8 IMPACT IDENTIFICATION AND EVALUATION – NORMAL CONSTRUCTION AND OPERATIONS

This section is equivalent to Sections ix and x, assessment of impacts and identification of alternatives and impacts management or environmental mitigation measures, of the legislative structure. If in doubt, please refer to Table 1.5-1 Environmental Impact Statement Structure on page 1-5.

8.1 Introduction

8.1.1 Scope

This section describes and assesses the potential changes to the baseline biological, physical, socio-economic and health conditions of each valued environmental and social component (VEC) that are considered likely to be caused by the EACOP project planned activities described in Sections 2.1 to 2.5.

The methodology used to identify and evaluate potential project impacts is described in Section 5; specifically, Section 5.5 describes the process used to identify potential impacts and, Section 5.6.2.5 describes the methodology used to determine significance of each potential impact in terms of magnitude, duration, extent and the sensitivity of the VEC. Project effects that were considered likely to result in adverse or beneficial impacts have been evaluated; this process was informed by professional, industry specific experience and the characteristics of the AOI.

Where appropriate, such as for air quality and acoustic environment VECs, PES have been used to inform the evaluation of impacts; PES is fully described in Appendix F in terms of Tanzanian, East African and international standards. Where project emissions are predicted to cause an exceedance of PES associated impacts have been designated significant.

This section also addresses potential impacts of minor unplanned events; e.g., spills from refuelling vehicles and leaks from hydraulic hoses. Potential impacts associated with abnormal and unplanned events (e.g., traffic accidents, leaks) during construction and operations are described in Section 9.

This section includes:

- VEC-specific assessments of project and cumulative impacts and mitigations (Section 8.2 to 8.11)
- a summary of ecosystem services impacts (Section 8.21)
- a climate impact assessment (Section 8.22)
- decommissioning of the pipeline and AGIs (Section 8.23)
- a summary of the key impacts of the associated facilities (Section 8.24).
The methodology for defining project-related impacts, determining their significance before and after mitigation and assessing cumulative impacts is provided in Section 5. The approach used for describing impacts in this section is provided in Section 8.1.2. This section is best reviewed side by side with Section 5.6.2.5 for definitions of duration and extent, and Appendix D for magnitude and sensitivity grading for each VEC.

### 8.1.2 Approach

The approach to most VEC and other assessments, climate, decommissioning and associated facilities is described in this section including:

- key baseline condition sensitivities and considerations
- potential project impacts
- mitigation measures
- residual impacts and significance summary
- transboundary impacts
- cumulative impacts
- transboundary cumulative impacts
- ecosystem services.

#### Key Baseline Condition Sensitivities and Considerations

The key baseline conditions sensitivities and considerations section summarises the baseline condition, key sensitive VECs and receptors and ecosystem services provided by the VEC.

#### Potential Project Impacts

Potential generic and location-specific impacts (see Section 5.6.2.1) on VECs are identified and described by aspect and project phase (construction or operation).

The impact type is identified (see Section 5.6.2.2), as are impacts affecting human rights and ecosystem services provided, where applicable, by the VEC. Impacts associated with a high level of stakeholder concern are also identified.

The impacts are designated not significant or significant based on the methodology described in Section 5.6.2.5. At this stage, impact significance is determined before the proposed application of mitigation.

Project aspects are listed in Appendix E1 and the aspects, impacts and significance determination before mitigation are summarised in Appendix E2 for generic impacts and E3 for location-specific impacts.

#### Mitigation Measures

Impact mitigation methodology is described in Section 5.6.2.4. Mitigation measures to reduce impacts on a VEC are summarised by project phase (construction or operation) and referenced to the relevant management plan that will be developed to manage implementation.
The mitigation measures are listed in Appendices E2 and E3 and the master commitments register (Appendix E4) and are summarised in the ESMP (see Section 10 and Appendix J).

Impact significance is determined again, summarised and described after the proposed mitigation is applied.

**Residual Impacts and Significance Summary**

This section summarises the residual impacts and includes the residual impact significance scoring in tables. The tables summarise the generic impacts table in Appendix E2 and the location-specific impacts in Appendix E3 for the VEC. Associated impacts on ecosystem services are also summarised.

**Transboundary Project Impacts**

Transboundary project impacts that extend or occur across a national boundary are identified, assessed and described as part of the project’s impact assessment process described above.

**Cumulative Impacts**

This section describes the potential cumulative impacts on VECs from the EACOP project and third-party developments that have been screened-in to the CIA.

The screening of associated facilities and third-party developments and identifying where cumulative impacts may occur is described in Section 5.6.2.3. Associated facilities and screened-in third-party developments are listed in Section 2.5. A description of the screened-in third-party developments, maps and the interactions between EACOP VECs and the screened-in developments are provided in Appendix H, Sections H1, H2 and H3, respectively.

Where a high risk of a cumulative impact between third-party projects and EACOP is identified in Appendix H3 (Category 1 and 21), the potential impacts on the VEC are summarised and described in the CIA section based on the information available. When information is limited, professional judgement is used to predict the likely impacts of the third-party project.

The criterion for qualitatively determining cumulative impact significance is either the preferred condition of the VEC, a threshold or the limit of acceptable change as recommended in IFC (2013), see Section 5.6.2.3. Additional mitigation measures are proposed to avoid or reduce significant cumulative impacts, see Section 5.6.2.4.

**Transboundary Cumulative Impacts**

Cumulative impacts may also be transboundary. Transboundary impacts are identified and assessed as an integral part of the VEC-specific cumulative impact assessments described above.

---

1 Category 1: High risk of potential cumulative impacts and the EACOP project is an important contributor to the cumulative impacts on a VEC.

Category 2: High risk of potential cumulative impacts but the EACOP project is a small contributor to the cumulative impacts on a VEC.
8.1.2.1 **Ecosystem Services**

Consideration of ecosystem services is provided on a VEC-specific basis, so are fully integrated into each VEC impact assessment. **Section 8.21:**

- guides the reader to the sections of the VEC impact assessments that describe impacts on ecosystem services
- includes a high-level assessment of significant ecosystem services dependencies, i.e., where the project is dependent on an ecosystem service and summarises project resource use efficiency measures.

8.1.2.2 **Climate**

**Section 8.22** considers the greenhouse gas (GHG) emissions associated with the project and includes:

- quantification of the project’s main direct GHG emissions (direct emissions are those that occur from sources owned or controlled by the project)
- comparison of project emissions against national total emissions and associated reduction commitments, as described in **Section 6.4.4**
- description of the key mitigation measures used to reduce GHG emissions.

The impact of GHGs are placed in context rather than as a determination of significance because:

- No specific impact location or magnitude can be attributed to a particular GHG emission. Climate scientists have developed models that predict macro-scale effects based on particular global emission scenarios, but it is not advised to attempt to allocate impacts to a specific emission.
- GHG emissions are a source of the same cumulative, transboundary impact (climate change) on the same VEC (the global climate).

The section also describes the potential impacts of climate change on the EACOP project and how these have been considered in project design and implementation.

8.1.2.3 **Pipeline and AGI Decommissioning**

**Section 8.23** provides an overview of the impacts and mitigation measures when the pipeline is decommissioned as described in **Section 2.4.6.2** and **2.4.6.3**.

8.1.2.4 **Associated Facilities**

**Section 8.24** summarises the significant impacts of the upstream associated facilities.

8.2 **Biodiversity: Habitats of Conservation Importance**

This section describes potential impacts on habitats of conservation importance during construction, commissioning and operation of the EACOP project and associated mitigation measures to be adopted.
8.2.1 Key Sensitivities and Considerations

The habitats of conservation importance baseline conditions are described in Section 6.4.1 as well as:

- their sensitivity ranking based on the relevant Appendix D
- key considerations for the habitats of conservation importance.

The sensitivity ranking of habitats of conservation ranges from very low to very high.

The key aquatic habitats are the three permanent rivers, two wetlands and six ephemeral rivers crossed by the pipeline. The three permanent rivers and two wetlands have high sensitivity rankings, whereas the six ephemeral rivers have a moderate sensitivity; notwithstanding all potential impacts on aquatic habitats are considered generic because the nature of the impacts (in terms of magnitude, duration and extent) and the corresponding mitigation measures are all the same.

The following habitats and vegetation types are of high conservation importance either because of the species they support or the status of the habitat itself and are considered sensitive VECs:

- Itigi-like thicket (KP979.9 and KP996.7)
- ridgetop, dry miombo thicket (KP970.1)
- coastal thicket (KP1424.3)
- coastal woodland (KP1424)
- old growth woodland (KP438).

Ecosystem Services

Ecosystem services associated with habitats of conservation importance are listed here and potential impacts to ecosystem services are described in Section 8.2.2.

Provisioning services include:

- collecting wood (including for fuel and charcoal manufacture), which is legal in some areas, but not in others such as the Minziro Nature Forest Reserve
- hunting wildlife, gathering and foraging food, which is legal in some areas, but not in others, for example Minziro NFR
- collecting medicinal products
- trapping wildlife for the live trade market.

Regulating services include:

- climate change amelioration through carbon sequestration
- local climate regulation in terms of micro-climate
- local water and air purification – through waste assimilation, and water and air filtration
- water regulation and erosion control (i.e., water catchment protection) – in terms of maintaining higher flows in rivers and for longer duration; reducing flood surges; and reducing erosion and sedimentation from vegetation on steep slopes and river banks.
Cultural services include:

- ethical and biodiversity ‘non-use’ values, particularly through maintaining populations of endangered and endemic species and the appreciation of these species
- sense of place and way of life. These locations are likely to provide value to local people living near to and using these areas in terms of their way of life and special connection with such areas.
- ecotourism, particularly in protected areas
- aspects of these locations which may provide spiritual, sacred or religious values; inspiration for culture and design; and cognitive development.

Habitat and species support includes:

- habitats that provide important refuge, feeding, watering, breeding and nursery areas.

Other supporting services include:

- habitats and species that provide photosynthesis, seed propagation, pollinating services and water, carbon and nutrient cycling, which are values typically accounted for in other ecosystem services.

8.2.2 Potential Project Impacts

8.2.2.1 Introduction

Except for the MST and PRS1, the assessment of potential impacts from AGIs has been included in the description of generic impacts because these facilities are in modified habitats of low sensitivity. The nature of these impacts (in terms of magnitude, duration and extent) will be the same for each of these facilities and, therefore, the proposed mitigation measures will also be the same. A similar approach has been taken for the construction facilities.

Where the pipeline traverses agricultural land, this will be converted to natural grassland on completion of construction. This represents a considerable biodiversity enhancement of approximately 1707 ha.

Appendices E2 and E3 include all pre-mitigation and post-mitigation generic and location-specific impacts. This includes two types of construction and operational impacts, those from construction facilities and those from the pipeline and AGIs. For impacts on biodiversity, habitats of conservation importance, the construction facility and pipeline and AGI impacts have been aggregated and are described as either construction or operation impacts. If before the aggregation a construction facility or pipeline and AGIs impact was greater than the other, the greater impact was applied. If a pre-mitigation or post-mitigation impact was determined to be significant, it is noted in the text when the other aggregated impact is not significant. All disaggregated impacts are included in Appendices E2 and E3.

Potential impacts to ecosystem services have been addressed throughout this section where relevant. Ecosystem services impacts have not been scored in the same manner as other impacts but an indication of the likely significance of the ecosystem service impact has been provided in each case.
8.2.2.2 Construction

Generic Impacts

Soil Compaction
Impact: Impaired re-establishment of vegetation after construction

Soil compaction from inappropriate soil storage and management can restrict root penetration required for vegetation reinstatement. Soil types that are likely to be more susceptible to compaction (i.e., high silt and clay component) were identified at several locations along the right-of-way (RoW), including KP789–825.9. However, the pre-mitigation impact of soil compaction during construction was found to be not significant (see Section 8.5.2); as habitats found at the construction sites are typically easy to reinstate, the potential impact of soil compaction on vegetation re-establishment is also considered not significant.

Soil Erosion
Impact: Loss of topsoil through erosion by wind or water causing impaired reinstatement

Soil storage will be managed based on the best construction practices, to ensure soil will not be eroded by wind or water causing in diminished topsoil quality and quantity. The loss of topsoil could impair vegetation growth after reinstatement. This impact is considered not significant as, in the unlikely event of erosion, the effects will be limited to the work site and the magnitude will be medium.

Impact: Reduced primary productivity in watercourses, smothering of invertebrates, lethal or sublethal effects on fish, degradation of spawning habitat

Soil compaction and erosion can produce indirect impacts through increased runoff and siltation of aquatic habitats. The latter has potential to reduce the structural complexity of habitats (see Walker et al. 2013). Soil erosion may also impair re-establishment of vegetation and the recovery of aquatic habitats. It can also have direct impacts on turbidity which can cause smothering and degradation of habitats. This may indirectly impact primary productivity rates and degrade aquatic habitats (e.g., alter biochemistry), including functional habitats such as fish spawning and foraging habitats. As the rivers along the pipeline route generally show high turbidity and the duration would be transient, this is considered not significant.

Loss of Soil Structure, Fertility and Seed Bank
Impact: Poor recolonisation due to anaerobic conditions in stored soil, reduced fertility and loss of entrained seeds

Prolonged storage of topsoil (longer than six months) can cause loss of soil fertility, as nutrients may be leached out by rain or anaerobic conditions may be created by a lack of air circulation. Prolonged storage may also cause loss in viability of the seed bank in the stored topsoil. This can lead to poor recolonisation during reinstatement. As soil storage is likely to be for a short duration, this impact is considered not significant.
Impeded Flow of River or Channel and Abstraction of Water

Impact: Loss of aquatic and water-margin habitats or barrier effects

Impeded flow of the river (including reduced flow owing to river water abstraction) reduces flow volumes, which can lead to direct habitat loss in aquatic and marginal habitats. It can also lead to indirect loss by reducing access to habitats through creation of barriers within the river channel (e.g., insufficient depths to allow fish passage). Reduced water volumes and velocities could also indirectly affect the biochemical conditions of a habitat (e.g., reducing dissolved oxygen levels owing to higher ambient water temperatures) which could have sublethal and lethal impacts on species. In some instances, habitat structure may be modified rather than the aquatic or marginal habitats being lost altogether. As water levels within these rivers tend to fluctuate between seasons, this impact is considered not significant.

Loss of Habitat

Impact: Permanent loss of habitat from (AGIs and operational RoW)

The need to clear vegetation for the construction of AGIs will cause permanent habitat loss. Table 8.2-1 summarises the habitat loss at each AGI and the type of habitat affected. These facilities are not within protected areas or other areas highlighted through baseline studies as habitats of conservation importance and the habitat loss will be limited in extent. The impact is therefore considered not significant.

There will also be some permanent habitat loss along the RoW where woodland and forest habitats will be removed and not reinstated due to the requirement to have no deep-rooted species above the pipeline. As indicated in Table 8.2-1, this mostly affects modified habitats and this direct impact is considered not significant.

This habitat loss has indirect impacts on the species supported by the habitats as described in Section 8.3.

| Table 8.2-1 Permanent Habitat Loss (Aboveground Installations and Operational Right-of-Way²) (ha) |
|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| PS3 | PS4 | PS5 | PS6 | PRS1 | PRS2 | MST | Operational RoW | Total | % of AOI³ |
| Natural⁴ | 3.2 | 1.0 | - | - | 0.02 | - | 39.2 | 261.4 | 304.9 | 0.5 |
| Forest | - | - | - | - | - | - | - | 3.4 | 3.4 | 0.4 |
| Woodland | - | - | - | - | - | - | - | 9.5 | 9.5 | 0.3 |
| Bushland | - | 1.0 | - | - | 0.02 | - | 36.2 | 93.1 | 130.3 | 0.5 |
| Itigi-like thicket | - | - | - | - | - | - | - | 7.7 | 7.7 | 0.4 |

² The Operational RoW is a 10-m exclusion zone centred on the pipeline centreline where no deep-rooted trees species will be allowed to develop, to ensure the integrity of the pipeline

³ Percentage of each habitat type found within the AOI

⁴ The classification of habitat types is described in Appendix A1 Table A1.3-2 Physiognomic Habitat Classes in the Area of Influence.
Table 8.2-1 Permanent Habitat Loss (Aboveground Installations and Operational Right-of-Way) (ha)

<table>
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<th></th>
<th>PS3</th>
<th>PS4</th>
<th>PS5</th>
<th>PS6</th>
<th>PRS1</th>
<th>PRS2</th>
<th>MST</th>
<th>Operational RoW</th>
<th>Total</th>
<th>% of AOI³</th>
</tr>
</thead>
<tbody>
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<td>Wooded Grassland</td>
<td>3.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>159.3</td>
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<td>12.6</td>
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Impact: Temporary loss of habitat from construction activities (RoW and other temporary worksites, main camps and pipe yards (MCPYs))

Most of the construction causing temporary habitat loss is in modified habitat. Any habitat loss in areas of high bioquality is described in the location-specific impacts section. The temporary loss of vegetation along the RoW will cause a short-term direct impact on habitats (permanent loss of deep rooted species is described under permanent loss of habitat). Agricultural areas will be reinstated as grassland (representing a biodiversity benefit) and all other habitats will be returned to their original condition. As these impacts are temporary and affect mostly modified habitat (2030 ha of modified compared to 637 ha of natural habitat), this impact is considered be not significant.

Table 8.2-2 summarises the type and extent of temporary habitat loss for the RoW and the construction facilities.

---

5 Bioquality is defined as an aspect of a plant community’s conservation value, derived from the concentration of restricted range species occurring in the community – see Baseline Section 6.4.1.2.
### Table 8.2-2  Temporary Habitat Loss (Right-of-Way and Construction Facilities) (ha)

<table>
<thead>
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<th>Habitat Type</th>
<th>MCPY5</th>
<th>MCPY6</th>
<th>MCPY7</th>
<th>MCPY8</th>
<th>MCPY9</th>
<th>MCPY10</th>
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<th>MCPY13</th>
<th>MCPY14</th>
<th>MCPY15</th>
<th>MCPY16</th>
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<th>PS4</th>
<th>PS5</th>
<th>PS6</th>
<th>PRS</th>
<th>PRS1</th>
<th>PRS2</th>
<th>MST</th>
<th>RoW</th>
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<th>% of AOI</th>
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<td>11.5</td>
<td>16.6</td>
<td>4.7</td>
<td>12.1</td>
<td>19.2</td>
<td>15.8</td>
<td>1.3</td>
<td>2.3</td>
<td>1.8</td>
<td>0.5</td>
<td>0.1</td>
<td>1.3</td>
<td>2.3</td>
<td>2.3</td>
<td>0.5</td>
<td>0.5</td>
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<tr>
<td>Shrubland</td>
<td>2.6</td>
<td>1.6</td>
<td></td>
<td></td>
<td>0.3</td>
<td>0.5</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.6</td>
<td>138.2</td>
<td>144.3</td>
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<td>Plantation</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>1.3</td>
<td>1.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Settlement</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.2</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>17.5</td>
<td>8.7</td>
<td>17.5</td>
<td>2.4</td>
<td>17.5</td>
<td>37.6</td>
<td>10.2</td>
<td>17.5</td>
<td>18.2</td>
<td>6.0</td>
<td>12.1</td>
<td>19.2</td>
<td>18.0</td>
<td>2.3</td>
<td>2.3</td>
<td>2.3</td>
<td>2.3</td>
<td>0.5</td>
<td>0.5</td>
<td>1.0</td>
<td>10.0</td>
<td>2445.5</td>
<td>2668.1</td>
</tr>
</tbody>
</table>

*Percentage of each habitat type found within the AOI*
Impact: Modified habitat structure following reinstatement after construction

Habitats may not fully establish or return to their pre-project condition following reinstatement and some may take longer than others for example grassland will be quicker than forest. This may cause a different habitat structure which may, in turn, affect the species using the habitat. As most of the habitats to be reinstated are modified and widespread, this direct impact is considered not significant.

Habitats of high bioquality (such as riparian forest), which are highly unlikely to regenerate naturally, are described in the location-specific section

Impact: Loss of wetland and riparian habitat through open cut crossing during construction of the RoW

Open-cut crossing of rivers and wetlands during the pipeline construction will cause a direct loss of wetland and riparian habitat. Although this direct impact could affect habitat and species of high sensitivity, and is of large magnitude, it is temporary and as such is considered not significant.

Impacts from Introduction of Alien Invasive Species or Plant and Animal Diseases

Impact: Poor recolonisation by local flora through competition by alien invasive species (AIS) following reinstatement

The introduction of competitive species or plant and animal diseases, including alien invasive species, can modify the physical structure of aquatic and terrestrial habitats (e.g., changing flow patterns and choking channels in the case of some plant species). The accidental introduction of non-native species has the potential to hamper habitat reinstatement as non-native species tend to be vigorous in growth and out-compete native species for resources.

Some diseases or animal species can also target and ultimately remove structural and functional habitat features (e.g., submerged tree roots and aquatic and riparian plants).

As the magnitude of this potential impact is large and, once established, it is very difficult to eradicate non-native species, this is a potentially significant indirect impact.

Impacts from Disturbance or Harm to Wildlife

Impact: Interaction between construction workers and habitats of conservation importance, especially relating to food and fuel

Construction workers living at the camps have the potential to use natural resources from adjacent habitats for fuel and food causing local deforestation. This potential impact is not considered significant because meals will be provided and camps will be closed.

Impact: PIIM to areas around camps causing increased pressure on natural resources (farming, deforestation for fuel)

Construction camps will be a source of revenue and may encourage people to move to the area and set up temporary accommodation on land around the camps. These people may clear land for cultivation and food which will cause very long
duration impacts of local extent on habitats of moderate sensitivity, causing not significant impacts

**Ecosystem Services**

The following generic aspects may have impacts on ecosystem services that the habitats support:
- impeded flow of river or channel
- abstraction of water
- habitat loss.

Impacts from these aspects will have indirect effects on the ecosystem services that the habitats support.

Impacts from impeded flow of river or channel and abstraction of water could cause loss of aquatic and water-margin habitats that have the potential to affect the following ecosystem services:
- provisioning services including hunting, gathering and foraging food and collection of medicinal products
- cultural services such as ethical and biodiversity ‘non-use’ values and a sense of place and way of life.

Impacts from impeded flow and abstraction are considered not significant and therefore the indirect impacts on ecosystem services are similarly likely to be not significant.

Impacts from habitat loss are wide ranging as the habitat types are varied and multi-functional. Loss of habitat, whether permanent or temporary, will affect the following ecosystem services:
- provisioning services, including wood and wood fuel; hunting, gathering and foraging food; collection of medicinal products; and trapping of wildlife for the live trade market
- regulating services, including carbon sequestration, local climate regulation, local water and air purification, water regulation and erosion control
- cultural services, including ethical and biodiversity ‘non-use’ values; sense of place and way of life; ecotourism; spiritual, sacred or religious values; inspiration for culture and design; and cognitive development
- habitat and species support, including the habitats which provide important refuge, feeding, watering, breeding and nursery areas.

Impacts from habitat loss are considered not significant as most habitats affected are modified and impacts are localised only therefore associated impacts on ecosystem services are also likely to be not significant.
Location-Specific Impacts


Loss of Habitat

Impact: Temporary loss of habitat within protected and internationally recognised areas during pipeline construction

The pipeline passes through ten legally protected areas (two of which are internationally recognised as KBAs) and one internationally recognised area (a KBA) (see Figure 6.4-1 in Section 6.4.1.1). These areas vary in their level of protection and habitat types, but all are of moderate sensitivity for the habitats they support. Sites of particular importance for habitats or the species they support are described individually and the impacts on all others are described here. Where permanent facilities (with permanent habitat loss) are in or near protected areas these are described individually.

Table 8.2-3 provides a summary of the potential temporary loss of habitat in protected areas from the pipeline construction. The proportion of habitat to be removed compared to the overall resource and the fact that all habitats will be reinstated cause potential impacts of medium magnitude, short duration and site level extent to species of moderate sensitivity and are considered not significant.

Table 8.2-3  Temporary Habitat Loss in Protected and Internationally Recognised Areas

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>RoW (Including Additional Workspace) (ha)</th>
<th>MC13</th>
<th>Worksite PRS1</th>
<th>Total (ha)</th>
<th>Habitat in AOI</th>
<th>Habitat Type in AOI in Protected Area (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minzio NFR key biodiversity area (IBA/KBA) (311.42 km²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forest</td>
<td>0.01</td>
<td>-</td>
<td>-</td>
<td>0.01</td>
<td>81.7</td>
<td>0.0%</td>
</tr>
<tr>
<td>Woodland</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>0.5</td>
<td>104</td>
<td>0.5%</td>
</tr>
<tr>
<td>Total</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>0.5</td>
<td>185.8</td>
<td>0.3%</td>
</tr>
<tr>
<td>Ruiga River FR (1,200 km²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forest</td>
<td>6.9</td>
<td>-</td>
<td>-</td>
<td>6.9</td>
<td>613.9</td>
<td>1.1%</td>
</tr>
<tr>
<td>Bushland</td>
<td>1.1</td>
<td>-</td>
<td>-</td>
<td>1.1</td>
<td>130.7</td>
<td>0.8%</td>
</tr>
<tr>
<td>Wetland</td>
<td>2.7</td>
<td>-</td>
<td>-</td>
<td>2.7</td>
<td>410.5</td>
<td>0.7%</td>
</tr>
<tr>
<td>Wooded grassland</td>
<td>59.5</td>
<td>-</td>
<td>-</td>
<td>59.5</td>
<td>5,611.3</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

7 The classification of habitat types is described in Appendix A1 Table A1.3-2 Physiognomic Habitat Classes in the Area of Influence
8 The standard RoW is 30 m wide but in some areas such as steep side slopes or road, rail and river crossings, additional workspace may be required to safely construct the pipeline.
<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>RoW (Including Additional Workspace) (ha)</th>
<th>MC13</th>
<th>Worksite PRS</th>
<th>Total (ha)</th>
<th>Habitat in AOI</th>
<th>Habitat Type in AOI in Protected Area (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivation</td>
<td>35.7</td>
<td>-</td>
<td>-</td>
<td>35.2</td>
<td>3,111.0 1.1%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>105.9</strong></td>
<td>-</td>
<td>-</td>
<td><strong>105.9</strong></td>
<td><strong>10,107.6</strong> 1.0%</td>
<td></td>
</tr>
<tr>
<td>Burigi-Biharamulo Game Reserve (KBA) (1,104 km²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forest</td>
<td>0.7</td>
<td>-</td>
<td>-</td>
<td>0.7</td>
<td>608.1 0.1%</td>
<td></td>
</tr>
<tr>
<td>Bushland</td>
<td>6.9</td>
<td>-</td>
<td>-</td>
<td>6.9</td>
<td>110.3 6.3%</td>
<td></td>
</tr>
<tr>
<td>Wetland</td>
<td>2.4</td>
<td>-</td>
<td>-</td>
<td>2.4</td>
<td>320.2 0.7%</td>
<td></td>
</tr>
<tr>
<td>Wooded grassland</td>
<td>57.2</td>
<td>-</td>
<td>-</td>
<td>57.2</td>
<td>5,427.3 1.1%</td>
<td></td>
</tr>
<tr>
<td>Cultivation</td>
<td>0.7</td>
<td>-</td>
<td>-</td>
<td>0.7</td>
<td>579.9 0.1%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>73.0</strong></td>
<td>-</td>
<td>-</td>
<td><strong>73.0</strong></td>
<td><strong>7045.8</strong> 1.0%</td>
<td></td>
</tr>
<tr>
<td>Biharamulo FR (1,462.32 km²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bushland</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>0.5</td>
<td>146.9 0.3%</td>
<td></td>
</tr>
<tr>
<td>Wooded grassland</td>
<td>0.6</td>
<td>-</td>
<td>-</td>
<td>0.6</td>
<td>191.3 0.3%</td>
<td></td>
</tr>
<tr>
<td>Cultivation</td>
<td>26.7</td>
<td>-</td>
<td>-</td>
<td>26.7</td>
<td>4,991.6 0.5%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>27.8</strong></td>
<td>-</td>
<td>-</td>
<td><strong>27.8</strong></td>
<td><strong>5,329.8</strong> 0.5%</td>
<td></td>
</tr>
<tr>
<td>Uyovu FR (190.0 km²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bushland</td>
<td>1.6</td>
<td>-</td>
<td>-</td>
<td>1.6</td>
<td>166.8 1.0%</td>
<td></td>
</tr>
<tr>
<td>Wooded grassland</td>
<td>0.6</td>
<td>-</td>
<td>-</td>
<td>0.6</td>
<td>101.9 0.6%</td>
<td></td>
</tr>
<tr>
<td>Cultivation</td>
<td>11.5</td>
<td>-</td>
<td>-</td>
<td>11.5</td>
<td>1,059.1 1.1%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13.7</strong></td>
<td>-</td>
<td>-</td>
<td><strong>13.7</strong></td>
<td><strong>1327.8</strong> 1.0%</td>
<td></td>
</tr>
<tr>
<td>Ngogwa Busangi FR (466.01 km²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bushland</td>
<td>8.8</td>
<td>-</td>
<td>-</td>
<td>8.8</td>
<td>376.8 2.3%</td>
<td></td>
</tr>
<tr>
<td>Wooded grassland</td>
<td>0.6</td>
<td>-</td>
<td>-</td>
<td>0.6</td>
<td>161.5 0.4%</td>
<td></td>
</tr>
<tr>
<td>Cultivation</td>
<td>45.1</td>
<td>-</td>
<td>-</td>
<td>45.1</td>
<td>3,287.3 1.4%</td>
<td></td>
</tr>
<tr>
<td>Plantation</td>
<td>0.3</td>
<td>-</td>
<td>-</td>
<td>0.3</td>
<td>6.4 4.7%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>54.8</strong></td>
<td>-</td>
<td>-</td>
<td><strong>54.8</strong></td>
<td><strong>3832</strong> 1.4%</td>
<td></td>
</tr>
<tr>
<td>Mwakalundi FR (115.35 km²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bushland</td>
<td>1.5</td>
<td>-</td>
<td>-</td>
<td>1.5</td>
<td>250.4 0.6%</td>
<td></td>
</tr>
<tr>
<td>Cultivation</td>
<td>3.5</td>
<td>-</td>
<td>-</td>
<td>3.5</td>
<td>562.3 0.6%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5.0</strong></td>
<td>-</td>
<td>-</td>
<td><strong>5.0</strong></td>
<td><strong>812.7</strong> 0.6%</td>
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</tr>
</tbody>
</table>
Table 8.2-3  Temporary Habitat Loss in Protected and Internationally Recognised Areas

