressed in Section 10.12.3.

Impacts will be both beneficial and adverse in the construction phase.

Construction phase

In the construction phase the following impacts may occur:

- Increase in available jobs and incomes
- Temporary improved standard of living for households with members who have increased incomes due to employment
- Enhanced skills among local workforce
- 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
- Increase in sales for local businesses
- Resentment from business owners whose offer of goods and services is refused

- 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
- Reduction in number of visitors to important recreational and cultural heritage sites such as Jvari Monastery and indirect impacts on the tourism sector livelihoods and on livelihoods of owners/workers in facilities that are used by visitors/tourists as well as locals
- Reduced access to natural resources.

There is the potential for impacts relating to economy, employment, skills and livelihoods to result in secondary impacts on community relationships including conflicts. Key impacts of concern (including issues raised in stakeholder consultation meetings) are discussed in more detail below.

Local employment opportunities

The workforce of c.350 people 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, acting as a banksman for machine operators, and hustling skids.

Unskilled workers may be employed with or without prior construction 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. Here there will be the most favourable opportunities for hiring women 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. This will require careful handling particularly at settlements where unemployment is high.

Employment will provide a source of income, albeit temporarily for a limited number of individuals and households. Those who ‘lose out’ may feel resentment. Similarly at community level there may tensions, and even conflict, if job allocation between communities is not perceived as being ‘fair’.

Procurement of goods and services

The types of local contracts that are anticipated during construction and operation are shown below:

- Catering services to the construction sites
- Security services at the 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. There may however be resentment from those who do not benefit from the Project. This impact will be localised and is therefore assessed as low.

Tourism and service sector facilities

As one of the monuments within the Mtskheta World Heritage Site, Jvari monastery is a major cultural and tourist attraction that attracts many local and international visitors. It is accessed by a steep tarmac road which will be used by construction traffic driving to AR69. There is therefore the potential for construction traffic to inconvenience tourists particularly during the delivery of heavy loads.

Tourists may also meet construction traffic on the main east-west highway and very occasionally on other access routes. However, it is highly unlikely that their journeys will be delayed. They will also be able to see the construction works from various viewpoints, particularly in the Mtskheta area where sections of the ROW are on elevated slopes. However, the impact will be short lived given the limited duration of the construction activities.

It is not expected that the growth prospects of the tourism sector in areas near the WREP–SR Project activities will be affected adversely in a way to threaten seriously livelihoods of those working in the sector. Overall the impact on tourism will be low.

Bee-keeping/honey production

Bee keeping is not a major commercial activity along the route, but some households in project-affected communities keep bees to provide honey for personal use and occasional sale. The project 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 5 km 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.

Where hives are located within foraging distance of the pipeline corridor, honey production may be affected by loss of vegetation due to ROW preparation. However with a ROW of approximately 25m 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.

Accidents to livestock

A number of the potentially hazardous situations discussed in section 10.11 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.

Access to natural resources
Some project-affected communities living near forests contain a few households which own and operate wood processing facilities. These make a substantial contribution to livelihoods in those communities with access to forest resources. Any restriction on access would adversely affect these livelihoods.

Operational phase

Once operational, the new sections will be part of the WREP pipeline operations system so there will be no additional jobs created.

Table 10-31 provides an assessment of the significance of impacts on employment, skills and livelihoods (not including land-based livelihoods which are discussed is Section 10.12) before and after implementation of the proposed mitigation measures which are discussed in the following section. Table 10-32 shows impacts on livelihoods at specific locations.