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>RoW (Including Additional Workspace) (ha)</th>
<th>MC13 Worksite PRS1</th>
<th>Total (ha)</th>
<th>Habitat in AOI</th>
<th>Habitat Type in AOI in Protected Area (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wembere Steppe IBA and KBA (1,600 km²)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bushland</td>
<td>0.9</td>
<td>-</td>
<td>0.9</td>
<td>37.3</td>
<td>2.4%</td>
</tr>
<tr>
<td>Woodland</td>
<td>0.0</td>
<td>-</td>
<td>0.0</td>
<td>5.5</td>
<td>0.0%</td>
</tr>
<tr>
<td>Wooded grassland</td>
<td>0.1</td>
<td>-</td>
<td>0.1</td>
<td>30.1</td>
<td>0.3%</td>
</tr>
<tr>
<td>Cultivation</td>
<td>72.6</td>
<td>-</td>
<td>72.6</td>
<td>6,675.9</td>
<td>1.1%</td>
</tr>
<tr>
<td>Shrubland</td>
<td>2.6</td>
<td>-</td>
<td>2.6</td>
<td>113.0</td>
<td>2.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>76.2</td>
<td>-</td>
<td>76.2</td>
<td>6,861.8</td>
<td>1.1%</td>
</tr>
<tr>
<td><strong>Talamai OA (4,361.04 km²)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bushland</td>
<td>84.0</td>
<td>-</td>
<td>84.0</td>
<td>10,506.2</td>
<td>0.8%</td>
</tr>
<tr>
<td>Wetland</td>
<td>2.6</td>
<td>-</td>
<td>2.6</td>
<td>332.4</td>
<td>0.8%</td>
</tr>
<tr>
<td>Wooded grassland</td>
<td>27.1</td>
<td>1.3</td>
<td>28.4</td>
<td>3,325.2</td>
<td>0.9%</td>
</tr>
<tr>
<td>Cultivation</td>
<td>41.4</td>
<td>4.7</td>
<td>46.5</td>
<td>4,260.7</td>
<td>1.1%</td>
</tr>
<tr>
<td>Shrubland</td>
<td>8.0</td>
<td></td>
<td>8.0</td>
<td>1,436.4</td>
<td>0.6%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>163.2</td>
<td>6.0</td>
<td>169.5</td>
<td>19,860.9</td>
<td>0.9%</td>
</tr>
<tr>
<td><strong>Kitwai GCA (4,418.25 km²)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bushland</td>
<td>17.3</td>
<td>-</td>
<td>17.3</td>
<td>2,173.3</td>
<td>0.8%</td>
</tr>
<tr>
<td>Wetland</td>
<td>0.8</td>
<td>-</td>
<td>0.8</td>
<td>34.8</td>
<td>2.3%</td>
</tr>
<tr>
<td>Wooded grassland</td>
<td>4.6</td>
<td>-</td>
<td>4.6</td>
<td>715.1</td>
<td>0.6%</td>
</tr>
<tr>
<td>Cultivation</td>
<td>3.7</td>
<td>-</td>
<td>3.7</td>
<td>468.6</td>
<td>0.8%</td>
</tr>
<tr>
<td>Shrubland</td>
<td>0.9</td>
<td>-</td>
<td>0.9</td>
<td>128.9</td>
<td>0.7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>27.3</td>
<td>-</td>
<td>27.3</td>
<td>3,832</td>
<td>0.7%</td>
</tr>
<tr>
<td><strong>Handeni GCA (2,062.94 km²)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bushland</td>
<td>9.0</td>
<td>-</td>
<td>9.0</td>
<td>1,130.8</td>
<td>0.8%</td>
</tr>
<tr>
<td>Wetland</td>
<td>1.8</td>
<td>-</td>
<td>1.8</td>
<td>82.6</td>
<td>2.2%</td>
</tr>
<tr>
<td>Wooded grassland</td>
<td>32.0</td>
<td>-</td>
<td>32.0</td>
<td>2,534.1</td>
<td>1.3%</td>
</tr>
<tr>
<td>Cultivation</td>
<td>37.4</td>
<td>-</td>
<td>37.4</td>
<td>3,292.7</td>
<td>1.1%</td>
</tr>
<tr>
<td>Shrubland</td>
<td>1.5</td>
<td>-</td>
<td>1.5</td>
<td>362.5</td>
<td>0.4%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>81.7</td>
<td>-</td>
<td>81.7</td>
<td>7,402.7</td>
<td>1.1%</td>
</tr>
</tbody>
</table>
Location: Burigi–Biharamulo GR (KP438–472)

Loss of Habitat

Impact: Permanent loss of old-growth forest on ridge

The pipeline route passes through the Burigi–Biharamulo GR, causing 105.9 ha of temporary habitat loss. Most of the habitat affected is bushland with some wetland. A relic stand of old growth forest was identified during the baseline field survey on a relatively inaccessible ridge at KP457 (Figure 8.2-1) and, as such, is undisturbed and has a high habitat quality. This woodland stand is afforded a level of protection from anthropogenic threats by its relative inaccessibility.

![Old Growth Ridgetop Forest in Burigi-Biharamulo Game Reserve](image)

Based on visual interpretation of satellite imagery captured in 2016, an estimated 397 ha of primary woodland is within the AOI and, of that, approximately 7.9 ha is expected to be removed for construction. When considering the primary woodland alone, the loss is likely to be about 2%. This primary woodland habitat is of very high sensitivity, and the impact on is of national extent and very long duration (as
the forest is unlikely to re-establish naturally) and the magnitude is small; hence this direct impact is considered not significant.

**Location: Itigi-Like Thicket (KP979 and KP996)**

**Loss of Habitat**

**Impact: Loss of Itigi-like thicket**

Itigi-like thicket was surveyed in two locations during the baseline botanical survey at KP979.9 and KP996.7 (Figure 8.2-2), both areas are patchy in distribution but are on the RoW and extend beyond the RoW to the north and south across a 31 km section of the pipeline between KP965 and KP996. The portion of Itigi-like thicket approximately between KP965 and KP990 is thought to be within the Mgiori Community Forest Reserve. This type of thicket is characterised by densely compacted stands of 3–7 m high woody shrubs (White 1983; Kindt et al. 2011). These areas of thickets are considered of high bioquality and recognisable Itigi thicket is of global conservation importance, and therefore is of very high sensitivity.

![Figure 8.2-2  Itigi-like Thicket Within the Area of Influence](image-url)
The 16.5 ha of Itigi-like thicket that will be cleared during construction is unlikely to regenerate naturally from the soil seedbank. This is a long-duration impact at a national extent on a habitat of very high sensitivity. However, because the magnitude is small (representing a 2% loss of Itigi-like thicket within the AOI), the impact is not significant.

**Location: Miombo Woodland (KP970, KP1028 and KP1097)**

**Loss of Habitat**

Impact: Loss of dry miombo woodland of high bioquality

Stands of dry miombo woodland are an important component of a mosaic with Itigi-like thicket. Three patches of miombo woodland have been identified during the baseline surveys (Figure 8.2-3):

- at KP970.1 (58.5 m from the edge of the RoW) dry miombo thicket on a ridge top has high bioquality and is of global conservation importance.
- at KP1028.0 the pipeline directly crosses an area of relatively undisturbed, dry miombo woodland of moderate bioquality
- at KP1097.2 (239 m from the edge of the RoW) the pipeline is close to an area of miombo woodland of moderate bioquality.
Figure 8.2-3  Dry Miombo Woodland of Conservation Importance Within the Area of Influence

Site clearance will cause the loss of the patch of miombo woodland only at KP1028. Miombo woodland is likely to recolonise naturally after clearance (as long as areas of natural regeneration maintain connectivity with existing miombo woodland) and because the one affected patch is only of moderate bioquality this direct impact is long duration, of a national extent on a very high sensitivity habitat however the magnitude is considered negligible (representing a loss of < 1% of the dry Miombo woodland within the AOI), the impact is not significant.

**Location: Coastal Vegetation Mosaic near the Sigi River (KP1424)**

**Loss of Habitat**

**Impact:** Loss of coastal thicket and coastal woodland of high bioquality from within coastal vegetation mosaic

Coastal vegetation mosaic is an intricate mix of coastal forest, thicket and woodland and, sea-cliff and coastline vegetation. An area of coastal thicket at KP1424.3
(41 m from the edge of the RoW) and, 300 m further along the route at KP1424, a stand of coastal woodland, both near to the Sigi River (Figure 8.2-4) have particularly high bioqualities and hence are of conservation importance. The HDD at this location will ensure that coastal forest vegetation mosaic is largely avoided. An area near KP1425 may potentially be affected by the HDD worksite.

**Figure 8.2-4 Coastal Vegetation Mosaic at the Sigi River**

**Location:** Coastal Vegetation Mosaic at the Marine Storage Terminal

**Loss of Habitat**

**Impact:** Loss of coastal thicket and coastal woodland of high bioquality from within coastal vegetation mosaic

Coastal vegetation mosaic is an intricate mix of coastal forest, thicket and woodland and coastal forest. Habitat clearance for the construction of the MST will cause the permanent loss of 73 ha of semi-natural habitat, comprising a mosaic of agro-pastoral land interspersed with shrubland and coastal bushland. The loss of coastal vegetation mosaic caused by MST site clearance will be negligible magnitude, long...
duration, of a national extent on a very high sensitivity habitat is not significant impact.

Figure 8.2-5 Coastal Vegetation Mosaic at the Marine Storage Terminal Site

Ecosystem Services

The following location-specific impacts may have an indirect impact on ecosystem services:

- temporary loss of habitat within protected areas during pipeline construction
- loss of habitat within the high-sensitivity Minzio NFR and Burigi–Biharamulo GR, and the loss of Itigi-like thicket, miombo woodland and coastal forest mosaic habitat.

These impacts have the potential to cause indirect impacts on the following ecosystem services:
• provisioning services, including wood and wood fuel, food (hunting, gathering and foraging), collection of medicinal products, and trapping of wildlife for the live trade market
• regulating services, including carbon sequestration, local climate regulation, local water and air purification, water regulation and erosion control
• cultural services, including ethical and biodiversity ‘non-use’ values; sense of place and way of life; ecotourism; spiritual, sacred or religious values; inspiration for culture and design; and cognitive development
• habitat and species support, including the habitats which provide important refuge, feeding, watering, breeding and nursery areas for many animals that spend only part of their life in such areas.

Impacts from habitat loss at certain locations (see location-specific impacts) are considered significant and therefore indirect impacts on ecosystem services could also potentially be significant.

8.2.2.3 Operation

Generic Impacts
There are no generic impacts on habitats of conservation importance.

Location-Specific Impacts

Location: PS5 near Wembere Steppe and the MST in the East African Costal Forest EBA (KP824 and KP1442)

Disturbance or Harm to Wildlife
Impact: NOX emissions and acid deposition causing impaired growth of plants affecting habitat quality

The proposed operation of power generation equipment and bulk oil heaters at PS5 and the MST will release nitrogen oxides (NOx) and other substances, including fine particulate matter (PM2.5) to the atmosphere. Details of the dispersal and predicted ground-level concentrations at these sites are provided in Section 8.9, Air Quality.

These emissions to atmosphere have the potential to affect sensitive species within the AOI. NOx emissions may affect the wetland habitats in the Wembere Steppe and associated water birds approximately 3 km from PS5 and on the coastal vegetation mosaics and mangroves less than 100 m from the MST boundary. However, the predicted total annual average NOx concentrations are not expected to impact wetland habitat, the impact is considered not significant.
**Location: MST (KP1442)**

Loss of Habitat and Disturbance or Harm to Wildlife

Impact: PIIM causing deforestation of coastal forest mosaic habitat for fuel and cultivation.

The MST will not be a substantial source of employment once constructed and hence will likely cause only modest PIIM (see Section 8.12) of people with an associated modest increase in utilisation of natural resources; as such this impact is considered of medium magnitude, very long duration, local extent on a high sensitivity species and hence is not significant.

**Ecosystem Services**

The MST will not be a substantial source of employment once constructed and PS5 will mostly be unmanned and hence will likely cause only modest PIIM with an associated modest increase in utilisation of natural resources; as such there is unlikely to be any impact on ecosystem services. As project operation will have minimal impacts on habitats there is considered no impacts on ecosystem services from the project operation.

**8.2.3 Mitigation Measures**

This section describes the avoidance and mitigation measures that will be applied to the aspects and activities that could affect biodiversity impacts.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section and the associated management plan and other measures that are included in Appendix E4 have been collectively used to assess residual impacts, and to determine their significance.

**8.2.3.1 Design**

**Generic Mitigation Measures**

Soil Compaction and Erosion

Geological and geophysical surveys were undertaken to evaluate soil conditions and to assess potential geohazards (e.g., faulting) on the pipeline route. Geotechnical surveys established the physical properties of subsurface soils. These surveys require drilling of boreholes to sample and test the subsurface.

Good soil management practices that reduce the potential for erosion and compaction have been built into the project description and are covered in Section 8.5.3.

Crossing of perennial wetlands (those with standing water or saturated soil for most of the year) will be undertaken using open-cut methods with a wider trench to reduce erosion. Seasonal wetlands (those with no standing water or saturated soil for part of the year) will also be open-cut, but with a narrower trench since the potential for erosion is not as great.
Impeded Flow of River or Channel and Abstraction of Water

A study to identify and evaluate potential water sources to support construction, commissioning and operations was undertaken to identify potential water sources with enough supply to meet project requirements without adversely affecting other water users and biodiversity.

Loss of Habitat

Route selection has been an iterative process of gradual refinement based on a set of technical, environmental and social criteria. These criteria were applied with a view to delivering the final proposed route, worksites and facilities’ locations that strike the optimum balance between socio-economic, environmental and technical factors. Environmental factors used in the selection process included potential impacts on rivers and wetlands, forests, and sensitive and protected areas.

Construction methods were considered at the design stage to reduce impacts on a variety of VECs. Where the pipeline crosses watercourses, special construction methods will be employed to reduce the effects on biodiversity. Where required, method statements will be drafted for river crossings. At many locations the watercourse is likely to be low or dry while at others (such as the Pangani and Kagera rivers) there will be a wet open-cut crossing.

There are 234 watercourse and wetland crossings in Tanzania. The clear majority of these will be crossed using wet open-cut methods, except for the Kagera and Sigi River crossings which will employ HDD. This method was chosen for the Kagera crossing so that the pipe will pass under the national road that runs parallel to the river. The Sigi River flows through a small gorge with a steep wall that prohibits an open-cut crossing solution.

Introduction of Alien Invasive Species or Plant and Animal Diseases

The project description describes the reinstatement methods that will be used, including reinstating natural vegetation that occur in non-agricultural areas, from the soil seedbank to avoid introducing invasive species.

Disturbance or Harm to Wildlife

There are no specific design mitigation measures to address impacts from workers within construction camps and potential PIIM.

Location-Specific Mitigation Measures


Loss of Habitat

Impact: Temporary habitat loss within protected and internationally recognised areas during pipeline construction

Route selection helped to reduce the impacts on habitat loss in protected areas through avoidance. To reduce impacts on species of conservation importance,
there are proposals to reinstate MCPY12 (near Swaga Swaga GR) and MCPY13 (in Talamai OA, see Section 8.3.3.2).

**Location: Burigi–Biharamulo GR (KP438–472)**

Loss of Habitat
Impact: Permanent loss of old-growth forest
Route selection helped to reduce the impacts on habitat loss in this protected area through avoidance.

**Location: Itigi-Like Thicket (KP979 and KP996)**

Loss of Habitat
Impact: Permanent loss of Itigi-like thicket through pipeline construction
There are no design mitigation measures for this impact.

**Location: Miombo Woodland (KP970.1, KP1028 and KP1097.2)**

Loss of Habitat
Impact: Loss of dry Miombo woodland on ridge top (natural habitat of high bioquality and conservation importance) from within the dry Miombo woodland and Itigi-like thicket mosaic.
There are no design mitigation measures for this impact.

**Location: Coastal Woodland and Thicket (KP1424–KP1424.3)**

Loss of Habitat
Impact: Permanent loss of coastal woodland and thicket through pipeline construction
During route selection and refinement, crossing of the Sigi River by HDD was identified to be the preferred crossing method owing to the physical constraints of an open-cut crossing. This has resulted in reduced impacts on the coastal woodland and thicket near the river.

**8.2.3.2 Construction**

**Generic Mitigations**

Soil Compaction
Impact: Impaired re-establishment of vegetation after construction
The soil management plan, reinstatement plan and the community health, safety and security plan will include measures that contribute to the management of soil compaction.
During construction, local communities will be discouraged from using the RoW as an access track. Ground protection such as bogmats and geotextile fabric will be used to support heavy loads where ground is soft. Stock piled topsoil will be monitored for compaction and corrective action implemented if required. The
reinstatement plan will include ways to achieve an increasing trend in vegetation regrowth and diversity of desired species.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact will be reduced from small to negligible.

Soil Erosion
Impact: Loss of topsoil through erosion by wind or water causing impaired reinstatement

The soil management plan and reinstatement plan will include procedures to manage erosion.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from large to small.

Impact: Reduced primary productivity in watercourses, smothering of invertebrates, lethal or sublethal effects on fish, degradation of spawning habitat

The soil management plan and reinstatement plan will include measures to manage erosion and reduce siltation above background levels. Locations for discharging excavated pipeline trench water will be identified in the pollution prevention plan. Appropriate sediment control measures consistent with recognised industry best practices will be implemented.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Loss of Soil Structure, Fertility and Seed Bank
Impact: Poor recolonisation due to anaerobic conditions in stored soil, reduced fertility and loss of entrained seeds

The soil management plan will include measures for managing topsoil that will contribute to maintaining adequate soil condition.

Topsoil stacks will be monitored for compaction and corrective action implemented if required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Impeded Flow of River or Channel and Abstraction of Water
Impact: Loss of aquatic and water-margin habitats or barrier effects

The soil management plan, reinstatement plan and natural resource management plan will include mitigation that will contribute to the management of impeded flow and water abstraction from surface waters.

River bed and bank material will be stored separately and away from active water channels during river crossings and, where conditions require, river crossing method statements will be developed. Water flow at project surface water
abstraction points will be monitored and corrective measures implemented if required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Loss of Habitat

Impact: Permanent loss of habitat from AGIs and operational RoW

The biodiversity management plan will include measures that will contribute to the management of loss of habitat.

A vegetation removal method statement will be implemented to control activities such as tree felling and ensure vegetation outside the RoW is not impacted. Where habitats of conservation importance have been identified, pre-construction surveys will inform location-specific biodiversity management plans that will consider micro routing to avoid impacts or conservation measures to achieve no net loss to biodiversity. A schedule for all the surveys will be developed in the early stages of construction planning to allow surveys to be undertaken at an appropriate time.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Impact: Temporary loss of habitat from construction activities (RoW and other temporary worksites, main camps and pipe yards (MCPYs)).

The biodiversity management plan will include measures that collectively manage habitat loss.

A vegetation removal method statement will be developed to control activities such as tree felling and ensure vegetation outside the RoW is not affected. Where required pre-clearance survey will inform location-specific biodiversity management plans that allow for progressive, active habitat restoration; ways to achieve an increasing trend in vegetation regrowth and diversity of desired species will be explored.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from large to medium.

Impact: Modified habitat structure following reinstatement after construction

The biodiversity management plan will include measures that manage modification of habitat.

Location-specific biodiversity management plans will be developed and implemented where applicable allowing for progressive, active habitat restoration (including seeding with seed collected from similar habitats, propagation of seedlings off-site for supplementary planting if required). Ways will be explored to achieve an increasing trend in vegetation regrowth and diversity of desired species.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual
impact is reduced from medium to small while duration remains medium and extent remains local.

Impact: Loss of wetland and riparian habitat through open cut crossing during construction

The biodiversity management plan will include measures that manage loss of wetland and riparian habitat.

River crossing method statements will be developed that will set out measures to address impacts including construction during the dry period, pump-arounds to keep water flow and protection of riparian vegetation.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from large to medium.

Introduction of Alien Invasive Species (AIS) or Plant and Animal Diseases

Impact: Poor recolonisation by local flora through competition by AIS following reinstatement

The biodiversity management plan will include measures that manage poor recolonisation of local flora.

Biosecurity measures will be developed and implemented that will include a strategy for weed and pest control and measures to prevent the introduction or spread of alien invasive species such as wheel washing.

The application of the described mitigation will reduce the magnitude of impact from medium to small and hence the residual impact will be not significant; the duration remains very long term.

Disturbance or Harm to Wildlife

Impact: increased interaction between construction workers and habitats of conservation importance, especially relating to food and fuel

The biodiversity management plan, project induced in-migration plan, community health, safety and security plan and the occupational health, safety and security plan will include measures that collectively contribute to the management of the interaction between workers and habitats.

Construction camps will be designated as having “closed” status and food and fuel will be provided to prevent interactions between the workforce and surrounding habitats reducing the likelihood of fuel and food gathering activities.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Impact: PIIM to areas around camps causing increased pressure on natural resources (farming, deforestation for fuel)

The project will develop and implement a project induced in-migration plan that will aim to reduce the number of people that arrive into project-affected communities.
Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

**Ecosystem Services**

Impacts from habitat loss are considered not significant as most habitats affected are modified and impacts are localised only; therefore, associated impacts on ecosystem services are also likely to be not significant.

**Location-Specific Mitigation Measures**


**Loss of Habitat**

Impact: Temporary habitat loss within protected and internationally recognised areas during pipeline construction

In addition to the generic mitigation addressing habitat loss described in Section 8.2.3.2, the biodiversity management plan will include the following measure that will manage temporary loss of habitat.

Pre-construction surveys will be undertaken of habitats of conservation importance in protected areas. This information will be used to produce site-specific biodiversity management plans, where required, to reduce impacts on biodiversity during construction.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small and the duration of impact is reduced from medium to short term.

**Location: Burigi–Biharamulo GR (KP438–472)**

**Loss of Habitat**

Impact: Permanent loss of old-growth forest on ridge

In addition to the generic mitigation addressing habitat loss described in Section 8.2.3.2, the biodiversity management plan and reinstatement plan will include the following measures that will manage the loss of old-growth forest.

Pre-construction surveys will be planned that will inform site specific biodiversity management plans to reduce impacts on biodiversity during construction (exploring options to avoid, reduce, mitigate or compensate for loss). Pre-construction surveys will inform location-specific biodiversity management plans. The location-specific management plans will provide measures for reinstatement to allow for progressive, managed habitat restoration; ways to achieve an increasing trend in vegetation regrowth and diversity of desired species as well as possible enhancement measures to achieve no net loss of biodiversity.
Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; however, though the magnitude is reduced it remains small. The residual impact is not significant.

**Location: Itigi-Like Thicket (KP979 and KP996)**

**Loss of Habitat**

**Impact:** Permanent loss of Itigi-like thicket

In addition to the generic mitigation addressing habitat loss described in Section 8.2.3.2, the biodiversity management plan and reinstatement plan will include the following measures that manage the permanent loss of Itigi-like thicket.

The project will complete pre-construction surveys biodiversity surveys that will inform site specific biodiversity management plans to reduce impacts on biodiversity during construction (exploring options to avoid, reduce, mitigate or compensate for loss). Pre-construction surveys will inform location-specific biodiversity management plans that allow for progressive, active habitat restoration; ways to achieve an increasing trend in vegetation regrowth and diversity of desired species will be explored as well as possible enhancements to achieve no net loss of biodiversity. Ways will be explored to achieve an increasing trend in vegetation regrowth and diversity of desired species.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the duration of the residual impact is reduced from very long term to medium term.

**Location: Miombo Woodland (KP1028)**

**Loss of Habitat**

**Impact:** Loss of dry miombo woodland of high bioquality

In addition to the generic mitigation addressing habitat loss described in Section 8.2.3.2, the biodiversity management plan and reinstatement plan will include the following measures that will manage the permanent loss of miombo woodland.

Pre-construction biodiversity surveys will be planned that will inform site specific biodiversity management plans to reduce impacts on biodiversity during construction (exploring options to avoid, reduce, mitigate or compensate for loss). Pre-construction surveys will inform location-specific biodiversity management plans that allow for progressive, active habitat restoration; ways to achieve an increasing trend in vegetation regrowth and diversity of desired species will be explored as well as possible enhancements to achieve no net loss of biodiversity.

The mitigation will reduce the duration of the impact from long to medium, hence the residual impact to the patch of miombo woodland at KP1028 is not significant.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the duration of the residual impact is reduced from long term to medium term.
Location: Coastal Vegetation Mosaic near the Sigi River (KP1424) and MST

Loss of Habitat

Impact: Loss of coastal thicket and coastal woodland of high bioquality from within coastal vegetation mosaic.

Habitat clearance for the construction for the marine storage terminal (MST) at Chongoleani will cause the permanent loss of 73 ha of semi-natural habitat, comprising a mosaic of agro-pastoral land interspersed with shrubland, coastal bushland and thicket.

In addition to the generic mitigation addressing habitat loss described in Section 8.2.3.2, the biodiversity management plan and reinstatement plan will include the following measures that will manage the loss of coastal thicket and coastal woodland.

The project will complete pre-construction surveys that will inform site specific biodiversity management plans to reduce impacts on biodiversity during construction (exploring options to avoid, reduce, mitigate or compensate for loss). Pre-construction surveys will inform location-specific biodiversity management plans that allow for progressive, active habitat restoration; ways to achieve an increasing trend in vegetation regrowth and diversity of desired species will be explored as well as possible enhancements to achieve no net loss of biodiversity.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the duration of the residual impact is reduced from long term to medium term.

Ecosystem Services

Mitigation described to manage location-specific impacts on habitats of conservation importance will manage impacts to ecosystem services where applicable.

8.2.3.3 Operations

Generic Mitigation Measures

There are no generic impacts on habitats of conservation importance from the project operations and no generic mitigation measures.

Location-Specific Mitigation Measures

Location: PS5 near Wembere Steppe KBA and MST in the East African Coastal Forest EBA (KP824 and KP1442)

Disturbance or Harm to Wildlife

Impact: NOx emissions and acid deposition causing impaired growth of plants affecting habitat quality

The pollution prevention plan will include measures to manage project emissions.

All power generators will meet national regulations and project environmental standards with regards to air quality and emission limits.
Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

**Location: MST (KP1442)**

Loss of Habitat and Disturbance or Harm to Wildlife

Impact: PIIM causing deforestation of coastal forest mosaic habitat for fuel and cultivation.

In addition to mitigation described in Section 8.2.3.2 addressing mitigation to manage deforestation, the project induced in-migration management plan aims to reduce the number of people arriving into project-affected communities; labour management plan and the stakeholder engagement plan will include measures that contribute to the management of impacts from PIIM causing deforestation of coastal forest mosaic habitat for fuel and cultivation.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

### 8.2.4 Residual Impacts and Significance Summary

This section summarises the potential residual impacts on biodiversity after mitigation has been implemented, following the order in Table 8.2-4 and focusing on those impacts that are considered significant.

#### 8.2.4.1 Generic and Location-Specific Impacts

Table 8.2-4 summarises the potential generic biodiversity impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation. Table 8.2-5 summarises the location-specific impacts.