Table 10-31: 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 economy resulting in overall economic growth, albeit small-scale	Beneficial	28-17, 28-02, 28-04, 28-05, 28-07, 28-09, 28-10	Beneficial
		Agricultural lands not cultivated for a period of 2–3 years as self-employed subsistence farmers work for WREP and then farmers find it difficult to take up farming again after end of contract	C2 Low	28-20	C2 Low
		Resentment between local people who are employed by the Project and those whose applications were unsuccessful	C5 High	28-01, 28-03, 28-05, 28-06, 28-07, 28-08	C4 Medium
		Security patrols damaging crops and livelihood loss	C3 Medium	30-12, 30-22, 30-23, 28-12	C2 Low
		In-migration leading to infrastructure capacity exceedance	C2 Low	28-08, 28-02	C1 Low
A29	Provision of goods and services	Increase in sales for local businesses	Beneficial	29-03	Beneficial
		Resentment from business owners whose offer of goods and services is refused	C3 Medium		C2 Low
A20	Impeded movement of animals and people	Inconvenience to people trying to cross the working areas	D2 Medium	20-01, 21-01, 32-17	D1 Low
A18	Introduction of competitive species or diseases	Increased incidence of crop disease	D4 Medium	18-01, 18-05	D2 Medium
A28	Employment	Unmet employment expectations and/or resentment between local people who are employed by the project and those whose applications were unsuccessful	C5 High	28-17, 28-02, 28-04, 28-05, 28-07, 28-09, 28-10, 28-22	C4 Medium
A33	Community relations	Frustration and resentment if local workers perceive that foreign workers are receiving better pay or conditions for exactly the same job	C5 High	28-15, 28-14	C4 Medium

Issue		Potential Impacts	Potential Impact Significance*	Mitigation and Enhancement	Residual Impact Significance*
A28	Employment	Improved standard of living for households with members who have increased incomes due to employment of local people	Beneficial	28-17, 28-02, 28-04, 28-05, 28-07, 28-09, 28-10, 28-12	Beneficial
		Enhanced skills among local workforce	Beneficial		Beneficial
A24	Dust	Less honey production and livelihood loss	C3 Medium	2-02, 24-02, 23-06, 24-01, 23-05, 4-09, 24-05, 24-06	C2 Low
A37 A21 A34	Use of local road network Open excavations Loss of field boundaries	Accidents to livestock resulting in livelihood loss	C3 Medium	37-10, 19-07, 30-18, 37-04, 37-07, 21-01, 30-04, 30-09, 21-02, 19-04, 32-01, 3-19, 34-01	C2 Low
A21	Open excavations	Claims for compensation for animals	C2 Low	33-01	C2 Low
A32	Loss/severance of agricultural land	Reduced access to natural resources and livelihood loss	D4 High	33-20, 34-01	D2 Low
A24, A25, A26 A37 A8	Dust, Noise, Vibration, Use of local road network, Visual intrusion into landscape	Nuisance causing reduced visitor/customer numbers and livelihood loss in tourism sector and service facilities	C3 Medium	2-02, 24-02, 23-06, 24-01, 23-05, 4-09, 24-05, 24-06, 25-11, 25-01, 25-04, 25-05, 25-03, 25-17, 25-16, 37-08, 25-14, 25-15, 25-13, 37-10, 19-07, 30-18, 37-04, 37-07, 9-01, 17-05, 3-35, 9-04	C2 Low

* assessed using Tables 3-20 and 3-22

Table 10-32: Impacts on Livelihoods at Specific Locations

Approx KP/AR	Sensitive Receptor	Potential Impact	Potential Impact Significance*	Mitigation and Enhancement	Residual Impact Significance*
AR 69	Jvari Monastery	Potential reduction in visitors and livelihood losses	B2 Low	33-25	B2 Low

*assessed using Tables 3-20 and 3-22

10.13.4 *Mitigation*

Employment and livelihoods

BP's policy on local recruitment will be publicised e.g. via media announcements, at regional and national levels (28-01). The role of BP's CLOs in the recruitment process will be clearly defined and will include monitoring and assurance activities. One of the aims of the Project recruitment policy will be to discourage in-migration driven by the interest in employment and maximise employment opportunities in the PACs. Community Liaison Officers will monitor that PACs are given priority in recruitment and that recruitment is non-discriminatory in terms of gender and ethnicity (28-08). Job vacancies will be advertised in the PAC through appropriate and accessible media (consistent with employment targets) (28-17). Applications for employment will only be considered if submitted via the official application procedure (28-03). Unskilled labour will be preferentially recruited from the Project-affected communities (28-02). If insufficient suitable candidates are available from these communities, recruitment will be extended to other communities. Targets for local recruitment from PACs will be agreed with the Contractor (28-04). Recruitment procedures will be transparent, public and non-discriminatory and open with respect to ethnicity, religion, sexuality, disability, gender etc. (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 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).