Considering the generic and location-specific mitigation described there are no residual impacts on habitats of conservation importance.
### Table 8.2-4 Habitats of Conservation Importance – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil compaction</td>
<td>Impaired re-establishment of vegetation after construction</td>
<td>C</td>
<td>–</td>
<td>Reinstatement plan Community health, safety and security plan</td>
<td>2 2 1 3 8</td>
</tr>
<tr>
<td>Soil erosion</td>
<td>Loss of topsoil through erosion by wind or water causing impaired reinstatement</td>
<td>C</td>
<td>–</td>
<td>Soil management plan Reinstatement plan</td>
<td>4 3 1 4 12</td>
</tr>
<tr>
<td></td>
<td>Reduced primary productivity in watercourses, smothering of invertebrates, lethal</td>
<td>C</td>
<td>–</td>
<td>Soil management plan Reinstatement plan</td>
<td>4 2 2 3 11</td>
</tr>
<tr>
<td></td>
<td>or sublethal effects on fish, degradation of spawning habitat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of soil structure, fertility</td>
<td>Poor recolonisation due to anaerobic conditions in stored soil, reduced fertility</td>
<td>C</td>
<td>–</td>
<td>Soil management plan</td>
<td>4 2 1 3 10</td>
</tr>
<tr>
<td>and seed bank</td>
<td>and loss of entrained seeds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impeded flow of river or channel</td>
<td>Loss of aquatic and water-margin habitats</td>
<td>C</td>
<td>–</td>
<td>Soil management plan Reinstatement plan Natural resource management plan</td>
<td>4 2 4 3 13</td>
</tr>
<tr>
<td>Abstraction of water from river or</td>
<td>Loss of aquatic or water-margin habitats</td>
<td>C</td>
<td>–</td>
<td>Soil management plan Reinstatement plan Natural resource management plan</td>
<td>4 2 2 3 11</td>
</tr>
<tr>
<td>channel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss of habitat</td>
<td>Permanent loss of habitat from AGIs and operational RoW</td>
<td>C</td>
<td>–</td>
<td>Soil management plan Reinstatement plan Biodiversity management plan</td>
<td>4 5 2 3 14</td>
</tr>
</tbody>
</table>

**NOTES:** C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.2-4 Habitats of Conservation Importance – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of habitat</td>
<td>Temporary loss of habitat from construction activities (RoW, other temporary worksites main camps and pipe yards MCPYs)</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>6 3 2 4 15</td>
</tr>
<tr>
<td>Loss of habitat</td>
<td>Modified habitat structure following habitat reinstatement after construction</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>4 3 2 4 13</td>
</tr>
<tr>
<td>Loss of habitat</td>
<td>Loss of wetland and riparian habitat through open cut crossing during construction of the RoW</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>6 2 2 5 15</td>
</tr>
<tr>
<td>Introduction of competitive species or plant/animal diseases</td>
<td>Poor recolonisation by local flora through competition by non-natives following reinstatement</td>
<td>C&amp;O</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>4 5 2 5 16</td>
</tr>
<tr>
<td>Disturbance or harm to wildlife</td>
<td>Interaction between construction workers and habitats of conservation importance, especially relating to food and fuel</td>
<td>C</td>
<td></td>
<td>Biodiversity management plan, Project-induced in-migration plan, Community health, safety and security plan, Occupational health, safety and security plan</td>
<td>4 2 2 3 11</td>
</tr>
<tr>
<td>Disturbance or harm to wildlife</td>
<td>PIIM to areas around camps causing increased pressure on natural resources (farming, deforestation for fuel)</td>
<td>C&amp;O</td>
<td></td>
<td>Project-induced in-migration plan</td>
<td>4 5 2 3 14</td>
</tr>
</tbody>
</table>

**NOTES:**

C = construction; O = operation; C&O = construction and operation; B = beneficial impact; M = magnitude of impact; D = duration of impact; E = extent of impact; S = sensitivity; SS = significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.2-5 Habitats of Conservation Importance – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Various protected and internationally recognised areas (see narrative for details)</td>
<td>Loss of Habitat</td>
<td>Temporary loss of habitat within protected and internationally recognised areas during pipeline construction</td>
<td>C</td>
<td></td>
<td>Biodiversity management plan</td>
<td></td>
</tr>
<tr>
<td>KP438–472 Burigi-Biharamulo GR/KBA</td>
<td>Loss of Habitat</td>
<td>Permanent loss of old-growth forest on ridge (approx. 2% of primary forest within the AOI)</td>
<td>C</td>
<td></td>
<td>Soil management plan Reinstatement plan Biodiversity management plan</td>
<td>4 5 4 5 18</td>
</tr>
<tr>
<td>KP979–996 Itigi-like thicket</td>
<td>Loss of Habitat</td>
<td>Loss of Itigi-like thicket (c. 2% of Itigi-like thicket within the AOI)</td>
<td>C</td>
<td></td>
<td>Soil management plan Reinstatement plan Biodiversity management plan</td>
<td>4 3 4 5 16</td>
</tr>
<tr>
<td>KP1424 Coastal vegetation mosaic at Sigi River</td>
<td>Loss of Habitat</td>
<td>Loss of coastal thicket and coastal woodland of high bioquality from within coastal vegetation mosaic (&lt;1% of habitat type within AOI)</td>
<td>C</td>
<td></td>
<td>Biodiversity management plan Reinstatement plan</td>
<td>2 3 4 5 14</td>
</tr>
</tbody>
</table>

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<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>MST 1442 – Coastal vegetation mosaic</td>
<td>Loss of Habitat</td>
<td>Loss of coastal thicket and coastal woodland of high bioquality from within coastal vegetation mosaic (&lt;1% of habitat type within AOI)</td>
<td>O</td>
<td><strong>C</strong></td>
<td>Biodiversity management plan Reinstatement plan</td>
<td><strong>M</strong></td>
</tr>
<tr>
<td>KP825–825 PS5/Heating Station KP824.9</td>
<td>Disturbance or Harm to Wildlife</td>
<td>NOx emissions and acid deposition causing impaired growth of plants affecting habitat quality</td>
<td>O</td>
<td><strong>O</strong></td>
<td>Pollution prevention plan</td>
<td><strong>M</strong></td>
</tr>
<tr>
<td>KP1442–1442 MST KP1442.8</td>
<td>Disturbance or Harm to Wildlife</td>
<td>NOx emissions and acid deposition causing impaired growth of plants affecting habitat quality</td>
<td>O</td>
<td><strong>O</strong></td>
<td>Pollution prevention plan</td>
<td><strong>M</strong></td>
</tr>
<tr>
<td>KP1442–1442 MST KP1442.8</td>
<td>Loss of Habitat and Disturbance or Harm to Wildlife</td>
<td>PIIM causing deforestation for fuel and cultivation</td>
<td>O</td>
<td><strong>O</strong></td>
<td>Project induced in-migration management plan Labour management plan Stakeholder engagement plan</td>
<td><strong>M</strong></td>
</tr>
</tbody>
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8.2.5 Transboundary Project Impacts
No transboundary project impacts were identified.

8.2.6 Cumulative Impacts
EACOP’s contribution to cumulative impacts on the habitats of conservation
importance VEC is negligible and no further mitigation measures other than those
described in Section 8.2.3 are considered necessary.

8.2.7 Transboundary Cumulative Impacts
There are no transboundary cumulative impacts affecting habitats of conservation
importance.

8.3 Biodiversity: Flora and Fauna Species of Conservation
Importance
This section describes potential impacts on flora and fauna species of conservation
importance during construction, commissioning and operation of the EACOP project
and associated mitigation measures to be adopted.

8.3.1 Key Sensitivities and Considerations
The flora and fauna of conservation importance baseline conditions are described
in Section 6.4.1 as well as:
- their sensitivity ranking based on the relevant tables in Appendix D
- key considerations.

The sensitivity ranking of flora and fauna VECs ranges from low to very high.

Key habitats of high conservation interest for the flora and fauna species of
conservation importance they support for consideration include:
- Minziro Nature Forest Reserve (NFR IBA)
- Lake Ikimba
- Burigi-Biharamulo Game Reserve (GR IBA)
- Wembere Steppe (IBA KBA)
- Singida Lakes (IBA)
- Swaga Swaga (GR)
- the Talamai Open Area (OA)
- East African Coastal Forest (EBA)
- wetland habitats.

Key considerations for flora and fauna of conservation importance include 33
species of vascular plants. These species are important because 12 are listed by
the IUCN (2017) as endangered or vulnerable, and 22 have Black Star status as
endemic and or globally restricted-range species. The majority of globally rare and
restricted-range or endemic species in the study area were recorded in the dry
miombo woodlands, Itigi-like thicket and coastal vegetation mosaic (see Section 8.2). One restricted-range or endemic species was also recorded in the footprint of the MST. Vascular plant species of conservation importance are listed as follows:

- Aeschynomene bullockii
- Baphia kirkii
- Byttneria fruticosa
- Bussea massaiensis
- Cassia burtii
- Cissus trothae
- Cynometra suaheliensis
- Combretum harrisi
- Cordia balanocarpa
- Dalbergia vacciniifolia
- Grewia burtii
- Hirtella zanzibarica subsp. megacarpa
- Julbernardia magnistipulata
- Justicia salvioides
- Maerua eminii
- Megalochlamys tanzaniensis Vollesen
- Mildbraedia carpinifolia
- Millettia paucijuga
- Millettia oblate subsp. intermedia
- Pavetta burtii
- Pseudoprosopis euryphylla subsp. puguensis
- Rytigynia celastroides
- Saintpaulia ionantha
- Stuhlmannia moavi
- Stylochaeton bogneri
- Tapiphyllum obtusifolium
- Uvaria kirkii
- Warburgia stuhlmannii
- Zanthoxylum holtzianum.

Fauna species of conservation importance include (details of where these species were identified is contained in the baseline reports in Appendix A4):

- Zanzibar galago (Galagoides zanzibaricus)
- Maendeleo horseshoe bat (Rhinolophus maendeleo)
- African straw-coloured fruit bat (Eidolon helvum)
- Hildegarde’s tomb bat (Taphozous hildegardae)
- Ashy red colobus monkey (Piliocolobus tephrosceles)
- African wild dog (Lycaon pictus)
- lion (Panthera leo)
• leopard (*Panthera pardus*)
• elephant (*Loxodonta africana*)
• hippopotamus (*Hippopotamus amphibius*)
• Temminck’s ground pangolin (*Smutsia temminckii*)
• giraffe (*Giraffa camelopardalis*)
• Pancake tortoise (*Malacochersus tornieri*)
• Masiliwa snout burrower (*Hemisus brachydactylus*)
• bubbling puddle frog (*Phrynobatrachus bullans*).

Avifauna species of conservation importance include (details of where these species were identified can be found in the baseline report in Appendix A3):
• hooded vulture *Necrosyrtes monachus* (IUCN critically endangered)
• grey crowned crane *Balaerica regulorum* (IUCN endangered)
• shoebill *Balaeniceps rex* (IUCN vulnerable)
• papyrus yellow warbler *Calamonastides gracilirostris*, (IUCN vulnerable)
• blue swallow *Hirundo atrocaerulea* (IUCN vulnerable)
• white-backed vulture *Gyps africanus* (IUCN critically endangered)
• steppe eagle *Aquila nipalensis* (IUCN endangered)
• Karamoja apalis *Apalis karamojae* (IUCN vulnerable and endemic)
• Ruaha hornbill *Tockus ruahae* (IUCN not assessed)
• ashys starling *Lamprotornis unicolor* (IUCN least concern)
• orange-bellied parrot *Poicephalus rufiventris* (IUCN least concern)
• Martial eagle *Polemaetus bellicosus* (IUCN vulnerable)
• grey-breasted spurfowl *Pternistis rufopictus* (IUCN least concern and endemic to Tanzania)
• Fischer’s lovebird *Agapornis fischeri* (IUCN near threatened)
• yellow-collared lovebird *Agapornis personatus* (IUCN least concern)
• rufous-tailed weaver *Histurgops ruficaudus* (IUCN least concern)
• lesser flamingo *Phoeniconaias minor* (IUCN near threatened).

Many fish and macroinvertebrates of conservation importance (critically endangered, endangered, endemic, range-restricted and or migratory species) are likely to be present in the study area. During field surveys, species of conservation importance were recorded in the Kagera, Pangani and Sigi Rivers, Lake Victoria wetlands, and two of the surveyed ephemeral watercourses.

Some of these fauna, avifauna and aquatic species are migratory and congregatory, and some are endemic to Tanzania or range-restricted.

**Ecosystem Services**

Ecosystem services associated with species of conservation importance are listed below. Potential impacts to ecosystem services are addressed in Section 8.3.2.

Provisioning services include:
• collection of wood (including for fuel and charcoal manufacture), which is legal in some areas and not in others such as the Minziro NFR
hunting, gathering and foraging food, which is legal in some areas and not in others, for example Minziro Forest Reserve

- collection of medicinal products
- trapping of wildlife for the live trade market.

Cultural services include:

- ethical and biodiversity ‘non-use’ values – in terms of maintaining populations of endangered and endemic species.
- ecotourism, particularly in protected areas.

### 8.3.2 Potential Project Impacts

Except for the MST and PRS1, the assessment of potential impacts from AGIs has been included in the description of generic impacts because these facilities are in areas that do not tend to support species that have high or very high sensitivity. The nature of these impacts (in terms of magnitude, duration and extent) will be the same for each of these facilities and, therefore, the proposed mitigation measures will also be the same. A similar approach has been taken for the construction facilities.

Appendices E2 and E3 include all pre-mitigation and post-mitigation generic and location-specific impacts. This includes two types of construction and operation impacts, those from construction facilities and those from the pipeline and AGIs. For impacts on biodiversity, flora and fauna of conservation importance, the construction facility and pipeline and AGI impacts have been aggregated and are described as either construction or operation impacts. If a construction facility or pipeline and AGIs impact was greater than the other before the aggregation, the greater impact was applied. If a pre-mitigation or post-mitigation impact was determined to be significant, it is noted in the text when the other aggregated impact is not significant. All disaggregated impacts are included in Appendices E2 and E3.

Potential impacts to ecosystem services have been addressed throughout this section where relevant. Ecosystem services impacts have not been scored in the same manner as other impacts but an indication of the likely significance of the ecosystem service impact has been provided in each case.

#### 8.3.2.1 Construction

**General**

Impacts from the construction, including the development of construction facilities; construction and commissioning of the pipeline and aboveground installations (AGI) and the decommissioning of construction facilities are described together in this section as impacts are similar for all the activities.
Generic Impacts

Treatment and Disposal of Known and Unknown Contamination; Disposal of Solid and Liquid Waste and; Accidental Release of Oil and Chemicals

Impact: Injury or mortality of flora and fauna due to mobilisation of soil contaminants

Impact: Mortality of flora and fauna through contamination of food and water supply

Impact: Stress or mortality of flora and fauna due to disposal of solid and liquid waste

Accidental disposal of waste material and chemicals have the potential to pollute watercourses and cause mortality of macrophytes, which species of conservation importance may use. Accidental spills of waste material and chemicals are unlikely and not planned events and therefore this direct impact is considered not significant.

Impact: Increase in vermin around any established waste dumps and consequent increase in prey availability for carnivorous birds and mammals

There is the potential that the inappropriate disposal of waste may encourage vermin into the camps which could alter the predator–prey balance for species close to the camps causing an indirect impact on species. This may encourage some native raptors to the site but is more likely to increase vermin such as rats and invasive species such as the Indian house crow (*Corvus splendens*). The duration of such incidences is likely to be short, localised at site level and hence be small in magnitude; consequently, this direct impact is considered not significant.

Disposal of Surplus Water from Working Areas and Hydrotest Water

Impact: Reduced primary productivity in watercourses, smothering of invertebrates, lethal or sublethal effects on fish, and degradation of spawning habitat

As described in the habitats section, soil erosion can directly impact turbidity, which can cause smothering and degradation of aquatic habitats. This may indirectly impact primary productivity rates and degrade aquatic habitats (e.g., alter biochemistry), including functional habitats such fish spawning and foraging habitats. As the rivers along the pipeline route generally have high turbidity and the duration of any event resulting from construction activities is likely to be short, this impact is considered not significant.

Impeded Flow of River or Channel

Impact: Restrictions of fish (ranging from nonmigratory fish species to potamodromous fish species) movement and reduced reproductive success, impaired movement of other aquatic organisms and reduced habitat suitability

Impeding a river’s flow or channel may impair movement and reduce reproductive success for all fish but is a key consideration for potamodromous fish; those fish that migrate within or between rivers, wetlands or lakes to access key functional habitats used for refuge, foraging or spawning at different life stages. Nonmigratory fish are less sensitive to this impact and therefore sensitivity is lower. Impaired movement has the potential to affect the reproductive success of fish species. River
crossings during construction are typically of short duration therefore these impacts are considered not significant.

Abstraction of Water from River or Channel
Impact: Decreased water level due to water abstraction for project use leading to loss of aquatic and water-margin habitats causing reduced spawning activity
Impact: Mortality to aquatic organisms from the river through direct abstraction
Entrainment and removal of aquatic species during abstraction activities is likely to cause their stress, injury and or mortality. If no screens or inappropriate screens are used, there is also a risk that species may be killed or become trapped in or on the screens, which would cause stress, injury and mortality. An indirect impact linked to abstraction is a loss or reduction of aquatic and marginal habitat availability for aquatic flora and fauna caused by reduced water levels. As water levels generally rise and fall during the wet and dry seasons these indirect impacts are considered not significant.

Management of Black and Grey Water
Impact: Injury or mortality of flora and fauna due to surface water contamination
Inappropriate disposal of black and grey water could contaminate surface water which may cause stress, injury or mortality to aquatic species. Accidental release of oil or chemicals into aquatic habitats can also cause stress, injury or mortality of aquatic species, and terrestrial species using surface water habitats. Although the impacts from surface water contamination can be widespread and chronic, accidental discharge of untreated grey or black water is unlikely and is not a planned event and therefore this indirect impact has a small magnitude and therefore is considered not significant.

Abstraction of Groundwater
Impact: Decreased water level due to water abstraction for project use leading to loss of habitat for stygofauna
As described in Section 8.7.4, there are no significant residual impacts anticipated on groundwater levels caused by abstraction for project use during construction. Based on available secondary data relating to stygofauna in East Africa, the species of stygofauna (groundwater-dwelling animals) likely to be impacted are not of conservation importance, and habitat loss for stygofauna is predicted to be temporary; hence the indirect impact on stygofauna is considered not significant.

Loss of Habitat for Species of Conservation Importance
Impact: Permanent loss of breeding and foraging habitat for fauna through site clearance for construction
Vegetation removal and site clearance required when construction begins will remove habitat that can be used by species for breeding and foraging. Table 8.2-1 quantifies the amount of permanent habitat loss. This direct impact will disturb or remove breeding sites such as dens, earths and nests that may be present in the project footprint, and reduce forage availability, which could influence a species’ distribution or ability to reproduce causing a decline in the local population.
Although most of the permanent habitat loss in the RoW and AGIs is farmland or other modified habitat, species are opportunistic and may still use modified habitats for parts of their life cycle. Birds may forage on crop land and large mammals may roam through cultivated land. Species of conservation importance must therefore be assumed to be present in most habitat types if they are present in the landscape. Although the extent of habitat loss is local the sensitivity of potentially affected species is very high, and the magnitude is large as loss of breeding sites could cause a failure of that species to breed, duration is long because loss is permanent, but the extent is local; as such, this potential direct impact on species is significant.

Impact: Temporary loss of breeding and foraging habitat for fauna through site clearance for construction

As described for permanent habitat loss above the temporary loss of habitat will also have impacts on a variety of species using the landscape. Table 8.2-1 quantifies the amount of temporary habitat loss. However, as these temporary land takes will be reinstated the duration is short and the magnitude medium and therefore temporary habitat loss is not significant.

Impact: Habitat fragmentation causing disrupted species movement during construction on the RoW

During construction, vegetation will be removed from a 30-m wide strip along the length of the RoW. Tree-dwelling species and those that prefer cover to facilitate movement will not be able to move through their usual territories or will become more susceptible to predation and unable to move between habitat patches. Species of very high sensitivity that are susceptible to fragmentation are described in the location-specific impacts. Typically the duration when passage is blocked by either open trench or a pipeline string is short however, the species of conservation importance are of high sensitivity and the magnitude is large as fragmentation could cause abandonment of breeding sites or reduced forage range, extent is regional as species can move through large areas and duration is medium (due to the time it takes for various habitats to re-establish, grassland will be much quicker than forest); hence this impact is considered significant.

Introduction of AIS, or Plant or Animal Diseases

Impact: Modified habitats due to alien invasive species establishment leading to increased competition and loss of habitat for breeding and foraging

Non-native species can hinder the establishment of native species which has an indirect impact on species that use these habitats for breeding and foraging. Some invasive species can outcompete native species for ecological resources such as food and refuge or predate them in a way that they have not adapted to avoid. Some diseases and parasites can target native species, weakening them or removing them from habitats all together.

Once established invasive species can be hard to eradicate causing very long duration of medium magnitude for this potential indirect impact on very highly sensitive species of conservation importance but at a local level only; hence this indirect impact is considered not significant.
Disturbance or Harm to Wildlife

Impact: Increased predation due to removal of habitat used to shelter and forage

Site clearing will create a 30-m wide strip of un-vegetated land that could cause increased predation on species due to the loss of cover and shelter. This indirect impact is considered of medium duration due to the time taken for vegetation to re-establish but only of medium magnitude, and hence is not significant.

Impact: Mortality of fauna species of conservation importance due to movement of vehicles and presence of construction plant and structures

The use of vehicles and construction equipment may directly impact less mobile species such as reptiles and amphibians by death or injury. However, as most species can move away from vehicles and will avoid the construction area and hence traffic movement, the magnitude of potential impact is medium, and the duration will be short; hence this direct impact is considered not significant.

Impact: Increased gathering of flora and hunting of fauna species of conservation importance from PIIM to construction camps, from improved access along new or upgraded project access roads and access provided by RoW during construction and reinstatement.

The PIIM of people seeking employment at and around the camps or using the newly created access roads has the potential to cause indirect impacts on species using habitats surrounding the camps or accessed by roads. The clearance of land along the RoW can cause PIIM of people using the RoW as an unofficial access route. Most roads and camps are in areas surrounded by modified habitat types. Where roads are in areas of high conservation importance they are described in the location-specific section. When people move to an area, some will clear trees for charcoal and cultivate land leading to loss of habitat on which species of conservation importance depend. There may also be increased hunting of bushmeat and fishing which will have direct impacts on species of conservation importance. The duration is very long, as people outside the project cannot be directly controlled and access roads will be permanent, the sensitivity of the species of conservation importance is high (as species are opportunistic and can be found in modified and natural habitats), magnitude is medium as the loss of breeding habitat could affect a portion of a population and may bring about a change in abundance and/or distribution over more than one generation; hence this potential indirect impact is considered significant.

Impact: Disturbance from activities causing noise, vibration, human and vehicle activity affecting breeding and behaviour of animals

Construction activities create noise and visual disturbance from vehicle and human movement. This activity can cause species to move away from forage and breeding areas and can restrict breeding for some sensitive species. Those species considered very sensitive to disturbance are more likely to be found in natural habitats within the protected areas. As the pipeline mostly passes through modified habitat with settlements and human activity, this impact is considered of medium magnitude, short duration and therefore not significant.
Open Excavations

Impact: Injury or fatality of fauna from falling into excavations if they cannot escape or where they are at increased risk of predation

Trenching will create a long, linear trench of typically around 1.5 m width in which species could get trapped, particularly smaller, less mobile species. Once in the trench they are potentially subject to predation or are not able to access food and water could cause mortality. Impacts are of short duration and medium magnitude on species including those of very high sensitivity; they are considered as not significant.

Ecosystem Services

All the aspects described in the generic impacts section have the potential to affect ecosystem services. Any aspect which affects animals or plants that are used by local people for food, fuel or medicine will influence provisioning ecosystem services delivered by these species. However, the significance of the impact on ecosystem services is difficult to be quantified as it depends on how reliant each community is on the particular ecosystem service and whether there are any alternatives available.

Impacts on rivers through abstraction, sedimentation or contamination could affect fish used for the following provisioning service:

- capture fisheries and food (hunting, gathering and foraging).

Impacts from smothering of species from soil disposal, waste spills and introduction of competitive species could affect plants and animals used for these provisioning services:

- wood (including collection for fuel and charcoal manufacture)
- food (hunting, gathering and foraging)
- collection of medicinal products.

Impacts from disturbance or harm to wildlife, habitat loss and impeded movement could affect plants and animals used for these provisioning services:

- wood (including collection for fuel and charcoal manufacture)
- food (hunting, gathering and foraging)
- collection of medicinal products.

Location-Specific Impacts

Location: Locations that Support Tanzania Endemics such as Karamoja Apalis, Fischer's Lovebird, Ashy Starling and Yellow-Collared Lovebird (KP302–1442)

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Temporary loss of nesting habitat through site clearance

These endemic bird species use a variety of habitats along the pipeline route, particularly palms, baobab, Miombo woodland and Papyrus swamp (see baseline)
Section 6.4.1). The loss of these habitats may temporarily impact the ability of these species to nest and feed. Only small areas of habitat likely to be affected leading to a small magnitude and short duration, local extent to species of high sensitivity. This potential impact is considered not significant.

Location: Ponds and Wetlands Containing the Endemic Bubbling Puddle Frog
Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife
Impact: Direct mortality, destruction of breeding habitat and habitat fragmentation for bubbling puddle frog where construction affects ponds. Ponds and wetlands between KP420 and KP645 have the potential to support the endemic bubbling puddle frog (see Section 6.4.1). Habitat loss could directly reduce available breeding ground or restrict movement between ponds as well as the potential for direct mortality through site clearance and soil movement. This frog, although endemic, is found throughout large parts of the country and therefore impacts on this species are considered of medium magnitude and therefore not significant.

Location: Minziro Nature Forest Reserve, Important Bird Area and Key Biodiversity Area (KP302–312)
Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife
Impact: Loss of breeding and foraging habitat and disturbance to species using the reserve through pipeline construction.

The pipeline passes through this reserve, but no permanent or temporary facilities are in or near it. Site clearance before construction will remove grassland within the 30-m working width. A range of species uses this habitat. These IUCN-vulnerable fauna species are of particular concern:

- Temminck’s ground pangolin
- Leopard.

The construction activities will cause noise and visual disturbance to species using the surrounding habitat. This disturbance may affect the movement of the species through its territory or, if construction is undertaken during breeding season, it could affect the species ability to breed.

Although Temminck’s ground pangolins and leopards are high-sensitivity species and the population may be important at a national level, the potential impacts are during construction (short duration) only and therefore these impacts are considered not significant.

Loss of Habitat for Species of Conservation Importance
Impact: Loss of breeding and foraging habitat for ashy red colobus monkey through pipeline construction

Ashy red colobus monkeys (IUCN endangered) are mainly arboreal and, although the pipeline passes through the FR, the forest habitat is avoided. This monkey is considered of very high sensitivity. The ashy red colobus monkey is found in an area of less than 5000 km² and the subpopulations are severely fragmented (with
no movement between them) (Struhsaker 2016). As the habitat loss is unlikely to affect breeding sites and only sub-optimal habitat, the magnitude of the impacts is medium and not significant.

Disturbance or Harm to Wildlife

Impact: Disturbance (noise and visual) to ashy red colobus monkey through pipeline construction

Construction activities will cause noise and visual disturbance to this species and has the potential to displace them from their usual breeding and foraging areas. However, impacts will be short duration and of small magnitude so are considered not significant.

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Habitat loss and disturbance (noise and visual) to species using the important bird area causing restrictions to species’ distributions (blue swallow (IUCN vulnerable))

The blue swallow (IUCN vulnerable) overwinters in the grassland habitats associated with the reserve. Construction activities will cause direct habitat loss and indirect noise and visual disturbance. However, as the construction will only affect some of the habitat leading to a small magnitude and the duration will be short this impact is considered not significant.

Location: Lake Ikimba (KP350)

Disposal of Solid and Liquid Waste, Disposal of Black and Grey Water, Accidental Release of Oil / Chemicals and Disturbance or Harm to Wildlife

Impact: Potential pathway for contamination or sediment during construction on the lake’s tributaries and disturbance (noise and visual) affecting birds of conservation importance.

The lake supports hooded vulture (IUCN critically endangered), grey crowned crane (IUCN endangered), papyrus yellow warbler (IUCN vulnerable) and shoebill (IUCN vulnerable). Lake Ikimba will not be directly affected by the construction, but, as a site of high sensitivity supporting IUCN endangered and vulnerable species, it has the potential for indirect impacts from contamination of the lake and surrounding seasonal wetland habitat during construction. The lake is 3 km from the construction site, therefore magnitude is medium and duration is short. This impact is considered not significant.

Location: Burigi–Biharamulo Game Reserve (KP436–472)

Loss of Habitat for Species of Conservation Importance

Impact: loss of breeding and foraging habitat for IUCN critically endangered species (white-backed vulture), IUCN endangered species (steppe eagle, ashy red colobus) and multiple keystone species (raptors, owls, lion and leopard).

The pipeline passes through 105.9 ha of this reserve, although no permanent or temporary facilities will be constructed in or near it. Informal logging and charcoal
production activities are evident along the southern and south-eastern areas of the reserve and there is historic pressure from refugee camps on the edge of the reserve. Although rangers do administer the area it is considered sensitive to change and in declining condition. Site clearance will remove trees (7.9 ha) within an area of old growth forest on a steep escarpment. Ashy red colobus monkeys are arboreal, and the white-backed vultures and other raptors are known to use old growth forest for nesting and therefore tree loss has the potential to cause loss of breeding and feeding habitat for all these species. As these species are of very high sensitivity, the duration is very long (as forest habitats cannot be easily recreated), extent is national and magnitude is very large (as impacts may cause failed breeding attempts), this potential direct impact is considered significant.

Disturbance or Harm to Wildlife

Impact: Disturbance (noise, visual) to IUCN critically endangered species (white-backed vulture), IUCN endangered species (steppe eagle and ashy red colobus monkey) and multiple keystone species (raptors, owls, lion and leopard) during construction

Noise and activity from construction may move species away from their usual territories. As these species are generally wide-ranging and habitat loss within the reserve will be small in both size and duration, this impact is considered not significant.

Loss of Habitat for Species of Conservation Importance

Impact: Loss of habitat from creation of two new access tracks into the reserve

As described for the species above the construction of two new access roads will also cause loss of a linear strip approximately 3.5 km in length of breeding and forage habitat and disturbance to species of high and very high sensitivities. These direct and indirect potential impacts are of very long duration but of small magnitude due to the small area and are therefore not significant.

Loss of Habitat for Species of Conservation Importance

Impact: Facilitated access leading to habitat loss to species in Burigi-Biharamulo reserve through increased deforestation, hunting and human activity.

The upgraded road is likely to cause a PIIM. This will put additional pressure on natural resources within the reserve as people hunt for bushmeat or clear forests for cultivation and fuel. As the PIIM of people and their subsequent actions cannot be easily managed by the project, this impact is considered of large magnitude, very long duration, national extent and very high sensitivity; hence this indirect potential impact is considered significant.

Location: Coating Facility (KP701)

Disturbance or Harm to Wildlife

Impact: Disturbance to species using the nearby Mwakalundi FR from construction activities and PIIM around the coating facility.

The only species of conservation importance recorded during field surveys was the pancake tortoise *Malacochersus tornieri*, IUCN vulnerable. This was recorded in
Mwakalundi FR. The coating facility is 300 m to the east of the reserve and therefore there are no direct impacts on species using the reserve. However, the noise and disturbance during construction and the potential PIIM into the area to seek employment has the potential to affect species in the reserve. PIIM may cause increased pressure on natural resources with secondary impacts on the species using the reserve. However, as the part of the reserve nearest the coating facility is already heavily modified with cultivation and grazing this impact is of medium magnitude, and sensitivity is moderate and is therefore not significant.

**Location: Wembere Steppe KBA and IBA (KP826–868)**

**Loss of Habitat for Species of Conservation Importance**

Impact: loss of habitat within the IBA for a range of species it supports including the endemic species: Karamoja Apalis (IUCN VU), grey-breasted spurfowl (IUCN LC) and bubbling puddle frog (IUCN LC).

The Wembere Steppe IBA supports some endemic birds such as Karamoja apalis (IUCN vulnerable) and grey-breasted spurfowl (IUCN least concern) which are of high sensitivity.

Construction in this area includes pumping station (PS5) (12.4 ha), an upgrade of an existing road (4 km long) and a new permanent access road approximately 3 km from the Wembere Steppe. In addition, the pipeline route involves a land take of 76.2 ha along the northern edge of the IBA.

From aerial photographs it appears that 1.6 ha of shrubland that may encompass some *Acacia drepanolobium* (whistling thorn) woodland requires removal to facilitate construction, this has the potential to cause impacts on the Karamoja Apalis (IUCN vulnerable) which favours this habitat. In addition, any removal of ponds and wetland habitat will cause loss of breeding habitat for the bubbling puddle frog. As habitats along the RoW will be reinstated and therefore effects will be of short duration, small magnitude on high sensitivity species the residual impact is not significant.

**Disturbance or Harm to Wildlife**

Impact: disturbance (noise and visual) to endemic species: Karamoja apalis (IUCN vulnerable), grey-breasted spurfowl (IUCN least concern)

Construction will cause noise and visual disturbance to birds causing temporary restrictions to the species’ distribution and potentially reduced breeding success. The magnitude of this impact is moderate as it could cause abandonment of nests sites in the short term, but the duration is for the construction phase only and considered short; hence the resulting impact is considered not significant.

**Location: PS6 Adjacent to Singida Lakes Important Bird Area (KP931)**

**Disposal of Solid and Liquid Waste, Disposal of Black and Grey Water, Accidental Release of Oil / Chemicals and Disturbance or Harm to Wildlife**

Impact: Potential pathway for contamination/sediment during construction on tributaries to lakes. Site is an IBA that supports migratory/congregatory species.
At PS6, a road will be upgraded and a new permanent access road will be constructed from the RoW to the facility. PS6 is near Singida Lakes, which is a complex of lakes that are considered to meet the criteria of a Ramsar site (Neil Baker (author of the Tanzania Bird Atlas who undertook the baseline surveys for EACOP; pers. comm.). The lakes support greater flamingo (IUCN least concern, migratory and congregatory).

Incidents such as spills or increased sedimentation during construction have the potential to affect lake water quality and therefore the birds using the lake. As the lakes are 2 km from the road and approximately 5 km from PS6, the magnitude of the impact is small, duration is short and species sensitivity is very high and therefore is considered not significant.

**Location: Itigi-Like Thicket (KP936, KP979 and KP996) **

Loss of Habitat for Species of Conservation Importance

Impact: Loss of endemic and or range restricted (Black Star) plant species.

The Itigi-like thicket identified at KP936 was found to support these three endemic or restricted (Black Star) vascular plants of global conservation importance:

- *Maerua eminii*
- *Justicia salvioides*
- *Millettia paucijuga*.

Site clearance of 16.5 ha in this area could cause the loss of these populations. As these species are unlikely to regenerate naturally (as described in the botany baseline report Appendix A1) the impact is considered of large magnitude and long duration, national extent and to high sensitivity species the potential impact is considered significant.

**Location: Main Camp Pipe Yard (MCPY) 12 and Associated Roads (KP1035–1037) **

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Loss of habitat and potential disturbance (noise, lighting) which supports IUCN VU species (lion, leopard, elephant) as well as endemic or restricted range species.

MCPY12 is 500 m from the edge of the Swaga Swaga GR. The reserve and supporting habitat around the reserve supports the following endemic and or range-restricted species:

- Ruaha hornbill (*Tockus ruahae*) – IUCN not assessed
- ashy starling (*Lamprotornis unicolor*) – IUCN least concern
- racket-tailed roller (*Coracias spatulatus*) (IUCN least concern).

These birds have been observed within the reserve but are likely to use supporting shrub and farmland habitat outside the reserve for foraging and nesting. There is the potential for direct impacts on the birds outside the reserve from the removal of 1.6 ha of habitat.
The neighbouring Swaga Swaga GR is home to large mammals, including lion, leopard, elephant and lesser kudu (*Tragelaphus imberbis*) all of which are IUCN-vulnerable species and therefore considered of high significance. These species may use supporting habitat outside the reserve but a loss of only 1.6 ha of this supporting habitat is not likely to affect the population viability.

The noise and visual disturbance from construction and operation of MCPY12 and the upgrade to the 3379-m-long existing access road from the Kondo to Gisambalang, passing through the village of Serya may indirectly influence species behaviour along the edge of the GR, reducing species movement. Species such as elephant are well habituated to human activity (Kangwana 1995) but the noise and visual disturbance from construction activities are additional to normal levels and may affect species movement, however causing only a small magnitude impact. No information is available on the habituation to noise and visual disturbance of the bird species listed here; so a precautionary approach has been taken. When construction ends and camp decommissioning has been completed, the lease will be surrendered. Some of the MCPYs may be transferred to the government with some structures left in place, however for MCPY12 no infrastructure will be left behind and the site will be revegetated.

The habitat loss from the camp will be temporary and the camp is not within the reserve, this impact is therefore considered not significant.

### Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

**Impact:** Facilitated access leading to habitat loss to species in Swaga Swaga GR through increased deforestation, hunting and human activity.

The upgraded road and presence of a camp is likely to cause PIIM. This will put additional pressure on natural resources within the reserve as people hunt for bushmeat or clear forests for cultivation and fuel. Even though the camp structures are not retained, the duration of the impact will be very long, of large magnitude, national extent and high sensitivity; hence this direct and indirect potential impact is considered significant.

**Location: Miombo Woodland (KP1028–1097)**

**Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife**

**Impact:** Loss of endemic, range-restricted and vulnerable plant species

The following plant species were identified in an area of miombo woodland. These species are endemic or range-restricted species:

- *Warburgia stuhlmannii*
- *Tapiphyllum obtusifolium*
- *Pavetta burttii*
- *Millettia paucijuga*
- *Megalochlamys tanzaniensis*
- *Maerua eminii*
• *Justicia salvioides*
• *Grewia burttii*
• *Cordia balanocarpa*
• *Combretum harrisii*
• *Cissus trothae*
• *Bussea massaiensis*
• *Aeschynomene bullockii.*

The following IUCN vulnerable species were also found:
• *Warburgia stuhlmannii*
• *Justicia salvioides.*

As the extent of this miombo woodland habitat of high bioquality is unknown any site clearance for the RoW in this area could cause the loss of these species of conservation importance. As these species are unlikely to regenerate naturally from site clearance the duration is long, sensitivity is high but as the area affected is likely to be very small then the magnitude is medium and therefore the impact is not significant.

**Location: Talamai OA and Kitwai Game-Controlled Area (part of the Masai Steppe Important Bird Area; KP114–1224), Main Camps and Pipe Yards 13 and 14, and Pressure Reduction Station 1**

The following construction facilities are adjacent to the Talamai OA and Kitwai GCA which are directly adjacent and therefore assessed together:
• MC13 is 100 m within the Talamai OA
• PY13 is approximately 15 km from the ROW, but only 500 m from the OA boundary
• PRS1 is at KP1171.5 within Talamai OA and includes a permanent access road
• MCPY14 is on the edge of Kitwai GCA (KP1237.5).

Baseline surveys and a literature review show that this area is important for fauna of conservation importance including:
• lions *Panthera leo* – IUCN vulnerable
• elephant (*Loxodonta Africana*) – IUCN vulnerable
• giraffe (*Giraffa camelopardalis*) – IUCN vulnerable
• pancake tortoise (*Malacochersus tornieri*) – IUCN vulnerable
• African migrant butterfly (*Catopsilia florella*) – migratory species
• African wild dog (*Lycaon pictus*) – IUCN endangered
• orange-bellied parrot (*Neophema chrysogaster*) – IUCN critically endangered
• Pringle’s puffback (*Dryoscopus pringlii*) – IUCN least concern (endemic/range restricted)
• parrot-billed sparrow (*Passer gongonensis*) – IUCN least concern (endemic/range restricted).
However, it should be noted that a holder of a hunting concession in the area has ceased trading due to a paucity of game (WCS pers. comm.); within the last two years, the area surrounding PRS1 site has been modified by agricultural activities and temporary housing is spread throughout the western Talamai area in association with the agricultural activities.

Loss of Habitat for Species of Conservation Importance

Impact: Loss of breeding and forage habitat to species of conservation importance through the construction of MC13, PY13, MCPY14, PRS1

Construction and operation of MC13, PY13 and MCPY14, PRS1 and associated road upgrades will reduce habitat range and breeding and foraging habitat for the species listed above.

The construction of the camps will cause only small areas of habitat loss within the Talamai OA and Kitwai GCA, but as many of the species have large territorial range they will be found in suitable habitat outside the protected areas. Therefore, the loss of habitat from MC13, PY13, MCPY14 and PRS1 and from the construction of the pipeline will temporarily reduce the availability of feeding and forage habitat for these species. Although the land take will mostly affect farmland, some natural habitat will be affected and these large species may use both.

African wild dogs have very high sensitivity to change, as it appears that human activities and the availability of prey limit their current distribution. Their ranging behaviour leads to a very substantial “edge effect”, even in large reserves so any encroachment of habituation can have significant effects on a pack’s territory (Estes 1991, Kingdon 1997, Nowal 1999, cited on animaldiversity.org). Other species described above, particularly large carnivores and game, are subject to edge effects. Any reduction in habitat within a home range through site clearance will cause fragmentation and edge effects which is a large magnitude impact.

Although African wild dogs have large territorial ranges, this is not considered a transboundary impact as the animals in this reserve are not likely to move northwards in to Kenya as the distance makes this unfeasible.

The land which MC13 will occupy will be reinstated and returned to the Government without any remaining structures but MCPY14 structures may be transferred to the Government, hence the impact has medium magnitude, is of very long duration (as habitat loss from MCPY14 in addition to PRS1 and the access road will be permanent) and of national extent (as the habitat supports species of national importance), hence impact is considered significant.

Disturbance or Harm to Wildlife

Impact: Disturbance (noise, lighting) to IUCN EN species (African wild dog), IUCN VU species (lion, leopard, elephant, giraffe, pancake tortoise) and migrant species (African migrant butterfly)

In addition to the habitat loss from construction there will be noise and visual disturbance from vehicles and movement or people. Although this impact is on very high sensitivity species the duration is short and therefore the impacts are considered not significant.
Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Direct mortality and habitat fragmentation for pancake tortoise

Vehicle movements associated with construction activities have the potential to cause direct mortality or injury and habitat fragmentation to the highly sensitive species pancake tortoise (IUCN vulnerable). As these species are not likely to be commonly encountered throughout the area, the likelihood of the impact is low and as such the impact is considered not significant.

Disturbance or Harm to Wildlife

Impact: Disturbance to species using adjacent habitat through increased noise, lighting and human activity at the camps (MC13 and MCPY14). Exacerbated by PIIM and subsequent induced development

In migration of people to the area seeking employment in and around the construction camps (MC13 and MCPY14) may have detrimental impacts on the habitats around the camps through increased hunting, fishing and deforestation for fuel and land cultivation. This will directly and indirectly affect the species using these habitats through a reduction in suitable forage habitat, direct persecution or through an imbalance in prey species affecting the carnivores listed above. As the camps will be contained and the workers will be fed, the impact from workers in the camp will be small.

For MC13 the permanent structures will be removed, hence the camp is not likely to attract PIIM after the construction phase but MCPY14 structures may be transferred to the government and thus because of ongoing use, the duration of the impact will be very long, the magnitude is large at a national extent (as the habitat supports species of national importance) on very high sensitivity species; hence a potential significant impact.

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Use of upgraded access roads and new access road to PRS1 by nonproject persons. Facilitated access leading to habitat loss and disturbance to species in Talamai OA through increased deforestation, noise, lighting, hunting and human activity from nonproject persons during construction and operation

In this region one new road (to PRS1) and two upgraded roads) are planned. PIIM into the region facilitated by the creation of the new road to PRS1, will cause potentially significant direct and indirect impacts on species of conservation importance through increased hunting, fishing and deforestation. At the time of writing, although the OA is designated as open access, the dense thicket and shrubland mean that physical access is mainly restricted to Masai grazing routes and roads. The creation of new roads will provide access into previously inaccessible areas and PRS1 may become a focus of development being a permanent facility. As the species are of very high sensitivity, the duration is very long (as the roads and PRS1 will be permanent) the magnitude is large and extent is national, this impact is considered significant.
Location: Coastal Vegetation Mosaic near the Sigi River (KP1424) and Marine Storage Terminal (KP1442)

Disturbance or Harm to Wildlife
Impact: Loss of high and very high sensitivity plant species

The following endemic and range-restricted species are present in the coastal vegetation mosaic near the Sigi River:

- *Baphia kirkii* – IUCN vulnerable
- *Byttneria fruticosa* – endemic (Black Star)
- *Dalbergia vacciniifolia* – IUCN vulnerable and endemic / restricted range, (Black Star)
- *Julbernardia magnistipulata* – IUCN vulnerable and endemic /restricted range (Black Star)
- *Mildbraedia carpinifolia* – IUCN vulnerable
- *Pseudoprosopis euryphylla* subspecies *puguensis* – endemic / restricted (Black Star)
- *Saintpaulia ionantha* – endemic / restricted range (Black Star)
- *Stuhlmannia moavi* – IUCN vulnerable and endemic / restricted range, (Black Star)
- *Stylochaeton bogneri* – IUCN endangered, endemic / restricted range, (Black Star)
- *Uvariodendron kirkii* – IUCN vulnerable.

The limestone cliffs of Sigi River support *Saintpaulia ionantha*, which is listed as IUCN threatened and is an endemic/restricted range (Black Star) species.

As the extent of these species within the working area is unknown site clearance for the HDD send and receive pits for the Sigi River crossing could cause the loss of parts of the populations of these species. As this species is unlikely to regenerate naturally, this impact is of large magnitude and long duration and is therefore considered significant.

Location: MST in the East African Coastal Forest Endemic Bird Area (KP1442)

Loss of Habitat for Species of Conservation Importance
Impact: Habitat loss during construction of pipeline and MST for endemic and migratory species from site clearance

The construction of the MST, associated roads and the pipeline will cause the removal of 72.7 ha of habitat in the Chongoleani peninsula within the 697 km² East African Coastal Forest EBA which is also a biodiversity hotspot. About 54% (39.2 ha) of this is natural habitat, comprising bushland and wooded grassland.

The Chongoleani area has coastal forest with small-scale settlements scattered throughout. As described in Section 8.3.1, the baseline surveys and literature review identified three important bat species (Hildegard's tomb bat, *Taphozous hildegardeae*; Maendeleo horseshoe bat, *Rhinolophus maendeleo*; and African straw-coloured fruit bat, *Eidolon helvum*) and the endemic Zanzibar galago (*Galagoides zanzibaricus*; a bushbaby) of conservation importance. The loss of
coastal forest will cause loss of habitat for foraging and breeding for these species. Hildegard’s tomb and Maendeleo horseshoe bats are cave dwelling and likely to be using coral caves along the coast so their breeding habitat is unlikely to be directly affected but foraging and commuting routes may be. The African straw-coloured bat and the Zanzibar galago are arboreal and the loss of trees will have a direct impact on breeding habitat. This impact is considered of large magnitude owing to the area of habitat loss which is large enough to encompass an entire range for small species of bat that tend to feed within 3 km of their roosts.

The permanent loss of habitat for these high sensitivity species are of large magnitude, very long duration (due to permanent habitat loss) and national extent are considered significant.

Disturbance or Harm to Wildlife

Impact: Disturbance during construction for endemic and migratory species from site clearance

As well as direct habitat loss the species using the forest will also be indirectly affected by noise and visual disturbance during the construction of the MST and RoW. This will cause fragmentation of habitats as species are likely to be restricted in their movement because the facility will create a barrier to movement through habitat loss and from lighting, noise and visual disturbance. However, as the construction phase is of short duration, this impact is not significant.

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Upgrade of access road to MST causing loss of breeding and forage habitat and disturbance to endemic and migratory species of conservation interest through increase noise, lighting and human activity during construction of roads.

The potential impacts from the construction and upgrade of roads to the MST are the same as for the RoW but are of small magnitude as dirt roads are already in place and due to their small size. This potential indirect impact is therefore not significant.

Ecosystem Services

As described in Section 8.3.2.1, the impacts on species of conservation importance will have indirect impacts on ecosystem services should those species be used for provisioning services. Of the species of conservation interest described in the location-specific section, the following plant and animals are considered to provide specific ecosystem services:

- Temminck’s ground pangolin – collection of medicinal products, as it is used in traditional medicine
- leopard, lion and elephant – trophy hunting and for illegal international trade
- birds, Zanzibar galago, bats, game and some plants – food (hunting, gathering and foraging)
burttii Millettia paucijuga Combretum harrisii, Cissus trothae, Bussea massaiensis – wood (including collection for fuel and charcoal manufacture).

8.3.2.2 Operation

Generic Impacts

Impacts from Disturbance or Harm to Wildlife

Impact: Maintenance activities causing minor habitat loss and alteration

The only generic impact that may affect species of conservation importance during the project operations is the maintenance activities to manage scrub and tree establishment along the RoW through clearance by hand. These activities may cause injury or mortality to fauna species using these habitats. Maintenance activities will affect only very small areas and therefore this is impact is considered not significant.

Location-Specific Impacts

Location: MST in the East African Coastal Forest Endemic Bird Area (KP1442)

Disturbance or Harm to Wildlife

Impact: Disturbance (noise, lighting and activity) for endemic and migratory species of conservation importance in surrounding habitats from LOF and MST operation. Exacerbated by PIIM and subsequent induced development

The MST and LOF facilities will need to be lit for health and safety purposes and will be crewed on a permanent basis. These activities have the potential to cause light impacts on adjacent habitats and noise and visual disturbance from operating equipment and people that may restrict bat foraging and movement of other species. Although the duration of this impact is very long, the magnitude is only medium, as species are likely to become accustomed to the facility; hence this indirect potential impact in considered not significant.

Ecosystem Services

Operational impacts have the potential to cause indirect impacts on ecosystem services. Increased nitrogen deposition may impair growth of plant species and impact water birds used by people for provisioning services including the collection of:

- wood (including for fuel and charcoal manufacture)
- food (hunting, gathering and foraging)
- medicinal products.

The MST will not be a significant source of employment once constructed (see Section 8.12). It is therefore unlikely to cause more than a moderate PIIM, the social impact assessment concludes that PIIM is a larger concern at the camps than during the project operations, which could have increased pressure on natural resources; as such there is unlikely to be any indirect impacts on ecosystem services.
8.3.3 Mitigation Measures

This section describes the impact avoidance and mitigation measures that will be applied to the aspects and activities that could affect biodiversity impacts. Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management plan and other measures that are included in Appendix E4 have been collectively used to assess residual impacts, and to determine their significance.

8.3.3.1 Design

Generic Mitigation Measures

Treatment and Disposal of Known and Unknown Contamination; Disposal of Solid and Liquid Waste and; Accidental Release of Oil and Chemicals

The construction waste management will be based on the following elements:

- avoidance – establishing contracts to allow return of excess product and packaging
- reduction – construction processes to reduce waste generation (e.g., accurate calculation of concrete mixes) and waste reduction techniques (e.g., reduce volume of waste materials)
- reuse and recycling – all categories of waste will be segregated to facilitate recycling and reuse. Waste materials which cannot be recycled either locally or shipped to recycling facilities (e.g., plastics) will be treated at site.

Disposal of Surplus Water from Working Areas and Hydrotest Water

Each pipeline sections will be dewatered after completion of the tests. The water will be reused to test the next section via a temporary connection. Upon completion of the hydrostatic testing the water will be released as described in the project description and meeting water quality discharge standards.

Impeded Flow of River or Channel

Design mitigation measures are the same as those described for habitats in Section 8.2.3.

Abstraction of Water from River or Channel

Design mitigation measures are the same as those described for habitats in Section 8.2.3.

Abstraction of Groundwater

The primary sources of water for pipeline hydrostatic testing will be seawater and surface water. If enough surface water or seawater is not available to make up losses incurred during testing, groundwater may be used. An application for a drilling and ground water use permit which would include mitigation measures would be submitted to local water management authorities.
Management of Black and Grey Water

As outlined in the project description (Section 2), there will be a sewage treatment plant at each MCPY for the treatment of black and grey water with discharge of effluent to discharge quality standards and periodic removal of sewage sludge for treatment at an approved waste management facility. An alternative is the use of septic tanks and tanker transfer of sewage/effluent to a project facility for processing.

Loss of Habitat for Species of Conservation Importance

Design mitigation measures are the same as those described for habitats in Section 8.2.3.

Introduction of AIS, or Plant or Animal Diseases

Design mitigation measures are the same as those described for habitats in Section 8.2.3.

Disturbance or Harm to Wildlife

Route selection and methods for construction through wetlands and rivers as described in the habitats section (8.2.3) have helped reduce potential impacts on wildlife.

Impeded Movement of Animals and People

Route selection and methods for construction through wetlands and rivers as described in the habitats section (8.2.3) have helped reduce potential impacts on wildlife.

Open Excavations

There are no design mitigation measures specific to this impact

Location-Specific Mitigation Measures

Design mitigation measures are the same as those described for habitats in Section 8.2.3.

8.3.3.2 Construction

Generic Impacts

Treatment and Disposal of Known and Unknown Contamination; Disposal of Solid and Liquid Waste and; Accidental Release of Oil and Chemicals

Impact: Injury or mortality of flora and fauna due to mobilisation of soil contaminants

Impact: Mortality of flora and fauna through contamination of food and water supply

Impact: Stress or mortality of flora and fauna due to spills of hazardous materials into watercourses

The pollution prevention plan and waste management plan will include measures to manage contamination, waste and accidental oil and chemical releases.

The storage of hazardous materials will be restricted to designated hazardous materials storage areas at least 50 m from surface waters; storage will be covered,
bunded (no drainage valves/holes) and have an impermeable floor. A refuelling procedure will be developed to address mobile and static refuelling, spill prevention techniques and training will be included as part of the pollution prevention plan.

Areas of contamination identified before construction within the project footprint will be remediated before or during construction. Contaminated material will be temporarily stored in impermeable bunds and covered to prevent contaminated runoff and airborne losses. In the event of accidental spills, a trained rapid response team will be mobilised to contain, clean and remediate polluted locations; spill response equipment will be available at all work site locations.

Although the pre-mitigation impacts are considered not significant, the application of the above measures will further reduce impact; the residual impacts will still have a medium duration but the magnitudes are reduced from medium to small or negligible.

Impact: Stress or mortality of flora and fauna due to disposal of solid and liquid waste

The pollution prevention plan and waste management plan will include measures to manage floral or faunal stress from waste spills.

The storage of hazardous materials will be restricted to designated hazardous materials storage areas at least 50 m from surface waters; storage will be covered, bunded (no drainage valves/holes) and have impermeable floor. In the event of accidental spills, a trained rapid response team will be mobilised to contain, clean and remediate polluted locations; spill response equipment will be available at all work site locations.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from small to negligible.

Impact: Increase in vermin around any established waste dumps and consequent increase in prey availability for carnivorous birds and mammals

The occupational health, safety and security plan and the waste management plan will include measures that manage vermin.

Worker food requirements will be planned with a focus to reduce food waste; waste will be managed as per the waste management plan that will detail waste collection, segregation, treatment, storage, transfer and final disposal.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from small to negligible.

Disposal of Surplus Water from Working Areas and Hydrotest Water

Impact: Reduced primary productivity in watercourses, smothering of invertebrates, lethal or sublethal effects on fish, degradation of spawning habitat

The pollution prevention plan and waste management plan will include measures that manage effects surface water and aquatic ecology.
An environmental evaluation will be completed for potential treated wastewater discharge locations; the results will inform the development of location-specific mitigation.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Impeded Flow of River or Channel

Impact: Restriction of fish (ranging from nonmigratory to potamodromous fish species) movement and reduced reproductive success, impaired movement of other aquatic organisms and reduced habitat suitability

The biodiversity management plan, natural resource management plan and the pollution prevention plan will include measures that manage effects on fish and aquatic habitat.

During open-cut watercourse crossing activities, bank and bed material will not be placed where flow or drainage will be obstructed. If dams and pumps are used to maintain water flow, then fish screens will be used on the end of the pump inlet hose; fish caught within dammed areas either side of the crossing will be transferred up or downstream as appropriate by suitably experienced personnel.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Abstraction of Water from River or Channel

Impact: Decreased water level due to water abstraction for project use leading to loss of aquatic and water-margin habitats causing reduced spawning activity

Impact: Mortality to aquatic organisms from the river through direct abstraction

The biodiversity management plan and natural resource management plan will include measures that manage habitat loss, effects on spawning and mortality of aquatic organisms.

Flow, water level or water volume in the waterbody will be assessed before abstraction and monitored during abstraction to evaluate compliance with permit conditions; suitably sized fish screens will be fitted to water inlet hoses.

Although the pre-mitigation impacts are considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impacts are reduced from medium to small and small to negligible respectively.

Management of Black and Grey Water

Impact: Injury or mortality of flora and fauna due to surface water contamination

The waste management plan and the pollution prevention plan will include measures that manage black and grey water.

Grey water will be separated from black water, treated to meet legislation and project discharge standards and permit conditions. Treated wastewater will be reused where possible.
Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to negligible, duration is reduced from long term to short term and extent reduces from regional to local.

Abstraction of Groundwater

Impact: Decreased water level due to water abstraction for project use leading to loss of habitat for stygofauna

The natural resource management plan will include measures that manage effects on stygofauna.

Hydraulic testing and hydrogeological impact assessments will be undertaken to evaluate the potential impact on groundwater levels at local groundwater abstraction points; if significant adverse impacts are predicted then alternative borehole locations will be considered.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from small to negligible.

Loss of Habitat for Species of Conservation Importance

Impact: Permanent loss of breeding and foraging habitat for fauna through site clearance for construction

The biodiversity management plan will include measures that manage permanent habitat loss.