The Contractor will explain the temporary nature of jobs during the recruitment process and explain to workers the need 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).

Workforce training will also include advice on:

- Minimising energy consumption (22-02)
- Minimising Noise disturbance (25-03)
- Environmental and social issues (28-11)
- Issues relating to cultural heritage awareness (such as ownership of finds, notification of finds and protection of cultural heritage sites) (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). As a consequence, the skills base of those employed by the Project will be enhanced.

All workers will have contracts describing conditions of work and will have the contents explained to them (28-14). As part of the recruitment programme community liaison teams will seek to manage any misconceptions about perceived differences in pay or conditions (28-15).

During construction (and operations), due diligence will be applied to the 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). The contractor

will be expected to use the designated access roads (30-22) and keep within the designated footprint (30-23) as detailed in Sections 10.7.4 and 10.11.4.

Procurement of goods and services

The Procurement and Supply Plan will seek to maximise the purchase of goods and services from within Georgia provided that local suppliers are able to meet Project standards (29-03).

Tourism sector and service facilities

Consultation will be undertaken with the responsible authority before construction and the agreed measures will be implemented with the aim of minimising disturbance to visitors to Jvari monastery (33-25).

Bee-keeping/honey production

Measures to control dust, as specified in Section 10.8, will help to prevent impacts on bees and honey production; however two specific measures will be implemented to further mitigate the potential impacts. The Project will prepare an inventory of bee hives within 300 m of pipeline construction areas and access routes before the start of construction. An independent bee expert will be employed to determine any impacts on bees and/or honey production and develop appropriate mitigation measures (24-05). The likelihood of bees being affected by construction is low, but if impacts do arise they could lead to reduced honey production or the loss of colonies. The Project will develop and implement a policy for the compensation of beekeepers adversely affected by Project impacts (24-06).

Grazing and livestock management

A number of measures described in other sections will help reduce potential impacts on grazing animals and possible livelihood losses. However, three specific measures will be implemented to further mitigate the potential impacts. The project will consult with local government authorities, landowners and land users, including grazers, before restricting access to land (32-01). Any field boundaries that are removed will be replaced with temporary fencing, to meet reasonable landowner/user requirements (34-01). Field boundaries will be reinstated to pre-existing condition on completion of construction (3-19).

Access to natural resources

The Project will aim to consult with the leaders of project-affected communities located near forests about the extent of community use of forest products. Where access to forests is important to these communities Company will keep access routes open if practicable (33-20).

Community relations

Despite maximising local employment throughout the construction phase of the pipeline, it is likely that almost half of the workforce will be from outside the local communities. Construction workers will travel to the site daily.

The community liaison teams will maintain regular liaison with local communities before, during and after construction to ensure that disturbance of local communities (including local events e.g. weddings and funerals) by Project activities is minimised (33-03). An employee Code of Conduct will be prepared and issued to all recruits; the code will prohibit the workforce from participating in illegal activities, including use of illegal drugs, bribery and corruption or requesting or receiving gifts from communities (33-04). 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' (33-15).

Random drug and alcohol testing of the workforce will be conducted and recorded and audited regularly (30-15). 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). Worker education and awareness programmes will be conducted and will include the health risks associated with smoking, alcohol and substance abuse (31-10).

Workforce training will include awareness of local issues and sensitivities (33-09).

As far as possible, the Project will seek to resolve grievances outside of the judicial system. The Contractor will be required to develop and implement a Grievance Procedure to allow individuals to express grievances about Project-related activities and employees. A grievance register will be used to document all third party grievances, corrective actions and outcomes (33-01). In the event of failure of non-judicial approaches to grievance resolution, Georgian legislation provides for aggrieved parties to take action through civil courts, with avenues for appeal.

10.13.5 *Residual Impacts*

Overall the Project is expected to have a small beneficial effect on local 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.

Despite the mitigation measures there remains a reasonable probability that there will be community dissatisfaction with elements of job allocation and remuneration, potentially causing localized public expressions of discontent or even acts of civil disobedience. This potential impact is considered to be 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. There may however 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 bee keepers, the income of the tourism sector and service facilities is expected to be low or, in case of some facilities such as cafes/restaurants may be beneficial.

Once the pipeline is operational there will be no additional impacts on the community relations over and above those associated with operation of the existing WREP pipeline.