Pre-construction surveys within the RoW are planned to identify whether action is required to protect breeding and foraging habitat during construction in the RoW; and, a vegetation removal method statement will be developed to control activities such as tree felling and ensure vegetation outside the RoW is not impacted. These surveys will inform location-specific biodiversity management plans which may include such measures as micro rerouting to avoid permanent habitat loss or conservation measures to achieve no net loss to biodiversity.

The pre-mitigation impact is significant, however, application of mitigation described above will reduce magnitude of impact from large to small and hence the residual impact is not significant.

Impact: Temporary loss of breeding and foraging habitat for fauna through site clearance for construction

The biodiversity management plan will include measures that manage temporary habitat loss.

Pre-construction surveys within the RoW are planned to identify whether action is required to protect species during construction in the RoW; and, a vegetation removal method statement will be implemented to control activities such as tree felling and ensure species outside the RoW are not impacted. These surveys will inform location-specific biodiversity management plans that allow for progressive, active habitat restoration; ways to achieve an increasing trend in vegetation regrowth and diversity of desired species will be explored.
The pre-mitigation impact is considered significant, however, application of mitigation described above will reduce magnitude of impact from large to small and hence the residual impact is not significant. Impact: Temporary habitat fragmentation causing disrupted species movement during construction on RoW. The biodiversity management plan will include measures that manage temporary habitat fragmentation.

The total duration of construction disturbance will be minimised.

The pre-mitigation impact is considered significant, however, application of mitigation described above will reduce magnitude of impact from large to medium and duration from medium to small; hence the residual impact is not significant.

Introduction of Alien Invasive Species, or Plant or Animal Diseases

Impact: Modified habitats due to alien invasive species establishment leading to increased competition and loss of habitat for breeding and foraging.

The biodiversity management plan will include measures that manage alien invasive species and plant or animal diseases.

Biosecurity measures will be developed and implemented including measures to prevent the introduction or spread of alien invasive species and for weed and pest control.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Disturbance or Harm to Wildlife

Impact: Mortality of fauna species of conservation importance due to movement of vehicles and presence of construction plant and structures.

The biodiversity management plan, community health, safety and security plan and the transport and road safety management plan will include measures that contribute to the management of faunal mortality.

Vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency). Pre-construction surveys will be completed to inform site-specific biodiversity management plans that will address species related seasonal constraints. Welded pipe sections will be capped to prevent fauna entering; fauna ladders will be placed in open excavations and morning trench inspection will be conducted.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Impact: Increased predation due to removal of habitat used to shelter and forage.

The biodiversity management plan will include measures that contribute to management of increased predation rates.

Pre-construction surveys within the RoW are planned to identify whether action is required to protect species during construction in the RoW; a vegetation removal
method statement will be developed to ensure vegetation outside the RoW is not impacted; in areas of high biodiversity value the area will be reviewed to determine if the working width can be reduced and a strategy for tree removal and replanting, minimising habitat loss, will be developed.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Impact: Increased gathering of flora and hunting of fauna species of conservation importance from PIIM to construction camps, from improved access along new or upgraded project access roads and access provided by RoW during construction and reinstatement.

The biodiversity management plan, labour management plan, community health, safety and security plan and the stakeholder engagement plan will include measures that contribute to the management of impacts associated with this aspect.

Construction camps will be “closed” to reduce interaction between workers and the environment. Employment opportunities will be communicated to communities to reduce the numbers of people collecting around camps in the hope of employment and the project induced in-migration management plan will aim to reduce in-migration. Additionally, local communities will be discouraged from using the right-of-way as an access road and, hunting, fishing, unauthorised gathering of products and deliberate disturbance or harassment of fauna will be prohibited for project personnel.

The pre-mitigation impact is considered significant, however, application of mitigation described above will reduce magnitude of impact from large to medium hence the residual impact is not significant.

Impact: Disturbance from activities causing noise, vibration, human and vehicle activity affecting breeding and or behaviour of animals

The pollution prevention plan will include measures to control and manage project noise emissions; this, with measures described in the biodiversity management plan, the occupational health, safety and security plan, the project induced in-migration plan and the transport and road traffic management plan will manage faunal disturbance.

Project noise emissions will not exceed project limits and noise and vibration impacts will be assessed where piling is to be undertaken. The total duration of construction disturbance will be minimised. Vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency). Construction camps will be “closed” to reduce interaction between workers and the environment.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.
Open Excavations

Impact: Injury or fatality of fauna from falling into excavations if they cannot escape or where they are at increased risk of predation.

The biodiversity management plan will include measures that manage the risk of injury or fatality of fauna from construction activity.

Fauna ladders will be placed at suitable intervals in all open excavations and trapped animals will be safely removed and released into suitable habitat away from working areas; the maximum length of open trench at any one time (per spread) will be managed depending on the sensitivity of the habitat and species.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Ecosystem Services

All aspects described in the generic impacts section have the potential to affect ecosystem services. Any aspect which affects animals or plants that are used by local people for food, fuel or medicine will have an impact on provisioning ecosystem services delivered by these species. However, the significance of the impact on ecosystem services is difficult to be quantified as it depends on how reliant each community is on the particular ecosystem service and whether there are any alternatives available. However, as impacts to species of conservation importance are considered not significant, it is determined that associated impacts on ecosystem services are also likely to be not significant.

Location-Specific Mitigation Measures

Location: Locations that Support Tanzania Endemics such as Karamoja Apalis, Fischer’s Lovebird, Ashy Starling and Yellow-Collared Lovebird (KP302–1442)

Loss of Habitat for Species of Conservation Importance

Impact: Temporary loss of nesting habitat through site clearance

In addition to the generic mitigation addressing habitat loss described in Section 8.3.3.2, the biodiversity management plan will include the following measure that will contribute to the management of temporary loss of nesting habitat.

All practicable efforts will be taken to retain and protect mature baobab and borassus palm trees within the RoW.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from small to negligible.
**Location: Ponds and Wetlands Containing the Endemic Bubbling Puddle Frog**

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Direct mortality, destruction of breeding habitat and habitat fragmentation for bubbling puddle frog where construction affects ponds

In addition to the generic mitigation addressing habitat loss described in Section 8.3.3.2, the biodiversity management plan will include the following measure to manage effects on the bubbling puddle frog.

Pre-clearance surveys within the RoW are planned and any discovered individuals will be translocated to nearby ponds outside the RoW.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

**Location: Minziro Nature Forest Reserve, Important Bird Area and Key Biodiversity Area (KP302–312)**

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Loss of breeding and foraging habitat and disturbance (noise and visual) to species using the reserve through pipeline construction

In addition to the generic mitigation addressing habitat loss and disturbance described in Section 8.3.3.2, the biodiversity management plan and reinstatement plan will include the following measure that will contribute to managing effects on flora and fauna of conservation concern in the Minziro NFR.

Site-specific reinstatement measures will be developed and implemented to promote vegetation regrowth and to achieve the desired species composition including species that provide forage, refuge and nesting for species of conservation importance.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Loss of Habitat for Species of Conservation Importance

Impact: Loss of breeding and foraging habitat for ashy red colobus monkey through pipeline construction

In addition to the generic mitigation addressing habitat loss described in Section 8.3.3.2, the biodiversity management plan and reinstatement plan will include the following measure to manage loss of ashy red colobus habitat in Minziro NFR.

Site-specific reinstatement measures will be developed and implemented to promote an increasing trend in vegetation regrowth and to achieve the desired species composition including species that provide forage and nesting for the ashy red colobus monkey.
Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small and the extent from national to local.

Disturbance or Harm to Wildlife

Impact: Disturbance (noise and visual) to ashy red colobus monkey through pipeline construction

The generic mitigation addressing disturbance described in Section 8.3.3.2 will contribute to manage disturbance of the Minziro ashy red colobus population; no additional mitigation is required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from small to negligible and the extent is reduced from national to subnational.

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Habitat loss and disturbance (noise and visual) to species using the Important Bird Area causing restrictions to species’ distributions (blue swallow (IUCN vulnerable))

In addition to the generic mitigation addressing habitat loss and disturbance described in Section 8.3.3.2, the biodiversity management plan and reinstatement plan will include the following measure that will manage potential effects on birds of conservation concern in Minziro.

Site-specific reinstatement measures will be developed and implemented to promote an increasing trend in vegetation regrowth and to achieve the desired species composition including species that provide forage, refuge and nesting for species of conservation importance.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from small to negligible and the duration from medium term to short term.

Location: Lake Ikimba (KP350)

Disposal of Solid and Liquid Waste, Disposal of Black and Grey Water, Accidental Release of Oil / Chemicals and Disturbance or Harm to Wildlife

Impact: Potential pathway for contamination or sediment during construction on the lake’s tributaries and disturbance (noise and visual) affecting birds of conservation importance.

In addition to generic mitigation addressing waste, accidental release of chemicals and erosion described in Section 8.3.3.2, the biodiversity management plan will include the following measure that will manage impact from construction activities on birds of conservation importance at Lake Ikimba. Construction activities within 500 m of seasonal wetland habitat will be avoided where feasible when the wetland is wet and is supporting species of conservation importance.
Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

**Location: Burigi–Biharamulo Game Reserve (KP436–472)**

**Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife**

Impact: Loss of breeding and foraging habitat for IUCN critically endangered species (white-backed vulture), IUCN endangered species (steppe eagle, ashy red colobus) and multiple keystone species (raptors, owls, lion and leopard).

In addition to the generic mitigation addressing habitat loss and disturbance described in Section 8.3.3.2, the biodiversity management plan and reinstatement plan will include the following measures to manage loss of breeding and foraging habitat.

A biodiversity survey strategy will be developed to include timings and methods of pre-construction surveys to be undertaken.

Site-specific reinstatement measures will be developed and implemented to promote an increasing trend in vegetation regrowth and to achieve the desired species composition including species that provide forage, refuge and nesting for species of conservation importance. The pre-mitigation impact is considered significant and although the application of mitigation described above will reduce magnitude of impact from very large to medium the extent remains national and the duration remains long term; the residual impact remains significant.

**Disturbance or Harm to Wildlife**

Impact: Disturbance (noise, visual) to IUCN critically endangered species (white-backed vulture), IUCN endangered species (steppe eagle and ashy red colobus monkey) and multiple keystone species (raptors, owls, lion and leopard) during construction.

In addition to the generic mitigation addressing disturbance described in Section 8.3.3.2, the biodiversity management plan will include the following measure to manage loss of breeding and foraging habitat, critically endangered, endangered and keystone species.

Vegetation clearing in suitable nesting habitat for vultures will be undertaken in advance of the dry season (when nesting occurs); pre-clearance checks for occupied vulture nests will be undertaken in suitable nesting habitat within 500 m of the RoW, where occupied nests are found construction will be avoided until the chick has fully fledged or acoustic and visual barriers will be installed.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from large too small.
Loss of Habitat for Species of Conservation Importance
Impact: Loss of habitat from creation of two new temporary access tracks into the reserve

The biodiversity management plan and the reinstatement plan will include the following measure to manage loss of habitat.

The access tracks on either side of the forested ridge within the Burigi-Biharamulo Game Reserve/Important Bird Area will be decommissioned and fully reinstated on completion of pipeline construction.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the duration of the residual impact is reduced from very long to short term.

Loss of Habitat for Species of Conservation Importance
Impact: Facilitated access leading to habitat loss to species in Burigi-Biharamulo reserve through increased deforestation, hunting and human activity

In addition to the generic mitigation addressing disturbance described in Section 8.3.3.2, the community health, safety and security plan, labour management plan and the biodiversity management plan will include the following measures to manage facilitated access.

Local communities will be discouraged from using the right-of-way as an access road and, hunting, fishing, unauthorised gathering of products and deliberate disturbance or harassment of fauna will be prohibited for project personnel.

The pre-mitigation impact is considered significant, however, application of mitigation described above will reduce magnitude of impact from large to medium, duration from very long to short term and the extent from national to local; hence the residual impact is not significant.

Location: Coating Facility (KP701)
Disturbance or Harm to Wildlife
Impact: Disturbance to species using the FR from construction activities and PIIM around the coating facility.

In addition to the generic mitigation addressing disturbance described in Section 8.3.3.2, the stakeholder engagement plan and the labour management plan will include the following measure to manage in-migration

A PIIM management plan will be developed and implemented with the aim of reducing the number of, and impacts associated with people attracted by job opportunities arriving into PACs.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.
Location: Wembere Steppe Key Biodiversity Area and Important Bird Area (KP828–868)

Loss of Habitat for Species of Conservation Importance

Impact: Loss of habitat within the IBA for a range of species it supports including the endemic species: Karamoja apalis (IUCN VU), grey-breasted spurfowl (IUCN LC) and bubbling puddle frog (IUCN LC)

In addition to the generic mitigation addressing habitat loss and disturbance described in Section 8.3.3.2, the biodiversity management plan and reinstatement plan will include the following measures to manage habitat loss.

A biodiversity survey strategy will be developed to include timings and methods of surveys to be undertaken.

Site-specific reinstatement measures will be developed and implemented to promote an increasing trend in vegetation regrowth and to achieve the desired species composition including species that provide forage, refuge and nesting for species of conservation importance.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from small to negligible.

Disturbance or Harm to Wildlife

Impact: Disturbance (noise and visual) to endemic species: Karamoja apalis (IUCN vulnerable), grey-breasted spurfowl (IUCN least concern)

The generic mitigation addressing disturbance described in Section 8.3.3.2 will contribute to manage avifauna disturbance. No additional mitigation is required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Location: PS6 Adjacent to the Singida Lakes Important Bird Area (KP931)

Disposal of Solid and Liquid Waste, Disposal of Black and Grey Water, Accidental Release of Oil / Chemicals and Disturbance or Harm to Wildlife

Impact: Potential pathway for contamination / sediment during construction on tributaries to lakes. Site is IBA, supporting migratory/congregatory species

In addition to generic mitigation addressing waste and accidental release of chemicals described in Section 8.3.3.2 and the generic mitigation addressing erosion in Section 8.2.3.2, the biodiversity management plan will include the following measure to manage contamination of Singida Lakes.

Construction activities within 500 m of tributaries and lakes will be avoided where feasible when the wetland is wet and is supporting species of conservation importance.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from small to negligible.
Location: Itigi-Like Thicket (KP936, KP979 and KP996)

Loss of Habitat for Species of Conservation Importance

Impact: Loss of endemic and or range restricted (Black Star) plant species.

In addition to the generic mitigation addressing habitat loss described in Section 8.3.3.2, the biodiversity management plan will include the following measures to manage loss of Itigi-like thicket species.

A biodiversity survey strategy will be developed for flora. Where a section of the ROW is through habitats of high biodiversity value (i.e., Itigi-like thicket), the area will be reviewed to determine if the working width can be reduced to limit impacts.

The pre-mitigation impact is considered significant, however, application of mitigation described above will reduce magnitude of impact from large to medium, duration remains medium and extent remains national; the residual impact is not significant.

Location: Main Camp Pipe Yard 12 and Associated Roads Adjacent to Swaga Swaga game Reserve (KP1035–1037)

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Loss of habitat surrounding the reserve and potential disturbance (noise and lighting) which supports IUCN vulnerable species (lion, leopard and elephant) as well as endemic or restricted range species

In addition to the generic mitigation addressing habitat loss and disturbance described in Section 8.3.3.2, the biodiversity management plan will include the following measures that will manage loss of habitat.

Site-specific biodiversity management plans will identify fine-scale mark features for retention and protection, develop biorestoration measures including seed collection, translocation and species propagation and provide details of the specific mitigation measures to be implemented. Although at other camps, some structures may be left in place, MCPY12 will be fully decommissioned and actively revegetated and reinstated.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the duration from very long to short, hence the residual impact is not significant.

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Facilitated access leading to habitat loss to species in Swaga Swaga GR through increased deforestation, hunting and human activity

In addition to the generic mitigation addressing habitat loss and disturbance described in Section 8.3.3.2, the biodiversity management plan and PIIM will include measures that will manage facilitated access.

A biodiversity survey strategy will be developed to include timings and methods of surveys to be undertaken.
As MCPY12 will be actively revegetated and reinstated, the application of the above measures and reinstatement will reduce impact from a medium to short term duration and hence the residual impact is not significant.

**Location: Miombo Woodland (KP1028–1097)**

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Loss of endemic, range-restricted and vulnerable plant species.

In addition to the generic mitigation addressing habitat loss described in Sections 8.2.3.2 and 8.3.3.2, the biodiversity management plan will include the following measures to manage loss of a species.

A biodiversity survey strategy will be developed for flora. Where a section of the right-of-way is through habitats of high biodiversity value (i.e., Miombo woodland), the area will be reviewed to determine if the working width can be reduced to limit impacts.

The pre-mitigation impact is considered significant, however, application of mitigation described above will reduce magnitude of impact from medium to small, and extent from national to local; the residual impact is not significant.

**Location: Main Camps and Pipe Yards 13 and 14, and Pressure Reduction Station 1 near the Talamai Open Area and Kitwai Game-Controlled Area (KP1144–1224)**

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Loss of breeding and forage habitat to species of conservation importance through the construction of MC13, PY13, MCPY14, PRS1

In addition to the generic mitigation addressing habitat loss and disturbance described in Sections 8.2.3.2 and 8.3.3.2, the biodiversity management plan and reinstatement plan will include the following measures to manage loss of breeding and foraging habitat.

A biodiversity survey strategy will be developed to include timings and methods of pre-construction surveys to be undertaken, the results of the surveys will inform the location-specific biodiversity management plans and pre-clearance surveys; these will account for species-specific seasonal constraints. An increasing trend in vegetation regrowth and diversity of desired species (specifically species composition) and, plant species that support forage, refuge and nesting for species of conservation importance will be explored. Although at other camps, some structures may be left in place and converted into community facilities, MC13 will be fully decommissioned and actively revegetated and reinstated.

The application of the above measures will reduce magnitude of impact from medium to small and duration from very long term to medium and hence the residual impact is not significant.
Disturbance or Harm to Wildlife

Impact: Disturbance (noise, lighting) to IUCN EN species (African wild dog), IUCN VU species (lion, leopard, elephant, giraffe, pancake tortoise) and migrant species (African migrant butterfly)

The generic mitigation addressing disturbance described in Section 8.3.3.2 will manage faunal disturbance; no additional mitigation is required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Direct mortality and habitat fragmentation for pancake tortoise

In addition to the generic mitigation addressing habitat loss and disturbance described in Sections 8.2.3.2 and 8.3.3.2, the biodiversity management plan will include the following measure manage mortality and habitat fragmentation.

Populations of the pancake tortoise will be monitored pre and post construction and all incidences of accidental injury or death of fauna will be recorded. If injury or death records show a pattern of causal factors or in location, remedial measures will be implemented such as additional worker awareness raising, warning signs of the presence of tortoises, traffic calming measures.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Disturbance or Harm to Wildlife

Impact: Disturbance to species using adjacent habitat through increase noise, lighting and human activity at the camp. Exacerbated by PIIM and subsequent induced development

The generic mitigation addressing disturbance described in Section 8.3.3.2 will manage species disturbance and the PIIM plan will help manage impacts of in migration around the camps during the construction phase. The biodiversity management plan will set out options for disturbance reduction measures and options for rapid reinstatement of construction facilities. Although other camps may be converted to community use, MC13 will be fully decommissioned and actively revegetated and reinstated.

The application of the above measures will reduce duration from very long term to medium; hence the residual impact is not significant.

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Use of upgraded access road by nonproject persons. Facilitated access leading to habitat loss and disturbance to species in Talamai OA through increased deforestation, noise, lighting, hunting and human activity during construction and operation
The generic mitigation addressing disturbance described in Section 8.3.3.2 will manage use of the road and project facilities during the construction phase. However, as the road and PRS1 are permanent facilities ongoing control measures are not possible.

The pre-mitigation impact is considered significant and, although application of mitigation described above will reduce magnitude from large to medium, the extent remains national and duration remains very long due the permanence of PRS1 and access road; the residual impact remains significant.

**Location: Coastal Vegetation Mosaic near the Sigi River (KP1424) and Marine Storage Terminal (KP1442)**

**Disturbance or Harm to Wildlife**

Impact: Loss of endemic and / or range restricted plant species.

In addition to the generic mitigation addressing habitat loss and disturbance described in Section 8.3.3.2, the biodiversity management plan and reinstatement plan will include the following measures to manage plant species loss.

An increasing trend in vegetation regrowth and diversity of desired species (specifically species composition) and, plant species that support forage, refuge and nesting for species of conservation importance will be explored.

A biodiversity survey strategy will be developed for flora. Where a section of the right-of-way is through habitats of high biodiversity value (i.e., coastal vegetation mosaic), the area will be reviewed to determine if the working width can be reduced to limit impacts.

The pre-mitigation impact is considered significant however application of the above measures will reduce magnitude from very large to small, duration from very long term to medium and the extent from national to local; the residual impact is not significant.

**Location: Marine Storage Terminal in the East African Coastal Forest Endemic Bird Area (KP1442)**

**Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife**

Impact: Habitat loss during construction of pipeline and MST for endemic and migratory species from site clearance.

In addition to the generic mitigation addressing habitat loss and disturbance described in Sections 8.2.3.2 and 8.3.3.2 the biodiversity management plan and reinstatement plan will include the following measures to manage habitat loss.

A biodiversity survey strategy will be developed to include timings and methods of surveys to be undertaken, the results of the surveys will inform the construction planning surveys which in turn will inform location-specific biodiversity management plans; these will account for species-specific seasonal constraints.

Site-specific reinstatement measures will be developed and implemented to promote an increasing trend in vegetation regrowth and to achieve the desired
species composition including species that provide forage, refuge and nesting for species of conservation importance.

The pre-mitigation impact is considered significant and, although application of mitigation described above reduces the impact magnitude from large to medium the residual impact remains significant.

Disturbance or Harm to Wildlife

Impact: Disturbance during construction for endemic and migratory species from site clearance

The generic mitigation addressing disturbance described in Section 8.3.3.2 will manage construction disturbance; no additional mitigation is required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from small to negligible.

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Upgrade of access road to MST causing loss of breeding and forage habitat and disturbance to endemic and migratory species of conservation interest through increased noise, lighting and human activity during construction of roads.

The generic mitigation addressing disturbance described in Section 8.3.3.2 will manage habitat loss and species disturbance; no additional mitigation is required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Ecosystem Services

All aspects described in this section have the potential to affect ecosystem services. Any aspect which affects animals or plants that are used by local people for food, fuel or medicine will impact provisioning ecosystem services delivered by these species. However, the significance of the impact on ecosystem services is difficult to be quantified as it depends on how reliant each community is on the particular ecosystem service and whether there are any alternatives available. However, as impacts to species of conservation importance are considered not significant it is determined that associated impacts on ecosystem services are also likely to be not significant.

8.3.3.3 Operations

Generic Mitigation Measures

Impacts from Disturbance or Harm to Wildlife

Impact: Maintenance activities causing in minor habitat loss and alteration

The biodiversity management plan will include measures to manage habitat loss and alteration.
The project will develop and implement a maintenance plan for the management of vegetation around AGIs and along the RoW; this will include information on the relevant habitat and species of conservation importance with recommended action to reduce impacts on these habitats and species such as nesting checks and avoidance of work during sensitive periods.

This will reduce the impact from small to negligible; the residual impact is not significant.

**Location-Specific Mitigation Measures**

**Location: Marine Storage Terminal in the East African Coastal Forest Endemic Bird Area**

Disturbance or Harm to Wildlife

Impact: Disturbance (noise, lighting and activity) for endemic and migratory species of conservation importance in surrounding habitats from LOF and MST operation, exacerbated by PIIM and subsequent induced development

The generic mitigation addressing disturbance described in Section 8.3.3.2 will manage faunal disturbance; no additional mitigation is required.

The magnitude of the impact will reduce from medium to small and the residual impact is not significant.

**8.3.4 Residual Impacts and Significance Summary**

This section describes the residual impacts on biodiversity after mitigation has been implemented, following the order in Table 8.3-1 and focusing on those impacts that are significant.

**8.3.4.1 Generic and Location-Specific Impacts**

Table 8.3-1 summarises the potential generic biodiversity impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation. Table 8.3-2 summarises location-specific impacts.

After the generic and location-specific mitigation has been applied there are four impacts which are significant after mitigation has been applied:

**Location: Burigi-Biharamulo Game Reserve and Key Biodiversity Area (KP438–472)**

Loss of Habitat for Species of Conservation Importance

Impact: Loss of breeding and foraging habitat for IUCN critically endangered species (white-backed vulture), IUCN endangered species (steppe eagle and ashy red colobus monkey) and multiple keystone species (raptors, owls, lion, leopard).

As the project cannot avoid or fully mitigate for impacts associated with the development within the old growth forest in the Burigi-Biharamulo GR then further enhancement and conservation measures will be developed and implemented.
Location: Main Camps and Pipe Yards 13 and 14, and Pressure Reduction Station 1 in or near the Talamai Open Area and Kitwai Game-Controlled Area (Part of Masai Steppe Important Bird Area)

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Use of upgraded access road into reserve by nonproject persons. Facilitated access leading to habitat loss and disturbance to IUCN CR and EN bird and mammal species in Talamai OA through increased deforestation, noise, lighting, hunting and human activity during construction and operation.

It should be noted that a holder of a hunting concession in the area has ceased trading due to a paucity of game (WCS pers. comm.).

As the project cannot avoid or fully mitigate for impacts associated with the development within Talamai OA then further enhancement and conservation measures will be developed and implemented.

Location: Marine Storage Terminal in the East African Coastal Forest

Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife

Impact: Habitat loss and disturbance during construction for endemic, range restricted and migratory fauna and flora species from site clearance.

As the project cannot avoid or fully mitigate for impacts associated with the development within the East African Coastal Forest then further enhancement and conservation measures will be developed and implemented.
### Table 8.3-1 Flora and Fauna Species of Conservation Importance (Terrestrial and Aquatic) – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment and disposal of known/unknown contamination</td>
<td>Injury or mortality of flora and fauna due to mobilisation of soil contaminants</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan Waste management plan</td>
<td>4 3 2 5 14</td>
</tr>
<tr>
<td>Disposal of solid and liquid waste</td>
<td>Mortality of flora and fauna through contamination of food and water supply</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan Waste management plan</td>
<td>2 2 1 5 10</td>
</tr>
<tr>
<td></td>
<td>Increase in vermin around waste dumps and consequent increase in prey availability for carnivorous birds and mammals</td>
<td>C</td>
<td>–</td>
<td>Occupational health, safety and security plan Pollution prevention plan Waste management plan</td>
<td>2 2 1 5 10</td>
</tr>
<tr>
<td></td>
<td>Stress or mortality of flora and fauna due to disposal of solid and liquid waste</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan Waste management plan</td>
<td>2 2 1 5 10</td>
</tr>
<tr>
<td>Disposal of surplus water from working areas and hydrotest water</td>
<td>Reduced primary productivity in watercourses, smothering of invertebrates, lethal or sublethal effects on fish, degradation of spawning habitat</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan Waste management plan</td>
<td>4 2 3 5 14</td>
</tr>
</tbody>
</table>

**NOTES:** C = construction; O = operation; C&O = construction and operation; B = beneficial impact; M = magnitude of impact; D = duration of impact; E = extent of impact; S = sensitivity; SS = significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.

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### Table 8.3-1 Flora and Fauna Species of Conservation Importance (Terrestrial and Aquatic) – Generic Impacts

<table>
<thead>
<tr>
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<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impeded flow of river or channel</td>
<td>Restriction of fish (ranging from general fish species (nonmigratory) to potamodromous fish) movement and reduced reproductive success, impaired movement and reduced habitat suitability of other aquatic organisms</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan Natural resource management plan Pollution prevention plan</td>
<td>4 2 4 3–5 13–15</td>
</tr>
<tr>
<td>Abstraction of water from river or channel</td>
<td>Decreased water level due to water abstraction for project use leading to loss of aquatic and water-margin habitats causing reduced spawning activity</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan Natural resource management plan</td>
<td>4 2 3 13</td>
</tr>
<tr>
<td>Mortality to aquatic organisms from the river through direct abstraction</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan Natural resource management plan</td>
<td>2 2 2 4 10</td>
<td></td>
</tr>
<tr>
<td>Disposal of black and grey water</td>
<td>Injury or mortality of flora and fauna due to surface water contamination</td>
<td>C&amp; O</td>
<td>–</td>
<td>Waste management plan Natural resource management plan</td>
<td>2 2 2 4 10</td>
</tr>
<tr>
<td>Abstraction of groundwater</td>
<td>Decreased water level due to water abstraction for project use leading to loss of habitat for stygofauna</td>
<td>C</td>
<td>–</td>
<td>Natural resource management plan</td>
<td>2 2 2 2 8</td>
</tr>
<tr>
<td>Loss of habitat for species of conservation importance</td>
<td>Permanent loss of breeding and foraging habitat for fauna through site clearance before construction</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>4 5 2 2 13</td>
</tr>
<tr>
<td></td>
<td>Temporary loss of breeding and foraging habitat for fauna through site clearance before construction</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>4 2 2 2 11</td>
</tr>
</tbody>
</table>

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### Table 8.3-1 Flora and Fauna Species of Conservation Importance (Terrestrial and Aquatic) – Generic Impacts

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<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temporary habitat fragmentation causing disrupted species movement during construction of RoW</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>6 2 4 4 16</td>
</tr>
<tr>
<td></td>
<td>Introduction of competitive species or plant/animal diseases</td>
<td>C &amp; O</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>4 5 2 5 16</td>
</tr>
<tr>
<td></td>
<td>Disturbance or harm to wildlife</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>4 3 2 5 14</td>
</tr>
<tr>
<td></td>
<td>Mortality of fauna species of conservation importance due to movement of vehicles and presence of construction plant and structures</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan, Community health, safety and security plan, Transport and road safety management plan</td>
<td>4 3 2 5 14</td>
</tr>
<tr>
<td></td>
<td>Increased gathering of flora and hunting of fauna species of conservation importance from PIIM to construction camps, from improved access along new or upgraded project access roads and access provided by RoW during construction and reinstatement.</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan, Labour management plan, Community health, safety and security plan, Stakeholder engagement plan</td>
<td>4 5 3 5 17</td>
</tr>
</tbody>
</table>

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Table 8.3-1  Flora and Fauna Species of Conservation Importance (Terrestrial and Aquatic) – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open excavations</td>
<td>Injury or fatality of fauna from falling into excavations if they cannot escape or where they are at increased risk of predation</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>4 2 2 5 13</td>
</tr>
<tr>
<td>Noise, vibration and visual disturbance</td>
<td>Disturbance from activities causing noise, vibration, human and vehicle activity affecting breeding and behaviour of animals</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan</td>
<td>4 2 2 5 13</td>
</tr>
<tr>
<td>Accidental release of oil / chemicals</td>
<td>Stress or mortality to flora and fauna due to spills of hazardous materials into watercourses</td>
<td>C&amp;O</td>
<td>–</td>
<td>Pollution prevention plan Waste management plan</td>
<td>4 4 3 5 16</td>
</tr>
<tr>
<td>Disturbance or harm to wildlife</td>
<td>Maintenance activities causing in minor habitat loss and alteration</td>
<td>O</td>
<td></td>
<td>Biodiversity management plan</td>
<td>2 1 1 5 9</td>
</tr>
</tbody>
</table>

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Table 8.3-2  Flora and Fauna Species of Conservation Importance – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
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<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plans</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locations which support Tanzania endemic birds (KP302–1442)</td>
<td>Loss of Habitat for Species of Conservation Importance</td>
<td>Temporary loss of nesting habitat for endemic bird through site clearance</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>2 2 2 4 10</td>
</tr>
<tr>
<td>Ponds and wetlands containing the endemic bubbling puddle frog: (KP420–645)</td>
<td>Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife</td>
<td>Direct mortality and destruction of breeding habitat for bubbling puddle frog where construction affects ponds</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>4 2 2 4 12</td>
</tr>
<tr>
<td>KP302–312 Minziro NFR, IBA and KBA</td>
<td>Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife</td>
<td>Loss of breeding and foraging habitat and disturbance to species using the reserve through pipeline construction</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan Reinstatement plan</td>
<td>4 2 2 4 12</td>
</tr>
<tr>
<td>KP302–312 Minziro NFR and IBA and KBA</td>
<td>Loss of Habitat for Species of Conservation Importance</td>
<td>Loss of breeding and foraging habitat for ashy red colobus monkey through pipeline construction</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan Reinstatement plan</td>
<td>4 2 4 5 15</td>
</tr>
<tr>
<td>KP302–312 Minziro NFR and IBA and KBA</td>
<td>Disturbance or Harm to Wildlife</td>
<td>Disturbance (noise and visual) to ashy red colobus monkey</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan</td>
<td>2 1 3 5 11</td>
</tr>
</tbody>
</table>

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### Table 8.3-2 Flora and Fauna Species of Conservation Importance – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
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<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plans</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>KP302–312 Minziro NFR and IBA and KBA</td>
<td>Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife</td>
<td>Habitat loss and disturbance (noise and visual) to birds in the Important Bird Area (IBA) causing restrictions in species’ distributions (blue swallow (IUCN vulnerable))</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan, Reinstatement plan</td>
<td>2 2 2 4 10</td>
</tr>
<tr>
<td>KP350–350 Lake Ikimba</td>
<td>Disposal of solid and liquid waste, Disposal of black and grey water, Accidental release of oil / chemicals and Disturbance or Harm to Wildlife</td>
<td>Potential pathway for contamination or sediment during construction on the lake’s tributaries and disturbance (noise and visual) affecting birds of conservation importance.</td>
<td>C</td>
<td>–</td>
<td>Soil management plan, Pollution prevention plan, Waste management plan, Biodiversity management plan</td>
<td>4 1 4 5 14</td>
</tr>
<tr>
<td>KP438–472 Burigi–Biharamulo GR and KBA</td>
<td>Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife</td>
<td>Loss of breeding and foraging habitat for IUCN CR species (white-backed vulture), IUCN EN species (steppe eagle) and multiple keystone species (raptors, owls, lion, leopard)</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan, Reinstatement plan</td>
<td>6 5 4 5 20</td>
</tr>
</tbody>
</table>

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Table 8.3-2 Flora and Fauna Species of Conservation Importance – Location-Specific Impacts

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<th>Location</th>
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<th>High Stakeholder Concern</th>
<th>Management Plans</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pollution prevention plan Biodiversity management plan</td>
<td></td>
</tr>
<tr>
<td>KP438–472</td>
<td>Disturbance or Harm to Wildlife</td>
<td>Disturbance (noise, visual) to IUCN CR species (white-backed vulture), IUCN EN species (steppe eagle) and multiple keystone species (raptors, owls, lion, leopard) during construction</td>
<td>C</td>
<td>–</td>
<td></td>
<td>4 1 2 5 12</td>
</tr>
<tr>
<td>KP438–472</td>
<td>Loss of Habitat for Species of Conservation Importance</td>
<td>Loss of breeding and forage habitat for creation of two new access tracks into the reserve</td>
<td>C</td>
<td>–</td>
<td>Reinstatement plan Biodiversity management plan</td>
<td>4 2 2 5 13</td>
</tr>
<tr>
<td>KP456–459</td>
<td>Loss of Habitat for Species of Conservation Importance</td>
<td>Facilitated access leading to habitat loss species in Burigi-Biharamulo GR through increased deforestation, hunting and human activity</td>
<td>C</td>
<td>–</td>
<td>Community health, safety and security plan Labour management plan Biodiversity management plan</td>
<td>6 2 2 5 15</td>
</tr>
<tr>
<td>KP701 Coating Yard</td>
<td>Disturbance or Harm to Wildlife</td>
<td>Disturbance to species using the nearby Mwakalundi FR from construction activities and PIIM around the coating facility</td>
<td>C</td>
<td>–</td>
<td>Stakeholder engagement plan Labour management plan</td>
<td>4 2 2 3 11</td>
</tr>
</tbody>
</table>

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### Table 8.3-2 Flora and Fauna Species of Conservation Importance – Location-Specific Impacts

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<th>High Stakeholder Concern</th>
<th>Management Plans</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>KP828–868 Wembere Steppe KBA and IBA</td>
<td>Loss of Habitat for Species of Conservation Importance</td>
<td>Loss of habitat within the IBA for a range of species it supports including the endemic species: Karamoja Apalis (IUCN VU), grey-breasted spurfowl (IUCN LC) and bubbling puddle frog (IUCN LC)</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan Reinstatement plan</td>
<td>2 2 1 4 9</td>
</tr>
<tr>
<td>KP828–868 Wembere Steppe KBA and IBA</td>
<td>Disturbance or Harm to Wildlife</td>
<td>Disturbance (noise and visual) to endemic species: Karamoja Apalis (IUCN vulnerable), grey-breasted spurfowl (IUCN least)</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan</td>
<td>4 2 2 4 12</td>
</tr>
<tr>
<td>KP936–936 Singida Lakes IBA</td>
<td>Disposal of solid and liquid waste, Disposal of black and grey water, Accidental release of oil / chemicals and Disturbance or Harm to Wildlife</td>
<td>Potential pathway for contamination / sediment during construction on tributaries to lakes. Site is an IBA that supports migratory/congregatory species.</td>
<td>C</td>
<td>–</td>
<td>Soil management plan Pollution prevention plan Waste management plan Biodiversity management plan</td>
<td>2 1 4 5 12</td>
</tr>
<tr>
<td>KP936, KP979 and KP996 Itigi-like thicket</td>
<td>Loss of Habitat for Species of Conservation Importance</td>
<td>Loss of endemic and or range-restricted (Black Star) plant species</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>6 3 4 5 18</td>
</tr>
</tbody>
</table>

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Table 8.3-2 Flora and Fauna Species of Conservation Importance – Location-Specific Impacts

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<th>Management Plans</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>KP1035–1037 Swaga Swaga Game Reserve</td>
<td>Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife</td>
<td>Loss of habitat surrounding the GR and potential disturbance (noise, lighting) which supports IUCN VU species (lion, leopard, elephant) as well as endemic or restricted range species</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>2 2 2 4 10</td>
</tr>
<tr>
<td>KP1035–1037 MCPY12 KP1037.7</td>
<td>Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife</td>
<td>Facilitated access leading to habitat loss to species in Swaga Swaga GR through increased deforestation, hunting and human activity.9</td>
<td>C&amp;O</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>6 2 4 4 16</td>
</tr>
<tr>
<td>KP1028–1097 Miombo Woodland</td>
<td>Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife</td>
<td>Loss of endemic range-restricted and vulnerable plant species</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>4 3 2 4 13</td>
</tr>
</tbody>
</table>

9 MCPY 12 will be reinstated

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Table 8.3-2 Flora and Fauna Species of Conservation Importance – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plans</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talamai OA and Kitwai GCA (part of the Masai Steppe IBA (KP114–1224)) MCPY13, MCPY14 and PRS1</td>
<td>Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife</td>
<td>Loss of breeding and forage habitat to species of conservation importance through the construction of MCPY13, MCPY14, PRS1 and the pipeline.¹⁰</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan&lt;br&gt;Reinstatement plan</td>
<td>4 3 4 5 16</td>
</tr>
<tr>
<td>Talamai OA and Kitwai GCA (part of the Masai Steppe IBA (KP114–1224)) MCPY13, MCPY14 and PRS1</td>
<td>Disturbance or Harm to Wildlife</td>
<td>Disturbance (noise, lighting) to IUCN EN species (African wild dog), IUCN VU species (lion, leopard, elephant, giraffe, pancake tortoise) and migrant species (African migrant butterfly)</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>4 1 2 5 12</td>
</tr>
<tr>
<td>Talamai OA and Kitwai GCA (part of the Masai Steppe IBA (KP114–1224)) MCPY13, MCPY14 and PRS1</td>
<td>Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife</td>
<td>Direct mortality and habitat fragmentation for pancake tortoise</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan</td>
<td>4 3 1 4 12</td>
</tr>
</tbody>
</table>

¹⁰ Range of duration due to option to reinstate or retain camp

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Table 8.3-2 Flora and Fauna Species of Conservation Importance – Location-Specific Impacts

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<tr>
<th>Location</th>
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<th>Management Plans</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talamai OA and Kitwai GCA (part of the Masai Steppe IBA (KP114–1224)) MCPY13, MCPY14</td>
<td>Disturbance or Harm to Wildlife</td>
<td>Disturbance to species using adjacent habitat through increased noise, lighting and human activity at the camp. Exacerbated by PIIM and subsequent induced development</td>
<td>C&amp;O</td>
<td>–</td>
<td>Project induced in-migration management plan Pollution prevention plan</td>
<td>6 2 4 5 17</td>
</tr>
<tr>
<td>Talamai OA and (part of the Masai Steppe IBA (KP114–1224)) PRS1 and associated access road</td>
<td>Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife</td>
<td>Use of upgraded access road into reserve by nonproject persons. Facilitated access leading to habitat loss and disturbance to bird and mammal species in Talamai OA through increased deforestation, noise, lighting, hunting and human activity during construction and operation</td>
<td>C&amp;O</td>
<td>–</td>
<td>Biodiversity management plan Labour management plan Community health, safety and security plan Stakeholder engagement plan</td>
<td>6 5 4 5 20</td>
</tr>
<tr>
<td>Coastal Vegetation Mosaic near the Sigi River KP1424 MST KP1442</td>
<td>Disturbance or Harm to Wildlife</td>
<td>Loss of high and very high sensitivity plant species</td>
<td>C</td>
<td>–</td>
<td>Biodiversity management plan Reinstatement plan</td>
<td>4 4 2 5 15</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.

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### Table 8.3-2  Flora and Fauna Species of Conservation Importance – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plans</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>KP1442–1443 MST</td>
<td>Loss of Habitat for Species of Conservation Importance</td>
<td>Habitat loss during construction of pipeline and MST for endemic and migratory species from site clearance</td>
<td>C –</td>
<td>Biodiversity management plan Reinstatement plan</td>
<td>6 5 4 4 19</td>
<td></td>
</tr>
<tr>
<td>KP1442–1443 MST MST KP1442.8</td>
<td>Disturbance or Harm to Wildlife</td>
<td>Disturbance during construction for endemic and migratory species from site clearance</td>
<td>C –</td>
<td>Biodiversity management plan Community health, safety and security plan Transport and road safety management plan</td>
<td>2 1 4 4 11</td>
<td></td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.3-2 Flora and Fauna Species of Conservation Importance – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plans</th>
<th>Residual Impact</th>
</tr>
</thead>
</table>
| KP1442–1443 MST KP1442.8 | Loss of Habitat for Species of Conservation Importance and Disturbance or Harm to Wildlife | Upgrade of access road to MST. Loss of breeding and forage habitat and disturbance to endemic and migratory species through increase noise, lighting and human activity during construction of roads | C     | –                        | Biodiversity management plan  
Community health, safety and security plan  
Transport and road safety management plan  
Project induced in-migration management plan | 4 3 2 4 13  |
Table 8.3-2  Flora and Fauna Species of Conservation Importance – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plans</th>
</tr>
</thead>
</table>
| KP1442–1443 MST KP1442.8 | Disturbance or Harm to Wildlife | Disturbance (noise, lighting and activity) for endemic and migratory species of conservation importance in surrounding habitats from LOF and MST operation. Exacerbated by PIIM and subsequent induced development | O     | –                        | Biodiversity management plan  
Community health, safety and security plan  
Transport and road safety management plan  
Project induced in-migration management plan |

<table>
<thead>
<tr>
<th>Residual Impact</th>
<th>M</th>
<th>D</th>
<th>E</th>
<th>S</th>
<th>SS</th>
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<tbody>
<tr>
<td></td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>15</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
8.3.5 Transboundary Project Impacts

No transboundary project impacts were identified.

8.3.6 Cumulative Impacts

8.3.6.1 Context

The baseline condition of flora and fauna species of conservation importance in the EACOP project’s AOI, the trends and sensitivity to change are described in Section 6.4.1. Residual project impacts are summarised in Table 8.3-1 and Table 8.3-2.

Third-party developments that are in the AOI of the EACOP project are shown in the cumulative impacts matrix, described and mapped in Appendix H. The developments are:

- rural electrification (TZ03)
- road upgrade (TZ27).

No cumulative impacts with the associated facilities were identified.

The preferred condition is that the number of species remains stable or increases, relative to the background changes in population levels. The limit of acceptable change is a short-term decrease followed by recovery to pre-construction numbers.

8.3.6.2 Cumulative Impacts

Swaga Swaga Game Reserve

The Swaga Swaga Game Reserve is intact habitat that is considered useful to mammals and birds in terms of breeding, feeding and resting despite encroaching agriculture to the north and east, see Section 8.3.2.

The Swaga Swaga Game Reserve supports the following species:

- IUCN vulnerable, flagship species: giraffe (Giraffa camelopardalis) and elephant (Loxodonta africana)
- IUCN endangered East African lion subpopulation lion (Panthera leo)
- IUCN vulnerable lesser kudu (Tragelaphus imberbis)
- IUCN not assessed, endemic Ruaha hornbill (Tockus ruahae)
- IUCN least concern, endemic ashy starling (Lamprotornis unicolor)
- IUCN least concern, endemic racket-tailed roller (Coracias spatulatus).

There is a potential cumulative impact on species of conservation interest in Swaga Swaga GR from the EACOP project and the road upgrade by TANROADS between Kondoa and Chemba.

MCPY12, approximately 500 m from the edge of the game reserve, will be reinstated. The existing access road to the location for MCPY12 will be upgraded as part of the EACOP project. The TANROADS road upgrade provides an improved link from the village of Kondoa to the national road system and the EACOP access road (see Figure 8.3-1).
Figure 8.3-1  Cumulative Impacts: Swaga Swaga Game Reserve and Talamai Open Area

The TANROADS road upgrade and the construction of EACOP have the potential to cause indirect cumulative impacts on the species of conservation importance from PIIM during the operation of the MCPY and the public use of the upgraded national and EACOP access roads. Increased human access to the reserve may cause cumulatively more pressure on natural resources such as hunting for bushmeat which also has indirect impacts on large carnivores, as their prey availability will reduce, and deforestation leading to loss of breeding and forage habitat for species on conservation importance in the reserve.

As part of the management of PIIM, there will be liaison with the third-party developer (TANROADS) to address cumulative PIIM effects from EACOP and the Kondoa and Chemba road improvement.
Consequently, it is predicted that the limit of acceptable change will be achieved and hence the residual cumulative impact is considered not significant.

**Talamai Open Area**

The Talamai Open Area is open woodlands, shrubland and grassland. As mentioned in the project residual impacts section, and here for baseline context, the area around the PRS1 has been modified by agricultural activities and there is associated temporary housing throughout the area. In addition, there are two roads, passing villages, to the field in which PRS1 will be located. Permitted land uses include cultivation, pastoralism and hunting under permit; it should be noted that Talamai OA is not nationally protected. Species diversity, particularly of carnivores, is high, see Baseline Appendix A4.

The Talamai OA supports the following species:

- lions (*Panthera leo*) – IUCN vulnerable
- elephant (*Loxodonta africana*) – IUCN vulnerable
- giraffe (*Giraffa camelopardalis*) – IUCN vulnerable
- pancake tortoise (*Malacochersus tornieri*) – IUCN vulnerable
- African migrant butterfly (*Catopsilia florella*) – migratory species
- African wild dog (*Lycaon pictus*) – IUCN endangered
- orange-bellied parrot (*Neophema chrysogaster*) – IUCN critically endangered
- Pringle’s puffback (*Dryoscopus pringlii*) – IUCN least concern (endemic or range restricted)
- parrot-billed sparrow (*Passer gongonensis*) – IUCN least concern (endemic or range restricted).

African wild dogs are particularly susceptible to edge effects and increased edge effects due to habitat degradation as described in the Baseline Appendix A4.

The preferred condition is that the number of species remains stable or increases, relative to the background changes in population levels. The limit of acceptable change is a short-term decrease followed by recovery to preconstruction numbers for the African wild dog and other species of conservation importance in the OA.

There is a potential cumulative impact on species of conservation importance in the Talamai OA from the EACOP project and the road upgrade between Handeni and Singida at KP1143 and 1223.5. The TANROADS road upgrade project includes the construction of a bitumen road replacing the existing murram road. This upgrade will allow more vehicles to pass through the area more quickly. The road lies outside Talamai OA but the EACOP access roads to PRS1 and MC13 will fork from this main road (Figure 8.3-1).

The operation of the national road and the EACOP project access roads to MC13 and PRS1 cumulatively have the potential to cause increased pressure on natural resources in the OA from increased human access and activity. With increased access, people may gather food and natural resources as fuel. This may affect species directly through hunting, and indirectly through deforestation which will reduce habitat. As African wild dogs are particularly sensitive to edge effects and human habitation, any permanent reduction in habitat area could have significant
edge effects. In addition, since availability of prey is considered to limit their
distribution, the reduction of prey availability from hunting of game by people will
affect survival rates.

When MC13 is revegetated and reinstated when construction is complete, the
effects of PIIM may be lessened as the draw from this area of habitation will be
removed. However, as the access road to PRS1 will provide access directly into the
OA impacts are still considered significant. The residual project impact on the
species in the Talamai OA is still significant.

It is difficult to assess the impact of PIIM because future human movements are
speculative. However, assuming PIIM does occur in the area, the number of
species using the Talamai OA is unlikely to remain stable and may decrease,
relative to the background changes in population levels. The EACOP access road
to PRS1 will be permanent and therefore the cumulative impacts from the new
EACOP access road and the TANROADS road upgrade will have a very long
duration on species of very high sensitivity, it is therefore unlikely that the limit of
acceptable change will be achieved. Consequently, it is predicted that there will be
a significant residual cumulative impact.

A biodiversity action plan incorporating enhancement and conservation measures
will be developed and when implemented, predicted cumulative impacts are
expected to be reduced.

8.3.6.3 Transboundary Cumulative Impacts

There are no transboundary cumulative impacts on species of conservation
interest.

8.4 Biodiversity: Legally Protected, Internationally or Nationally
Recognised Areas

This section describes potential impacts on legally protected, internationally or
nationally recognised areas during construction, commissioning and operation of
the EACOP project and associated mitigation measure to be adopted.

8.4.1 Key Sensitivities and Considerations

The legally protected, internationally or nationally recognised areas baseline
conditions are described in Section 6.4.1 as well as:

- their sensitivity rankings described in the relevant tables in Appendix D
- key considerations for legally protected, internationally or nationally recognised
  areas.

The sensitivity ranking of legally protected, internationally or nationally recognised
areas ranges from moderate to very high.

Key legally protected, internationally or nationally recognised areas for
consideration are:

- Minziro Nature Forest Reserve (NFR and KBA)
- Burigi-Biharamulo Game Reserve (GR)
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- Wembere Steppe (KBA and IBA)
- Singida Lakes (IBA)
- Swaga Swaga (GR)
- Talamai Open Area (OA)
- Kitwai (GCA)
- East African Coastal Forest (biodiversity hotspot).

Ecosystem Services
A summary of the ecosystem services provided by the habitats found within these protected areas is described in habitats Section 8.2.1.

8.4.2 Potential Project Impacts

8.4.2.1 Construction

Background

Generic Impacts
There are no generic impacts for the protected areas and internationally recognised areas VEC.

Location-Specific Impacts

Location: Protected and Internationally Recognised Areas (Ruiga River Forest Reserve KP420–469, Burigi-Biharamulo Forest Reserve KP535–549, Uyovu Forest Reserve KP551–557.5, Ngogwa Busangi Forest Reserve KP622–644.5 and Mwakalund Forest Reserve KP698–701)

Loss of Habitat Disturbance to Wildlife
Impact: Loss of ecological function and integrity of protected sites through impacts on species and habitats

Section 8.2 describes the loss of habitat at protected sites from pipeline construction. A quantification of habitat loss within the protected areas is provided in Table 8.2-1 in Section 8.2. Of the ten protected areas (two of which are internationally recognised as KBAs) and one internationally recognised area (a KBA) that the route passes through, five are designated for commercial forestry or have been heavily modified by human activity and are therefore of low or moderate sensitivity for the species and habitats they support. As such, the short-term impacts of site clearance followed by reinstatement are considered not significant. The integrity of the site and status as an FR will not be affected and thus the effects are not significant.
Location: Minziro Nature Forest Reserve and Key Biodiversity Area

Loss of Habitat Disturbance to Wildlife

Impact: Loss of ecological function and integrity of protected site through impacts on species and habitats

The pipeline passes through grassland within, and part of, the reserve that is important for over-wintering blue swallow. In addition, ashy red colobus monkeys use the reserve, but the pipeline passes through sub-optimal habitat for this species. The protected area covers 311.42 km² of which the project will affect 20.5 ha.

As the impacts are of short duration and only affect a small part of the grassland habitat in the protected area, the ecological function of the reserve and protected status of the NFR and KBA are unlikely to be affected. Therefore, this impact is considered not significant.

Location: Burigi-Biharamulo Game Reserve

Loss of Habitat Disturbance to Wildlife

Impact: Loss of ecological function and integrity of protected site through impacts on species and habitats

The pipeline passes through an area of old growth forest on a steep embankment. This habitat type is important as a remnant forest in an area of rapid deforestation and because it supports raptors and primates of very high sensitivity. The GR is 1200 km² and the KBA and IBA 3500 km². The construction will affect 105.9 ha of habitat of which approximately 7.9 ha is old growth forest. These direct and indirect impacts on habitats and species have the potential to cause a loss of integrity and ecological function and this impact is considered of large magnitude, medium duration, national extent and of very high sensitivity; hence the direct and indirect impacts are significant.

Location: Talamai Open Area, Kitwai Game-Controlled Area and Handeni Game-Controlled Area

Loss of Habitat Disturbance to Wildlife

Impact: Loss of ecological function and integrity of protected site through impacts on species and habitats

Pipeline construction will remove of 169.6 ha of Talamai OA habitat (equivalent to 0.04% of the total area), 27.3 ha of Kitwai GCA habitat (equivalent to 0.7% of the total area) and 81.7 ha of Handeni GCA (equivalent to 1.1% of the total area). These protected areas are assessed together, as they are contiguous and any impacts could be felt throughout the three protected areas. The habitat within these areas is similar and therefore of moderate sensitivity, but the sites support large carnivores including African wild dog which are of very high sensitivity. The potential impacts on these areas are of very large magnitude as there may be PIIM into the area from MC13, MCPY14 during the construction phase and via a new permanent access road to PRS1. This could cause accelerated rates of deforestation, causing a loss of ecological function of the hunting Open Area.
Although MC13 will be reinstated this direct impact is considered of large magnitude, medium duration and national extent on a site of high sensitivity; hence the direct and indirect potential impact are considered significant.

**Ecosystem Services**

Potential impacts on ecosystem services are described in Sections 8.2 and 8.3. There are no ecosystem services that relate to protected areas exclusively that are not already described in the habitats of conservation importance and species of conservation importance sections. However, given the protected areas status, potential non-use values can be considered higher for habitats with protected areas.

### 8.4.2.2 Operation

**Generic Impacts**

There are no generic impacts from the pipeline, AGI and MST operation on legally protected, internationally or nationally recognised areas.

**Location-Specific Impacts**

**Location: East African Coastal Forest**

**Loss of Habitat Disturbance to Wildlife**

Impact: Disturbance to species using habitat surrounding the MST and PIIM leading to increased deforestation and bushmeat hunting leading to a loss of integrity or ecological function

The combination of PIIM to the area creating pressure on natural resources (both species and habitats) and disturbance to species using the surrounding habitat, through noise and lighting, has the potential to affect species and habitats. However, as this EBA and biodiversity hotspot is 25,000 km², the impacts on habitats and species affect only a small proportion causing a medium magnitude impact and therefore in not significant indirect impacts on the integrity and functioning of the site.

**Ecosystem Services**

Potential impacts on ecosystem services are described in Sections 8.2 and 8.3. There are no ecosystem services that relate to protected areas exclusively that are not already described in the habitats of conservation importance and species of conservation importance sections. However, given the protected areas status, potential non-use values can be considered higher for habitats with protected areas.

### 8.4.3 Mitigation Measures

This section describes the impact avoidance and mitigation measures that will be applied to the aspects that could affect biodiversity impacts.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key
mitigation measures presented in this section, and the associated management plan and other measures that are included in Appendix E4 have been collectively used to assess residual impacts, and to determine their significance.

8.4.3.1 Design

Generic Mitigation Measures

The design mitigation measures relating to route selection described under Section 8.2.3.1 are of relevance.

Location-Specific Mitigation Measures

There are no specific design mitigation measures of relevance to protected areas.

8.4.3.2 Construction

Generic Mitigation Measures

The mitigation measures described for habitats of conservation importance and species of conservation importance will be used to mitigate for impacts on these VECs and will, in turn, mitigate for impacts on protected areas.

Location-Specific Mitigation Measures

The mitigation measures described for habitats of conservation importance and species of conservation importance will be used to mitigate for impacts on these VECs and will, in turn, mitigate for impacts on protected areas.

Location: Protected and Internationally Recognised Areas (Ruiga River Forest Reserve KP420–469, Burigi-Biharamulo Forest Reserve KP535–549, Uyovu Forest Reserve KP551–557.5, Ngogwa Busangi Forest Reserve KP622–644.5 and Mwakalundi Forest Reserve KP698–701)

Loss of Habitat Disturbance to Wildlife

Impact: Combined impacts on habitats and species from construction causing impacts on the integrity of the functioning of the protected area and potential effects on protected area status

The biodiversity management plan will include measures described in sections 8.2 and 8.3 for habitats and species of conservation importance that collectively contribute to the management of impacts at these locations.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.
Location: Minziro Nature Forest Reserve and Key Biodiversity Area
Loss of Habitat Disturbance to Wildlife
Impact: Loss of ecological function and integrity of protected site through impacts on species and habitats
The biodiversity management plan and pollution prevention plan will include measures described in sections 8.2 and 8.3 for habitats and species of conservation importance that collectively contribute to the control of impacts at this location.
Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small.