10.14 Infrastructure and Services

A discussion of the potential impacts on infrastructure and services and mitigation measures to be adopted during construction of the WREP-SR Project, is provided in this section.

10.14.1 *Aspects of WREP-SR Project that Could Affect Infrastructure and Services*

The following WREP-SR Project aspects have the potential to affect infrastructure and services:

- Undertake earth-moving/excavation works that may inadvertently damage existing infrastructure (A35)

- Use existing infrastructure and utilities for the temporary above–ground facilities and existing roads for access to Project sites (A35)

10.14.2 *Key Sensitivities*

Key sensitivities include:

- Infrastructure/utility services (quantity and quality of supply)
- Integrity of irrigation structures
- Dependency on springs and wells for domestic and irrigation water
- Road conditions and ease of traffic flow/access.

10.14.3 *Impacts during Construction Phase*

It is known form the baseline survey work that the quantity and quality of infrastructure and utility services is a key issue for Project-affected communities. The main impacts are as follows:

- Temporary loss of utility supply to other consumers
- Infrastructure capacity exceeded with reduction in service quality and quantity to all users
- Reduced availability of groundwater and surface water sources, such a springs for local users
- Additional vehicle movements causing disturbance and inconvenience to local users and increased threats to health and safety of local people (considered in Section 10.11 above)
- Disruption of traffic flows causing inconvenience to local users
- Wear/degradation of road surface
- Traffic congestion and delays, particularly during movement of long or heavy loads
- Road widening and upgrades may result in easier and faster travel for Project-affected communities thus assisting integration into the wider economy.

By using local roads for access to the ROW, construction vehicles will cause wear of the surface and may cause delays for other users when heavy or long loads are being moved. There will also be an increased risk of accidents with animals or people (see Community Safety in Section 10.11.3 and Economy, Employment, Skills and Livelihood in Section 10.13) and buildings may be damaged by vibration (see Section 10.9).

There will be no impacts in the operational phase.

Table 10-33 provides an assessment of the significance of impacts on infrastructure (including roads) and services before and after implementation of the proposed mitigation measures which are discussed in the following section.

Table 10-33: 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	35-05, 35-01, 35-03, 35-09	D2 Medium
A38	Road closure	Disruption of traffic flows causing inconvenience to local users	D3 Medium	37-02 37-03	D1 Low

Issue		Potential Impacts	Potential Impact Significance*	Mitigation	Residual Impact Significance*
A37	Use of local road network by construction traffic	Wear/degradation of road surface	E4 High	37-07	E2 Medium
		Traffic congestion and delays, particularly during movement of long or heavy loads	D3 Medium	30-18, 37-04 37-11, 37-14	D2 Medium
		Road widening and upgrades resulting in more efficient transport links for local people	Beneficial	37-07	Beneficial

* assessed using Tables 3-23, 3-25/26

10.14.4 *Mitigation*

The Infrastructure and Services Management Plan shall include measures to protect the integrity of third party services that are acceptable to the service operator and procedures that facilitate the prompt repair of any either in consultation with, or by, the service operator (35-01). Surveys of irrigation and drainage systems will be undertaken before construction to determine their location and condition (35-05). Any planned diversion of services or road/track closures will be communicated to local authorities and affected communities at least 72 hours in advance of the works (35-03).

A bypass/alternative routes 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). 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).

To help avoid congestion and delays to other road users; 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). Also, temporary traffic control measures will be employed at road crossings and junctions (flagmen, temporary traffic lights) where a safety risk assessment has identified that traffic control measures will reduce the risk of traffic accident (37-04). The Project will aim to provide buses to transport workers to the construction sites (37-11).

The Contractor will also instigate a programme of repairs, upgrades and widening to create roads that are in as satisfactory condition for use by construction traffic. During construction, potholes will be repaired if they are dangerous or if they are likely to increase the vibration risk to fragile buildings.

Following construction, the Contractor will repair roads to at least their pre-construction condition. For roads that have been upgraded, the Contractor will submit a close out report for Company approval (37-07).

10.14.5 *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. Surface damage to local roads and disruption to traffic flows will occur, though the frequency of traffic flow disruption events will reduce. Both these residual impact will be of 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.