Location: Burigi-Biharamulo Game Reserve
Loss of Habitat Disturbance to Wildlife
Impact: Loss of ecological function and integrity of protected site through impacts on species and habitats
The biodiversity management plan will include measures described in sections 8.2 and 8.3 for habitats and species of conservation importance that collectively contribute to the management of impacts at these locations.
The pre-mitigation impact is considered significant, however, the application of mitigation described above reduces magnitude of impact from large to medium and duration from long to short term; the residual impact is not significant.

Location: Talamai Open Area, Kitwai Game-Controlled Area and Handeni Game-Controlled Area
Loss of Habitat Disturbance to Wildlife
Impact: Loss of ecological function and integrity of protected site through impacts on species and habitats
The biodiversity management plan will include measures described in sections 8.2 and 8.3 for habitats and species of conservation importance that collectively contribute to the management of impacts at these locations.
The pre-mitigation impact is considered significant, however, the application of mitigation described above reduces magnitude of impact from large to medium and the residual impact is not significant. The reinstatement of MCPY13 will reduce the duration of impacts at this location but PRS1 and the associated access road will be permanent causing significant residual impacts on species of conservation importance. However, these impacts will not be of sufficient magnitude to affect the integrity of the reserve.
8.4.3.3 Operation

Generic Mitigation Measures
The mitigation measures described for habitats of conservation importance and species of conservation importance will be used to mitigate for impacts on these VECs and will, in turn, mitigate for impacts on protected areas.

Location-Specific Mitigation Measures

Location: East African Coastal Forest Endemic Bird Area and Biodiversity Hotspot

Loss of Habitat Disturbance to Wildlife
Impact: Disturbance to species using habitat surrounding the MST and PIIM leading to increased deforestation and bushmeat hunting leading to a loss of integrity or ecological function.

The biodiversity management plan, project induced in-migration plan, stakeholder engagement plan and the pollution prevention plan will include measures that collectively contribute to the management of impacts at this location.

A lighting strategy will be developed to limit light impacts on habitat. Pre-construction surveys will inform location-specific biodiversity management plans that allow for progressive, active habitat restoration; ways to achieve an increasing trend in vegetation regrowth and diversity of desired species will be explored and, conservation measures to achieve net gain / no net loss for biodiversity. In addition, employment and training opportunities will be communicated to communities and the project induced in-migration management plan will aim to reduce in-migration.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude of the residual impact is reduced from medium to small; this is despite impacts on species of conservation importance at this location having significant residual impact, these impacts will not affect the integrity of the internationally recognised area.

8.4.4 Residual Impacts and Significance Summary

This section summarises the residual impacts on biodiversity after mitigation has been implemented, following the order in Table 8.4-1 and focussing on those impacts that are significant.

The implementation of mitigation measures for habitats of conservation importance and species of conservation importance will reduce impacts on those VECs and although there are some residual impacts on those VECs, none will be enough to cause an overall loss of integrity of the protected areas. It is therefore considered that there are no residual impacts on protected areas.

A biodiversity action plan incorporating further enhancement and conservation measures will be developed and implemented to achieve no net loss of biodiversity where feasible.
### Table 8.4-1 Legally Protected, Internationally or Nationally Recognised Onshore Areas – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Phase</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KP302–312 Minziro NFR, IBA and KBA</td>
<td>Loss of Habitat Disturbance to Wildlife</td>
<td>Loss of ecological function and integrity of protected site through in-combination effects on species and habitats</td>
<td>C &amp; O</td>
<td></td>
<td>Biodiversity management plan</td>
<td>4 2 2 4 10</td>
</tr>
<tr>
<td>KP438–472 Burigi-Biharamulo GR and KBA</td>
<td>Loss of Habitat Disturbance to Wildlife</td>
<td>Loss of ecological function and integrity of protected site through in-combination effects on species and habitats</td>
<td>C &amp; O</td>
<td></td>
<td>Biodiversity management plan</td>
<td>6 2 2 4 14</td>
</tr>
<tr>
<td>KP1144–1238 Talamai OA, Kitwai GCA and Handeni GCA</td>
<td>Loss of Habitat Disturbance to Wildlife</td>
<td>Loss of ecological function and integrity of protected site through in-combination effects on species and habitats</td>
<td>C &amp; O</td>
<td></td>
<td>Biodiversity management plan</td>
<td>6 2 2 4 14</td>
</tr>
</tbody>
</table>

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### Table 8.4-1 Legally Protected, Internationally or Nationally Recognised Onshore Areas – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact M</th>
<th>D</th>
<th>E</th>
<th>S</th>
<th>SS</th>
</tr>
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<tbody>
<tr>
<td>Operation Phase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Biodiversity management plan Project induced in-migration plan Stakeholder engagement plan Pollution prevention plan</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>East African Coastal Forest EBA KP1442.8</td>
<td>Loss of Habitat Disturbance to Wildlife</td>
<td>Disturbance to species using habitat surrounding the MST and PIIM leading to increased deforestation and bushmeat hunting leading to a loss of integrity or ecological function</td>
<td>O</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

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8.4.5 Transboundary Project Impacts

No transboundary project impacts were identified.

8.4.6 Cumulative Impacts

Potential cumulative impacts on habitats and species of conservation importance within protected areas are described in Sections 8.2 and 8.3. There are no cumulative impacts identified that are likely to affect the integrity or ecological function of a protected area.

8.5 Soils

This section describes potential impacts on soil during construction, commissioning and operation of the EACOP project in Tanzania and the associated mitigation measures to be adopted.

As mentioned in Section 6.4.2.1, while geology for this ESIA, is not considered a VEC, and is not assessed, the potential impact on aggregate extraction has been assessed and described in this section. Information on seismic risk areas traversed by the pipeline has been included in the project description (see Section 2).

Appendices E2 and E3 include all pre-mitigation and post-mitigation generic and location-specific impacts. This includes two types of construction and operation impacts, those from construction facilities and those from the pipeline and AGIs. For impacts on soil, the construction facility and pipeline and AGI impacts have been aggregated and are described as either construction or operation impacts. If a construction facility or pipeline and AGIs impact was greater than the other before the aggregation, the greater impact was applied. If a pre-mitigation or post-mitigation impact was determined to be significant, it is noted in the text when the other aggregated impact is not significant. All disaggregated impacts are included in Appendices E2 and E3.

8.5.1 Key Sensitivities and Considerations

The soil baseline conditions are described in Section 6.4.2.1, as well as:

- soil key valued environmental components (VEC) and their sensitivity ranking based on the relevant table in Appendix D
- key considerations for the soil impact assessment.

Sensitivity in the soil area of influence (AOI) ranges from very low to very high, depending on the soil type, and varies considerably throughout the pipeline route.

Key considerations include:

- The texture of the soil in approximately 70% of the survey samples from the pipeline route (which are considered as representative of soils along the route) is primarily silty and sandy; silty soil is considered more prone to compaction, has poor trafficability when wet and is prone to dust generation during dry conditions.
- Several areas of the proposed pipeline route are noted as having high erosion potential, for example, KP408, KP956 and KP1424.
• The topsoil is generally deep (predominantly 20–40 cm) along the route and at construction facilities, although there are likely to be sections where it is thin (<5 cm).
• The proposed pipeline route is predominantly through agricultural land with highly productive soil identified at several locations.
• Contamination from industrial or agricultural activities was not identified at any of the locations along the proposed route and, due to the predominantly rural nature of the AOI, is unlikely.
• Unexploded ordnance (UXO) may exist in certain areas within the AOI, particularly near the Tanzania–Uganda border.

The project impacts are assessed cumulatively, incorporating qualitatively, the baseline conditions.

Section 6.4.2.1 identifies ecosystem services associated with soil in the AOI. The following ecosystem services have been considered:

• aggregates and topsoil
• soil quality
• water storage
• water flow control.

Soil also provides the following ecosystem services that are considered in other sections:

• agriculture (land-based livelihoods VEC, Section 8.13)
• biodiversity (biodiversity VECs, Section 8.2 to Section 8.4).

### 8.5.2 Potential Project Impacts

#### 8.5.2.1 Construction

**Generic Impacts**

**Use of Raw Materials and Natural Resources**

Impact: Depletion of natural resources, for example, aggregate

Aggregate will be needed for aboveground installation (AGI) construction, for use as padding material for the pipeline and for concrete for constructing AGI components, construction of main line block valves, the coating plant, and for construction of the main camp and pipe yards (MCPY) and access roads. The extraction and use of aggregate constitutes the use of nonrenewable natural resources, which is a direct impact that is expected to be minimal because of the quantities required and their sourcing being distributed over a long distance (1100 km).

Construction will require the stripping of topsoil from within the soil AOI, which will be stored for later use, including pipeline reinstatement. If poorly managed, topsoil could be lost as a resource in several ways:

• reducing soil quality, for example by mixing topsoil with subsoil
• wasting soil by mixing it with construction waste or contaminated materials, which then must be treated before reuse or even disposed of as a last resort.

The extraction of aggregate may also have indirect impacts on surface water and water resources, biodiversity, cultural heritage, land users and communities that will be considered when an environmental and social appraisal is undertaken of sites, see Section 10.7.1.

The pre-mitigation impact for use of raw materials and natural resources during construction is considered not significant, because of the small magnitude, site-based extent and short duration.

Soil Compaction

Impact: Anaerobic conditions developing that restrict plant nutrient uptake efficiency and root development and loss of drainage capacity and poor plant establishment causing increased surface water ponding, runoff, soil erosion and decreased productivity

Compaction of soil during construction may occur and compaction-prone soil was identified at several locations during the field survey, for example, KP789–KP825.9. Compaction of soil during construction will occur where and when the soil bearing strength is exceeded by the load of construction activities, for example, vehicle movements and pipe storage. This causes soil particles to be compressed together, which reduces the soil’s porosity and increases its bulk density. Wet and clay-dominated soil is more sensitive to compaction due to the relatively small particle size and high bulk density.

Topsoil and subsoil will be stripped from all working areas before construction, so the impact will be limited to sites that are due to be reinstated, i.e., the RoW.

The indirect impacts of soil compaction are the alteration of drainage characteristics, which may cause surface runoff and localised flooding, and reduced dissolved oxygen levels in receiving waters, which could cause anaerobic conditions to develop. Compaction can also have indirect impacts on ecology by restricting root zone growth, as it can affect vegetation re-establishment (see habitats of conservation importance VEC, Section 8.2) and on agricultural productivity and associated livelihoods (see land-based livelihoods VEC, Section 8.13).

The pre-mitigation impact for soil compaction during construction is considered not significant. Although the magnitude is potentially large, the impact is not significant because of the site-based extent and short duration.

Soil Erosion

Impact: Loss of topsoil causing reduced fertility and impaired reinstatement

Preparation of the RoW and construction of the MCPYs and access roads, including removing vegetation, topsoil stripping and benching, will affect soil structure and stability. This may increase the risk of erosion, particularly where the soil has poor cohesion or there are steep slopes. The erosion risk is expected to be highest during wet weather, when runnels may develop, and it will be exacerbated by vehicle movements.
Topsoil removed from the RoW will be stored at the edge of the working area pending replacement during reinstatement. Topsoil stockpiles can be poorly consolidated, so prone to erosion and soil loss via wind erosion or washout by rainfall.

Soil stability at areas that exhibit active erosion could be made worse by AGI and pipeline construction activities, or erosion could be triggered in areas with erosion potential.

A RoW soil erosion classification study was conducted and is described in Appendix G1. Highly erodible soil was identified at several locations along the pipeline route, for example, KP408, KP956, and KP1424.

Treated hydrotecting water will be discharged to either land or a watercourse. Erosion could occur at the point of discharge to land. This discharge could indirectly cause scour and increased sediment loading if to a watercourse (see surface water VEC, Section 8.6).

Where access roads to the right of way (RoW) are widened, construction will include the removal of topsoil and subsoil, which can leave soil more exposed and more prone to erosion. Soil erosion may cause indirect impacts on aquatic fauna (from sediment release into watercourses) and could affect vegetation re-establishment (loss of soil). These potential impacts are described in the habitats of conservation importance VEC (Section 8.2). Soil erosion could also affect agricultural productivity, see land-based livelihoods VEC (Section 8.13) for a description of the potential impacts.

The pre-mitigation impact for soil erosion during construction is considered not significant, because of the site-based extent and short duration, although the magnitude is potentially large.

Loss of Soil Structure, Fertility and Seed Bank

Impact: Development of anaerobic conditions in stored soil and mixing of different soil or soil with foreign materials leading to loss of drainage and fertility

In areas with thin topsoil coverage, stripping of topsoil and segregation of topsoil and subsoil may be more difficult. A pre-construction survey will confirm location-specific topsoil depths.

Soil structure can be damaged by soil stripping and the nutrient content can be decreased due to leaching, which can affect vegetation re-establishment. Alterations to structure and nutrient content can also occur if topsoil and subsoil layers are mixed during construction and/or storage, or if surplus subsoil is disposed by spreading over topsoil or vegetation.

Prolonged storage of topsoil (longer than six months) can cause loss of soil fertility, as nutrients may be leached out by rain or by anaerobic conditions may be created by a lack of air circulation. Prolonged storage may also cause loss in viability of the seed bank in the stored topsoil. Soil fertility was identified as a key stakeholder concern; highly productive soil was identified in several areas within the AOI. Most of the AOI is considered to have low to medium fertility.
Indirect impacts include ecological effects due to loss of seed bank diversity, effects on vegetation re-establishment (see habitats of conservation importance VEC, Section 8.2).

The pre-mitigation impact on soil structure, fertility and seed bank during construction is considered not significant because of the small magnitude, short duration and site-based extent of the potential impact.

Disturbance, Treatment and Management of Contaminated Soil

Impact: Mobilisation of soil contaminants

There is a risk that unidentified contaminated soil may be encountered during construction. Two potential impacts are associated with encountering contaminated soil during construction:

- indirect risks from mobilising contaminants into the wider environment, thereby contaminating previously clean soil with consequent potential indirect impacts on community water sources, agricultural land, flora and fauna.

In addition to the risk of encountering contaminated soil, the border of Tanzania and Uganda has been identified as a potential UXO area. At the time of writing, the Tanzanian and Ugandan authorities are undertaking a survey to assess the UXO risk in the project area. Depending on the findings of the survey, a programme will be implemented to clear the area of UXOs.

The pre-mitigation impact of disturbance, treatment and disposal of contaminated soil during construction is considered not significant because of the small magnitude, short duration, and site-based extent of the potential impact.

Management of Solid and Liquid Waste and Accidental Release of Oil and Chemicals

Impact: Soil contamination

Construction activities have the potential to produce soil contamination. The principal potential contaminants associated with the construction activities are:

- fuels and lubricating oils
- hazardous wastes
- welding wastes
- field coating materials
- paints and solvents.

Potential indirect impacts from contamination of soil include:

- impacts on the viability of terrestrial flora and fauna (see flora and fauna species of conservation concern VEC, Section 8.3)
- damage to the viability of aquatic vegetation and fish through contaminants leaching into watercourses (see flora and fauna species of conservation concern VEC, Section 8.3)

The pre-mitigation impact for solid and liquid waste disposal and accidental release of oil or chemicals during construction is considered not significant because of the small magnitude, short duration, and site-based extent of the potential impact.
Management of Surplus Subsoil and Aggregate

Impact: Loss of soil structure, drainage, fertility and seed bank

If subsoil and aggregate are stored in areas where the topsoil has not been stripped before storage and the surplus subsoil and aggregate is not removed after construction, there could be adverse impacts on soil structure, fertility and the seed bank with consequent effects impacts on vegetation re-establishment and agricultural productivity. Offsite disposal at approved borrow and spoil pits of aggregate and surplus subsoil and aggregate and within project areas to be reinstated has the potential to cause impacts on the soil structure, fertility and seed bank of the receiving site.

The pre-mitigation impact for surplus subsoil and aggregate disposal during construction is considered not significant because of the small magnitude, transient duration and site-based extent of the potential impact.

Location-Specific Impacts

Location: Areas Sensitive to Soil Compaction

Soil Compaction

Impact: Anaerobic conditions develop that restrict plant nutrient uptake efficiency and root development and loss of drainage capacity and poor plant establishment causing increased surface water ponding, runoff, soil erosion and decreased productivity

Compaction of soil during construction will occur where and when the soil bearing strength is exceeded by the load of construction activities, for example, vehicle movements and pipe storage. The potential impacts associated with soil compaction described in the generic impacts section above apply.

Compaction-prone soil was identified at several locations on the RoW, for example, KP789–KP825.9, and it is likely that additional areas will be identified before construction. Sand-dominated soil was identified at most of the MCPY sample locations, for example, KP419 (MCPY6), KP513 (MCPY7), KP595 (MCPY8), KP702 (MCPY9 and coating facility), KP799 (MCPY10), KP915 (MCPY11), KP1038 (MCPY12), KP1144 (MCPY13) and KP1238 (MCPY14), which suggests that these sites will be less prone to compaction. Silt-dominated soil was identified at the remaining MCPY sample locations for example, KP325 (MCPY5), KP1318 (MCPY15) and KP1403 (MCPY16) which is more moderately prone to compaction. Clay soil, which is more susceptible to compaction, may exist in some areas of the proposed development. When the soil is wet, i.e., during the wet season, it will be prone to compaction regardless of texture. Topsoil and subsoil will be stripped from all working areas before construction, so the impact will be limited to sites that are due to be reinstated.

The pre-mitigation impact for soil compaction during construction at the above locations is considered not significant because of the short duration and site-based extent, although the magnitude is potentially large.
Location: Areas Sensitive to Soil Erosion

Soil Erosion
Impact: Loss of topsoil causing reduced fertility and impaired reinstatement

Construction, including removing vegetation, topsoil stripping and benching, will disturb soil structure and stability. The potential impacts associated with soil erosion described in the generic impacts section above apply.

A soil erosion classification study was conducted and is described in Appendix G1. Highly erodible soil was identified at several locations along the RoW, for example, KP408; KP956; KP1424; KP420, close to MCPY6 (KP419); and KP1038, close to MCPY12 (KP1037.7). However, it is possible that additional areas of highly erodible soil exist at other locations.

The pre-mitigation impact for soil erosion during construction at the above locations is considered not significant because of the short duration and site-based extent, although the magnitude is potentially large.

As described in Section 2.3.7 and 2.4.6.1, the land required for facilities will be leased from the government. When the construction phase has been completed and after decommissioning, the leases will be surrendered and some of the facilities, such as the MCPYs and CF may be transferred to the government with some structures left in place.

Project related construction phase location-specific impacts will be managed by the generic mitigation described in Section 8.5.3; there will not be any project-related location-specific impacts to soil once project-related construction activities are concluded, irrespective of whether the MCPYs and CF are retained by the government or reinstated.

8.5.2.2 Project Operation

Generic Impacts
Soil Erosion
Impact: Loss of topsoil causing reduced fertility and impaired reinstatement

As soil will be replaced during trench backfilling and reinstatement of the RoW and natural regeneration of vegetation allowed to occur, no potential impacts on soil are expected during project operation.

Following construction reinstatement, restoration of any soil cover to its original state will partially depend on the risk of erosion. Vegetation will eventually re-establish, although in areas with thin or erodible topsoil reinstatement this will take longer.

Soil stability at areas that exhibit active erosion could worsen, or erosion could be triggered in areas with erosion potential during operation. This may lead to erosion of the RoW and pipeline trench, which could potentially result in lateral displacement of the pipeline, thereby risking its integrity. Further information regarding management of pipeline integrity is provided in the project description (see Section 2.4.5).
During project operation, the only activity permitted on the RoW in agricultural areas will be grazing.

When the pipeline is operating, unmanned aerial vehicles will undertake regular patrols of the pipeline RoW. Driving along the RoW will be kept to a minimum and only allowed for maintenance and urgent security matters.

The pre-mitigation impact of soil erosion during project operation during project operation is considered not significant because of the site-based extent, although the magnitude is potentially large and the duration potentially long.

**Location-Specific Impacts**

**Location: PS3, PS4, PS5, PS6, PRS1, PRS2 and MST**

Management of Solid and Liquid Waste and Accidental Release of Oil and Chemicals

Impact: Soil contamination

Production, maintenance and inspection personnel will be accommodated at PS3, PS5 and the MST. At these locations there will be the need to dispose of small quantities of sewage, waste water and domestic waste, and very small quantities of chemicals and fuel for maintenance activities that have the potential to contaminate soil if spilled. There will be minimal sanitary waste requirements at unmanned AGIs (PS4, and PS6 and the PRSs).

There will also be some surface water runoff from concreted areas on the sites, which has the potential to contaminate soil through accidental releases of oil and chemicals, and to cause localised flooding. Potential indirect impacts could occur on surface water (see Section 8.6) and groundwater (see Section 8.7).

The pre-mitigation impact of solid and liquid waste disposal and accidental release of oil or chemicals during project operation is considered not significant because of the small magnitude and site-based extent of the potential impact although the duration is potentially long.

**8.5.3 Mitigation Measures**

This section describes the avoidance and mitigation measures that will be applied to the aspects and activities that could affect soil.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management plans and other measures that are included in Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.

**8.5.3.1 Design**

Design, routing and siting measures to avoid or minimise project impacts on soil are described in Section 2.2, Section 2.3 and Section 3.
8.5.3.2 Construction

Generic Impacts

Use of Raw Materials and Natural Resources

Impact: Depletion of natural resources, for example, aggregate

The waste management plan and the natural resource management plan will include measures that contribute to the management of natural resource use.

Excavated materials will be screened and reused where possible and new aggregate extraction sites will undergo environmental and social evaluation before development.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a site-based extent and long duration, although the magnitude is reduced to negligible.

Soil Compaction

Impact: Anaerobic conditions developing that restrict plant nutrient uptake efficiency and root development and loss of drainage capacity and poor plant establishment causing increased surface water ponding, runoff, soil erosion and decreased productivity

The soil management plan and the community health, safety and security plan will include measures that contribute to the management of compaction.

During construction, local communities will be discouraged from using the RoW for transportation. Ground protection such as bogmats and geotextile fabric will be used to support heavy loads where ground is soft. The soil management plan and reinstatement plan will include procedures to reduce and control compaction. Stock piled topsoil will be monitored for compaction and corrective action implemented if required; stockpiled topsoil areas will be free draining and include gaps to allow passage of floodwater.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a site-based extent, although magnitude is reduced to medium and the duration is reduced to transient.

Soil Erosion

Impact: Loss of topsoil causing reduced fertility and impaired reinstatement

The soil management plan and the community health, safety and security plan will include measures that contribute to the management of erosion.

During construction, local communities will be discouraged from using the RoW as an access track. Ground protection such as bogmats and geotextile fabric will be used to support heavy loads where ground is soft. The soil management plan and reinstatement plan will include procedures to reduce and control erosion. Stockpiled topsoil will be monitored for weeds and compaction and corrective action
implemented if required; stockpiled topsoil areas will be free draining and include
gaps to allow passage of floodwater.

Although the pre-mitigation impact is considered not significant, the application of
the above measures will further reduce impact; the residual impact will still have a
site-based extent, although magnitude is reduced to medium and the duration is
reduced to transient.

Loss of Soil Structure, Fertility and Seed Bank

Impact: Development of anaerobic conditions in stored soil and mixing of different
soil or soil with foreign materials leading to loss of drainage and fertility

The soil management plan will include measures that contribute to the management
of loss of soil productivity.

Stockpiled topsoil will be monitored for weeds and compaction and corrective action
implemented if required. Stockpiled topsoil and subsoil areas will be free draining
and include gaps to allow passage of floodwater.

Although the pre-mitigation impact is considered not significant, the application of
the above measures will further reduce impact; the residual impact will still have a
transient duration and a site-based extent, although the magnitude is reduced to
negligible.

Disturbance, Treatment and Management of Contaminated Soil

Impact: Mobilisation of soil contaminants

The pollution prevention plan and the reinstatement plan will include measures that
contribute to the management of soil contamination.

Areas of surface contamination identified before construction within the project
footprint will be remediated before or during project construction. Contaminated
material will be temporarily stored in impermeable bunds and covered to prevent
runoff and airborne losses.

Although the pre-mitigation impact is considered not significant, the application of
the above measures will further reduce impact; the residual impact will still have a
short duration and a site-based extent, although the magnitude is reduced to
negligible.

Management of Solid and Liquid Waste and Accidental Release of Oil and
Chemicals

Impact: Soil contamination

The pollution prevention plan and the waste management plan will include
measures that contribute to the management of impacts from waste management
and accidental substance releases.

In the event of a spillage of hazardous materials a trained rapid response team will
be mobilised to contain, clean and remediate spills. Spill response equipment will
be available at all work sites. The storage of hazardous materials will be restricted
to designated hazardous materials storage areas at least 50 m from surface waters;
storage will be covered, bunded (no drainage valves/holes) and have impermeable
A refuelling procedure will be developed to address mobile and static refuelling, spill prevention techniques and training.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a short duration and site-based extent, although the magnitude is reduced to negligible.

### Surplus Subsoil and Aggregate

**Impact:** Loss of soil structure, drainage, fertility and seed bank

The waste management plan will include measures that contribute to the surplus soil materials.

Disposal of surplus subsoil and aggregate will be subject to environmental and social evaluations to identify suitable offsite disposal sites to avoid impacts on soil structure, drainage, fertility and seed bank at potentially affected sites.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a short duration and site-based extent, although the magnitude is reduced to negligible.

### Location-Specific Impacts

#### Location: Areas Sensitive to Soil Compaction

**Soil Compaction**

**Impact:** Anaerobic conditions developing that restrict plant nutrient uptake efficiency and root development and loss of drainage capacity and poor plant establishment causing increased surface water ponding, runoff, soil erosion and decreased productivity.

The generic mitigation for soil compaction described in Section 8.5.3.2 will contribute to the management of compaction; no additional mitigation is required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a site-based extent, although magnitude is reduced to medium and the duration is reduced to transient.

#### Location: Areas Sensitive to Soil Erosion

**Soil Erosion**

**Impact:** Loss of topsoil causing reduced fertility and impaired reinstatement

The generic mitigation for soil erosion described in Section 8.5.3.2 will contribute to the management of this impact; no additional mitigation is required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a site-based extent, although magnitude is reduced to medium and the duration is reduced to transient.
8.5.3.3 Operation

Generic Impacts

Soil Erosion

Impact: Loss of topsoil causing reduced fertility and impaired reinstatement

The reinstatement plan and biodiversity management plan will include measures to reduce and control erosion during operation and explore ways to achieve an increasing trend in vegetation regrowth and diversity of desired species.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a site-based extent, although magnitude is reduced to medium and the duration is reduced to transient.

Location Specific Impacts

Location: PS3, PS4, PS5, PS6, PRS1, PRS2 and MST

Management of Solid and Liquid Waste and Accidental Release of Oil and Chemicals

Impact: Soil contamination

The pollution prevention plan and the waste management plan will include measures that contribute to the management of impacts from waste management and accidental substance releases, including spill response procedures, management of hazardous materials and a requirement for wastewater discharges to comply with permit conditions and project environmental standards.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a long duration and site-based extent, although the magnitude is reduced to negligible.

8.5.4 Residual Impacts and Significance Summary

This section summarises the residual impacts on soil after mitigation measures have been implemented.

Table 8.5-1 summarises the potential generic soil impacts, the proposed mitigation measures and the significance of the residual impacts after implementation of the mitigation measures. Table 8.5-2 summarises the location-specific impacts.

8.5.4.1 Generic Impacts

With the implementation of the planned mitigation measures, there are no predicted significant residual impacts associated with:

- use of raw materials and natural resources
- soil compaction
- soil erosion
- loss of soil structure, fertility and seed bank
- disturbance, treatment and disposal of contaminated soil
- management of solid and liquid waste and accidental release of oil or chemicals
- surplus subsoil and aggregate

### 8.5.4.2 Location-Specific Impacts

With the implementation of the planned mitigation measures, no significant residual location-specific impacts to soil are predicted.

### 8.5.4.3 Ecosystem Services

Section 6.4.2.1 identifies ecosystem services associated with soil in the AOI. The following ecosystem services have been assessed in Sections 8.5.2 and 8.5.3:

- aggregates and topsoil
- soil quality
- water storage
- water flow control.

With the implementation of the planned mitigation measures, there are no predicted significant residual impacts on the above services.
### Table 8.5-1  Soil – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>M   D  E  S*  SS</td>
</tr>
</tbody>
</table>
| Use of raw materials and natural resources | Depletion of natural resources, for example, aggregate | C     | –                        | Waste management plan  
Natural resource management plan                                               | 2   2  1  1–3  6–8 |
| Soil compaction | Anaerobic conditions developing that restrict plant nutrient uptake efficiency and root development  
Loss of drainage capacity and poor plant establishment  
causing increased surface water ponding, runoff, soil erosion and decreased productivity | C     | –                        | Soil management plan  
Community health, safety and security plan                                      | 6   1  1  1–3  9–11 |
| Soil erosion | Loss of topsoil causing reduced fertility and impaired reinstatement              | C     | –                        | Soil management plan  
Community health, safety and security plan                                      | 6   4  1  1–3  12–14 |
|        |                                                                                  | O     |                          | Reinstatement plan  
Biodiversity management plan                                                      |                 |
| Loss of soil structure, fertility and seed bank | Development of anaerobic conditions in stored soil  
Mixing of different soil or soil with foreign materials leading to loss of drainage and fertility | C     | Y                        | Soil management plan                                                           | 2   2  1  1–4  6–9 |

**NOTES:** C= construction; O= operation; C&O= construction and operation; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity (which may be a range); SS= significance score; Y = stakeholder concern; Yes; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.5-1 Soil – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disturbance, treatment and management of contamination</td>
<td>Mobilisation of soil contaminants</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan Reinstatement plan</td>
<td>2 1 1 3 7</td>
</tr>
<tr>
<td>Management of waste and accidental release of oil or chemicals</td>
<td>Soil contamination</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan Waste management plan</td>
<td>2 1 1 3 7</td>
</tr>
<tr>
<td>Management of surplus subsoil and aggregate</td>
<td>Loss of soil structure, drainage, fertility and seed bank</td>
<td>C</td>
<td>–</td>
<td>Waste management plan</td>
<td>2 1 1 1–3 5–7</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity (which may be a range); SS= significance score; Y = stakeholder concern; Yes; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.5-2  Soil – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Activity</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>All locations sensitive to soil compaction</td>
<td>Soil compaction</td>
<td>Anaerobic conditions developing that restrict plant nutrient uptake efficiency and root development</td>
<td>C</td>
<td>–</td>
<td>Soil management plan, Community health, safety and security plan</td>
<td>6 1 1 4–5 12–13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Loss of drainage capacity and poor plant establishment causing increased surface water ponding, runoff, soil erosion and decreased productivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All locations sensitive to soil erosion</td>
<td>Soil erosion</td>
<td>Loss of topsoil causing reduced fertility and impaired reinstatement</td>
<td>C</td>
<td>–</td>
<td>Soil management plan, Community health, safety and security plan</td>
<td>6 4 1 5 16</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity (which may be a range); SS= significance score; Y = stakeholder concern; Yes; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
8.5.5 Transboundary Project Impacts
No transboundary project impacts were identified.

8.5.6 Cumulative Impacts
EACOP’s contribution to cumulative impacts on the soil VEC is negligible and no further mitigation measures other than those described in Section 8.5.3 are considered necessary.

8.6 Surface Water
This section describes potential impacts on surface water during construction, commissioning and operation of the EACOP project and associated mitigation measures to be adopted.

Appendices E2 and E3 include all pre-mitigation and post-mitigation generic and location-specific impacts. This includes two types of construction and operation impacts, those from construction facilities and those from the pipeline and AGIs. For impacts on surface water, the construction facility and pipeline and AGI impacts have been aggregated and are described as either construction or operation impacts. If a construction facility or pipeline and AGIs impact was greater than the other before the aggregation, the greater impact was applied. If a pre-mitigation or post-mitigation impact was determined to be significant, it is noted in the text when the other aggregated impact is not significant. All disaggregated impacts are included in Appendices E2 and E3.

8.6.1 Key Sensitivities and Considerations
The surface water baseline conditions are described in Section 6.4.2.2 as well as:

- surface water key valued environmental components (VEC) and their sensitivity ranking based on the relevant tables in Appendix D
- key considerations for the surface water impact assessment.

Sensitivity rankings for surface water range from very low to high. High sensitivities include:

- change in flow in the watercourse at KP748.2 that drains to the Nzega urban water-supply reservoir and in the Pangani River (KP1370.4) which provides water to Hale town and for hydropower generation at Hale and Pangani Falls
- change in river channel morphology and stability of the Kigosi (KP604.7) and Nawa Rivers (KP713.1), the floodplain at KP729 that drains to the Nzega urban water-supply reservoir, the ephemeral watercourses at KP796.7 and 813.6, the Kinkungu River (KP854.8), the Bubu River and its tributary (KP1044 and 1064 respectively) and the Mnyuzi River (KP1337.1)
- change in channel morphology and stability of some watercourses crossed by access roads or adjacent to construction facilities (see below)
- change in water quality and potential contamination of the permanent wetland from KP458.1 to 458.3, the floodplain from KP1208.6 to 1209.3 and the watercourse from KP1228.4 to 1229.5
• change in water quality and contamination of most watercourses crossed by access roads and adjacent to construction facilities.

Key considerations include:
• flow in watercourses
• river channel morphology and stability
• water and sediment quality and sensitivity to contamination.

Section 6.4.2.2 identifies ecosystem services associated with surface water in the EACOP area of influence (AOI). The regulation of flood flows and water quality ecosystem service is considered in this section.

Surface water also provides the following ecosystem services evaluated in other sections:
• provisioning of water for people, livestock and agriculture (see Section 8.13)
• supporting biodiversity (see Section 8.2).

8.6.2 Potential Project Impacts

8.6.2.1 Construction

Generic Impacts

Erosion

Impact: Erosion of river or channel banks, scour, sediment contamination of surface waters

Direct impacts from erosion-causing and sediment-generating activities may occur during construction, including from vegetation removal, topsoil stripping and benching (see soil VEC, Section 8.5.2).

When bare soil is exposed to rain splash, fine particles may seal the surface, reducing the infiltration rate below the rainfall rate, causing sheet overland flow and sheet soil erosion. Where sheet flow is concentrated, rills and gullies may be eroded. Where runoff from a site reaches a watercourse, the flow rate may increase above baseline conditions and sustained higher flow rates may increase channel bed and bank erosion, channel instability and suspended sediment.

Sediment suspended in runoff from construction areas may be transported to downstream VECs. It may also be released to watercourses during soil handling, using vehicles in watercourses and during the excavation of trenches for foundations and services (e.g., for water supply pipes).

Sediment reduces light levels within the water column and can therefore have an indirect impact on aquatic biodiversity (see biodiversity VEC, Section 8.2). High suspended sediment concentrations can also make watercourses unsuitable as drinking water sources. However, at watercourses where vegetation is present this will act as a sediment filter, reducing suspended sediment concentrations.

Activities with similar direct impacts, include the excavation of the pipeline trench, wet and dry open-cut watercourse crossings, and the excavation of trenches for building foundations and services.
Open-cut crossings may affect the stability of the bed and banks of watercourses formed in uncohesive alluvial material. Natural processes of channel erosion and deposition may be exacerbated, resulting in an indirect impact on agricultural land (see land-based livelihoods VEC, Section 8.13).

Many watercourses in the AOI are protected from erosion by riparian vegetation. The pre-mitigation impact for erosion and increased suspended sediment in watercourses during construction is considered not significant because of the small magnitude, short duration and local extent of the potential impact, even though surface water sensitivity is moderate to high.

The potential for increased erosion and suspended sediment to affect highly sensitive watercourses is identified in the location-specific section.

Management of Waste and Accidental Release of Oil or Chemicals

Impact: Contamination of surface water

There is the potential for direct impacts on surface water quality in receiving watercourses from the following sources:

- the management of solid and liquid waste generated during the construction process and MCPY operation
- the management of surplus water (trench water) from working areas
- the accidental release of oil or chemicals during construction.

The principal potential contaminants associated with the construction activities are:

- fuel and lubricating oils
- hazardous waste
- paints and solvents
- high pH runoff from concrete batching areas.

Surface water contamination may increase downstream substance concentrations with indirect impacts on water supplies for drinking and domestic use (see social VECs, Section 8.18), aquatic biodiversity (see biodiversity VECs, Section 8.2) and agricultural land (see land-based livelihoods VEC, Section 8.13).

Most rivers assessed have good water quality and therefore have moderate or high sensitivity to contamination depending on the density of settlement in their catchments. Most rivers are used as sources of water for washing, bathing, and watering of livestock.

The pre-mitigation impact for the management of liquid waste and surplus water, and the accidental release of oil or chemicals in watercourses during construction is considered not significant because of the small magnitude, transient duration and local extent of the potential impact.

The potential for contamination of highly sensitive watercourses is identified in the location-specific section.
Impeded Flow in Watercourses
Impact: Deterioration of water quality

During the construction of watercourse crossings, the contractor may need to temporarily impede flow. There is potential for direct impact on water quality, mainly because of downstream scour, which can increase turbidity and suspended-sediment concentrations with indirect impacts on water supplies for drinking and domestic use (see social VECs, Section 8.18), aquatic biodiversity (see biodiversity VECs, Section 8.2), channel morphology (see above) and possibly agricultural land (see land-based livelihoods VEC, Section 8.13).

Specific locations where flow may need to be impeded will be identified at the time of construction.

The pre-mitigation impact for water-quality deterioration at sites of impeded flow during construction is considered not significant because of the negligible magnitude, transient duration and local extent of the potential impact.

Altered Drainage Pattern
Impact: Trench can act as conduit for groundwater, draining higher areas and flooding lower areas

Surface flooding may occur in new areas if the drainage pattern is altered. This may occur where stockpiled soil redirects floodwaters from the normal flow direction. On sloping ground, the pipeline trench may intercept groundwater and alter drainage patterns.

Specific locations where the drainage pattern may be altered are not known.

The pre-mitigation impact for flooding from an altered drainage pattern during construction is considered not significant because of the negligible magnitude, short duration and local extent of the potential impact, and low sensitivity of the VEC.

Location-Specific Impacts
Erosion and Increased Suspended Sediment in Watercourses
Impact: Erosion of river or channel banks, scour, sediment contamination of surface waters

Location-specific impacts from erosion-causing and sediment-generating activities may occur during the construction phase, with the direct impacts described in the generic impact section above.

The baseline study (Appendix A6) identified the following watercourses crossed by the pipeline as being particularly sensitive to erosion:

- the Kigosi River (KP604.7)
- the Nawa River (KP713.1)
- the floodplain at KP729 draining to the Nzega urban water-supply reservoir
- ephemeral watercourses at KP739.8, 796.7 and 813.6
- the Kinkungu River (KP854.8)
- the Bubu River and its tributary (KP1044 and 1064 respectively)
• the Mnyuzi River (KP1337.1).

Open-cut crossings on these rivers may increase their lateral mobility (change in channel position through bed and bank erosion, and sediment deposition). This could increase the rate of cultivated-land loss (potentially impacting livelihoods of affected farmers).

Most watercourses crossed by access roads or adjacent to construction facilities have low to moderate sensitivity to change in morphology and stability. The baseline study identified the following watercourses crossed by roads or near construction facilities that were considered to have a high sensitivity to change:

• road KP0.2 on permanent access road (PAR) to pumping station (PS) 4 (PAR-PS4) at pipeline KP610
• ephemeral floodplain 500 m west of MCPY11 (KP914.7)
• road KP6.0 and 7.4 on the existing road upgrade (ERU) to MCPY12 at pipeline KP1037.7 (ERU-MCPY12)
• road KP0.46, 2.4, 3.1, 3.5, 3.9, 4.7, 6.4, 10.2 and 11.1 on ERU-MCPY13 (MCPY13 is at pipeline KP1143.6)
• ephemeral watercourse 100 m north of MCPY13 (KP1143.6)
• ephemeral watercourse 180 m south of MCPY15 (KP1318.1).
• road KP1.5 on ERU-PRS2 at pipeline KP1330.

These watercourses are formed in uncohesive sandy soils with riparian scrub vegetation and evidence of sheet or gully erosion.

The pre-mitigation impact for erosion and increased suspended sediment at the above locations during construction is considered not significant because of the medium magnitude, short duration and local extent of the potential impact.

Management of Waste and Accidental Release of Oil or Chemicals

Impact: Contamination of surface water

There is potential for direct impacts on surface water quality during the construction caused by the management of waste and accidental release of oil or chemicals with the direct impacts described in the generic impact section above.

This risk exists mainly at construction facilities due to the longer duration of construction activity at these locations than on the RoW. The baseline study identified the following watercourses crossed by the pipeline as being particularly sensitive to contamination:

• the permanent wetland at KP458.1–458.3
• the floodplain at KP1208.6–1209.3
• the watercourse at KP1228.4–1229.5.

The baseline study identified the following watercourses crossed by roads as being highly sensitive to contamination owing to the sparsely settled nature of their catchments and likely good water quality:

• PAR-PS3 (pipeline KP410)
• ERU-PS3 (road KP5.0 and 5.5)
• PAR-PS4 (road KP0.25)
• ERU-PRS2 (road KP1.1 and 1.5)
• ERU-MCPY6 at road KP3.5 and 5.9
• ERU-MCPY12 at road KP2.7, 4.1, 6.0 and 7.4
• ERU-MCPY13 at road KPO.46, 2.4, 3.1, 3.5, 3.9, 4.7, 6.4, 10.2 and 11.1
• ERU-MCPY14 at road KP7.3 and 11.4.

The baseline study also identified the following watercourses as being highly sensitive to contamination owing to the sparsely settled nature of their catchments and likely good water quality:

• the cultivated and uncultivated land at PS4, pipe coating facility, PS5, pressure reduction station (PRS) 1 and 2, and the marine storage terminal (MST)
• the ephemeral watercourses at PS3 and PS6
• the ephemeral floodplain 50 m east of MCPY5 (KP325.5)
• the ephemeral watercourses at the following locations:
  o 350 m south of MCPY10 (KP800)
  o 500 m west of MCPY11 (KP914.7)
  o 50 m east of MCPY12 (KP1037.7)
  o 100 m north of MCPY13 (KP1143.6)
  o 180 m south of MCPY14 (KP1237.5)
  o 400 m south of MCPY15 (KP1318.1)
  o 150 m northwest of MCPY16 (KP1403.5).

The pre-mitigation impact from the management of liquid waste and the accidental release of oil or chemicals in the above watercourses during construction is considered not significant because of the small magnitude, transient duration and local extent of the potential impact, even though surface water has a moderate to high sensitivity to contamination.

Impeded Flow in Watercourses

Impact: Deterioration of water quality

Direct impacts on surface water quality may occur where flow is impeded by the construction of access roads across watercourses. This can cause downstream scour, which can increase turbidity and suspended-sediment concentrations with indirect impacts on water supplies for drinking and domestic use (see social VECs, Section 8.18), aquatic biodiversity (see biodiversity VECs, Section 8.2), channel morphology (see above) and possibly agricultural land (see land-based livelihoods VEC, Section 8.13).

Flow will only be impeded where the minor ephemeral streams are crossed by access roads during times of flow.

The pre-mitigation impact for water quality deterioration at sites of impeded flow during construction is considered not significant because of the negligible magnitude, transient duration and site-based extent of the potential impact, even though surface water has a moderate to high sensitivity to contamination of the VEC.
Surface Water Use
Impact: Decreased water level due to abstraction for project use

During pre-commissioning, the pipeline will be hydrotested as described in Sections 2.4.4.2 and 2.4.4.3. Surface water abstraction could cause a reduction in water level, flow or volume, depending on the waterbody from which water is abstracted.

The plan will be to abstract water from a source large enough such that the withdrawal volumes requirements will be negligible, relative to the volume of water in the waterbody, such as Lake Victoria. Even though the impact is expected to have a negligible magnitude, transient duration, and very localised extent, in the absence of a defined water source, the significance of the impact of abstraction is indeterminable.

Hydrotest Water Disposal
Impact: Deterioration of water quality

Disposal of the hydrotest water may impact the quality of the receiving water, depending on the waterbody receiving the discharge.

Potential receiving surface locations or waterbodies will be identified in the above-noted hydrotest management plan. Even though the impact is expected to have a transient duration and localised extent, in the absence of a defined receiving waterbody, the significance of the impact of abstraction is indeterminable.

Location: Pangani River

Open-Cut Crossing on the Pangani River
Impact: Deterioration of water quality

The open-cut crossing of the perennial Pangani River (KP1370) may increase bed erosion. This may cause increased siltation of the intakes 9 km downstream at the Hale hydroelectric power station and water supply system, and 18 km downstream at the Pangani Falls hydroelectric power dam. Siltation could reduce the operability of the intakes, increase turbine-blade wear and increase water-treatment costs.

The pre-mitigation impact for the open-cut crossing of the Pangani River is considered not significant because of the transient duration and site-based extent of the potential impact, even though the impact is considered of large magnitude.

As described in Section 2.3.7 and 2.4.6.1, the land required for facilities will be leased from the government. When the construction phase has been completed and after decommissioning, the leases will be surrendered and some of the facilities, such as the MCPYs and CF may be transferred to the government with some structures left in place. Project related construction phase location-specific impacts will be managed by the generic mitigation described in Section 8.6.3; there will not be any project-related location-specific impacts to surface water once project related construction activities are concluded irrespective of whether the MCPYs and CF are retained by the government or reinstated.
8.6.2.2 Operation

**Generic Impacts**
Management of Waste and Accidental Release of Oil or Chemicals

Impact: Contamination of surface water

There is potential for a direct impact on surface water quality from the following sources:

- the management of solid and liquid waste generated during operations
- the management of black water (e.g., sewage) and grey water
- the accidental release of oil or chemicals during refilling of storage tanks, storage, handling of these materials and tank maintenance.

All the watercourses have good water quality and are therefore sensitive to contamination. Most rivers are used as sources of water for a predominantly rural population and their livestock.

Surface water contamination may increase downstream substance concentrations with indirect impacts on aquatic biodiversity (see biodiversity VECs, Section 8.2) and agricultural land (see land-based livelihoods VEC, Section 8.13).

The pre-mitigation impact from the management of liquid waste and the accidental release of oil or chemicals during operation is considered not significant because of the small magnitude, short duration and local extent of the potential impact.

**Location-Specific Impacts**
Management of Waste and Accidental Release of Oil or Chemicals

Impact: Contamination of surface water

Most of the watercourses crossed by the pipeline have a high sensitivity to change because their catchments are predominantly rural, sparsely populated and have contamination sources limited to agricultural and domestic use. Water quality is considered relatively good and therefore sensitive to change.

The following watercourses crossed by the pipeline and access roads were considered to have natural catchments and a very high sensitivity to change in water quality:

**Pipeline**
- the permanent wetland from KP458.1–458.3
- the floodplain from KP1208.6–1209.3
- the watercourse from KP1228.4–1229.5

**Roads**
- PAR-PS3 (pipeline KP410)
- ERU-PS3 (road KP5.0 and 5.5)
- PAR-PS4 (road KP0.25)
- ERU-PRS2 (road KP1.1 and 1.5).
The baseline study also identified the following likely drainage VECs at AGIs as being highly sensitive to contamination owing to the sparsely settled nature of their catchments and likely good water quality:

- the cultivated and uncultivated land at PS4, the pipe coating facility, PS5, PRS1 and PRS2, and the MST
- the ephemeral watercourses at PS3 and PS6.

The pre-mitigation impact for the management of liquid waste and the accidental release of oil or chemicals during operation is considered not significant because of the small magnitude, short duration and local extent of the potential impact.

### 8.6.3 Mitigation Measures

This section describes the impact avoidance and mitigation measures that will be applied to the aspects and activities that could affect surface water.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management plan and other measures that are included in Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.

#### 8.6.3.1 Design

Design, routing and siting measures to avoid or reduce project impacts on surface water are described in Sections 2.2, 2.3 and 2.4.

#### 8.6.3.2 Construction

**Generic Impacts**

**Erosion**

Impact: Erosion of river or channel banks, scour, sediment contamination of surface waters

The soil management plan and reinstatement plan will include procedures to reduce and control erosion and compaction through measures developed for soil handling and management, topsoil stripping and storage, sediment interception, a strategy for tree removal and replanting and progressive, active, habitat restoration where required. Additionally, location specific method statements for open-cut watercourse crossings will be prepared where necessary; requirements such as segregation of bed and bank material; retention of as much riparian vegetation as possible and maintaining environmental base flows downstream of water crossings will be included.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a local extent and short duration, although the magnitude is reduced to negligible.
Management of Waste and Accidental Release of Oil or Chemicals

Impact: Contamination of surface water

The soil management plan, reinstatement plan and the waste management plan will include measures that contribute to the management of impacts from waste management and accidental releases.

An environmental and social evaluation of treated effluent discharge locations will be undertaken; treated effluent which is not reused will be preferentially discharged to land. Grey water will be separated from black water, treated in accordance with the project environment standards, treated wastewater will be reused where possible or discharged as per permit conditions. Kitchen facilities will be fitted with industry standard grease traps. In the event of a spillage of hazardous materials a trained rapid response team will be mobilised to contain, clean and remediate spills. Spill response equipment will be available at all work sites. The storage of hazardous materials will be restricted to designated hazardous materials storage areas at least 50 m from surface waters; storage will be covered, bunded (no drainage valves/holes) and have impermeable floor. A refuelling procedure will be developed to address mobile and static refuelling, spill prevention techniques and training.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a local extent and transient duration, although the magnitude is reduced to negligible.

Impeded Flow in Watercourses

Impact: Deterioration of water quality

The biodiversity management plan, soil management plan and the pollution prevention plan will include measures that collectively contribute to the management of water quality deterioration.

Vehicles and equipment will cross watercourses after installation of appropriately sized temporary culverts and bridging structures. During open-cut river crossings, bed and bank material will be stored away from active water channels and, where necessary, river crossing method statements will be developed. Bathing or washing clothes, vehicles and equipment by project employees will be prohibited in watercourses.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a negligible magnitude and transient duration, although the extent is reduced to site based.

Altered Drainage Pattern

Impact: Trench can act as conduit for groundwater, draining higher areas and flooding lower areas

The reinstatement plan will describe where trench breakers will be installed in the pipeline trench.
Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a negligible magnitude and local extent, although the duration is reduced to transient.

**Location-Specific Impacts**

**Erosion and Increased Suspended Sediment in Watercourses**

Impact: Erosion of river or channel banks, scour, sediment contamination of surface waters

The generic mitigation for erosion described in Section 8.6.3.2 will contribute to the management of this impact; no additional mitigation is required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a short duration and local extent, although the magnitude is reduced to small.

**Management of Waste and Accidental Release of Oil or Chemicals**

Impact: Contamination of surface water

The generic mitigation addressing surface water contamination described in Section 8.6.3.2 will contribute to the control of this impact; no additional mitigation is required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a transient duration and local extent, although the magnitude is reduced to negligible.

**Impeded Flow in Watercourses**

Impact: Deterioration of water quality

The generic mitigation addressing deterioration of water quality described in Section 8.6.3.2 will contribute to the management of this impact; no additional mitigation is required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a transient duration and site-based extent, although the magnitude is reduced to medium.

**Surface Water Use**

Impact: Decreased water level due to abstraction for project use

The generic mitigation for decreased water level described in Section 8.6.3.2 will manage water level; no additional mitigation is required.

Water sources will be confirmed in the hydrotest management plan, a subplan of the water management plan which will be produced in later project phases. Mitigation measures for potential abstraction impacts will be developed and included in the hydrotest management plan. The mitigation measures will be submitted as part of the surface water abstraction permit application to the relevant water authority with jurisdiction over the planned water abstractions.
Even though the pre-mitigation impact is expected to have a negligible magnitude, transient duration, and very localised extent, as water sources are yet to be defined, with the mitigation measures in the hydrotest management plan the residual impact is expected to be not significant.

Hydrotest Water Disposal
Impact: Deterioration of water quality

The natural resource management plan, pollution prevention plan and hydrotest management plan will include procedures to manage hydrotest water disposal during construction.

Mitigation measures for potential impacts on water quality of receiving waters will be developed and included in the hydrotest management plan. Mitigation measures will be included in the application for discharge approval.

Even though the pre-mitigation impact is expected to have a negligible magnitude, transient duration, and very localised extent, as receiving water bodies are yet to be defined, with the mitigation measures in the hydrotest management plan the residual impact is expected to be not significant.

Open-Cut Crossing on the Pangani River
Impact: Deterioration of water quality

In addition to the generic mitigation addressing deterioration of water quality described in Section 8.6.3.2 the natural resource management plan and pollution prevention plan will include the following measure that will contribute to the management of the deterioration of water.

Open-cut river crossings will be undertaken during the dry season where possible; where not possible site-specific method statements will be developed addressing ecological sensitivities.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a transient duration and site-based extent, although the magnitude is reduced to medium.

8.6.3.3 Operation

Generic Impacts

Management of Waste and Accidental Release of Oil or Chemicals
Impact: Contamination of surface water

The pollution prevention plan, waste management plan and the emergency preparedness and response plan will include procedures to manage impacts from waste management and accidental release of oil or chemicals during operation.

In the event of a spillage of hazardous materials a trained rapid response team will be mobilised to contain, clean and remEDIATE spills. Spill response equipment will be available at all work sites. The storage of hazardous materials will be restricted to designated hazardous materials storage areas; storage will be covered, bunded
(no drainage valves/holes) and have impermeable floor. A refuelling procedure will be developed to address mobile and static refuelling, spill prevention techniques and training.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a short duration and local extent, although the magnitude is reduced to negligible.

**Location-Specific Impacts**

Management of Waste and Accidental Release of Oil or Chemicals

Impact: Contamination of surface water

The generic mitigation addressing contamination of surface water described in Section 8.6.3.2 will contribute to the management of accidental releases; no additional mitigation is required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a short duration and local extent, although the magnitude is reduced to negligible.

### 8.6.4 Residual Impacts and Significance Summary

This section summarises the residual impacts on surface water after mitigation measures have been implemented.

Table 8.6-1 summarises the potential generic surface water impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation. Table 8.6-2 summarises location-specific impacts.

#### 8.6.4.1 Generic Impacts

The residual impacts of the following are considered not significant after mitigation measures are implemented:

- erosion of river or channel banks, scour and surface water sediment contamination
- surface water contamination from waste management and the accidental release of oil or chemicals;
- water-quality deterioration owing to impeded flow in channels
- flooding due to altered drainage patterns.

#### 8.6.4.2 Location-Specific Impacts

The residual impacts of the following are considered not significant after mitigation measures are implemented:

**Construction**

Erosion and increased suspended-sediment concentrations in:

- the Kigosi River (KP604.7)
- the watercourse at road KP0.2 on PAR-PS4 (pipeline KP610)
- the Nawa River (KP713.1)
• the floodplain at KP729 draining to the Nzega urban water-supply reservoir
• ephemeral watercourses at KP739.8, 796.7 and 813.6
• the Kinkungu River (KP854.8)
• the watercourse at MCPY11 (KP914.7)
• the watercourse at PS6 (KP931.1)
• the watercourses at road KP6.0 and 7.4 on ERU-MCPY12 (pipeline KP1037.7)
• Bubu River and tributary (KP1044 and KP1064 respectively)
• the watercourses at road KP0.46, 2.4, 3.1, 3.5, 3.9, 4.7, 6.4, 10.2 and 11.1 on ERU-MCPY13 (pipeline KP1143.6)
• the watercourse at MCPY13 (KP1143.6)
• the watercourse at MCPY15 (KP1318.1)
• the watercourse at road KP1.5 on ERU-PRS2 (pipeline KP1330).
• the Mnyuzi River (KP1337.1).

Surface water contamination from the disposal of waste and the accidental release of oil or chemicals on:
• ERU-MCPY6 at road KP3.5 and 5.9
• ERU-MCPY12 at road KP2.7, 4.1, 6.0 and 7.4
• ERU-MCPY13 at road KP0.46, 2.4, 3.1, 3.5, 3.9, 4.7, 6.4, 10.2 and 11.1
• ERU-MCPY14 at road KP7.3 and 11.4
• the ephemeral floodplain at MCPY5 (KP325.5)
• PAR-PS3 at pipeline KP410
• ERU-PS3 at road KP5.0 and 5.5
• the ephemeral floodplains at PS3 (KP405.4), PS4 (KP610), the pipe coating facility (KP701), PS5 (KP824.9)
• the ephemeral watercourses at MCPY6 (KP419), MCPY10 (KP800), MCPY11 (KP914.7), MCPY12 (KP1037.7), MCPY13 (KP1143.6), MCPY14 (KP1237.5), MCPY15 (KP1318.1) and MCPY16 (KP1403.5)
• the permanent wetland from KP458.1–458.3
• PAR-PS4 at road KP0.25
• the ephemeral watercourses at PS6 (KP931.1), PRS1 (KP1171.5), PRS2 (KP1330)
• the floodplain from KP1208.6–1209.3
• the watercourse from KP1228.4–1229.5
• ERU-PRS2 at road KP1.1 and 1.5.

Derogation of the water resource for other users by abstraction of surface water for hydrotesting from:
• Lake Victoria.

Contamination of as yet unidentified watercourses through:
• the disposal of hydrotest water
• open-cut crossing of the Pangani River.
Operation

Surface water contamination from the disposal of waste and the accidental release of oil or chemicals at:

- the permanent wetland from KP458.1–458.3
- the floodplain from KP1208.6–1209.3
- the watercourse from KP1228.4–1229.5.

Contamination of surface water from the disposal of waste and the accidental release of oil or chemicals at:

- PAR-PS3 at pipeline KP410
- ERU-PS3 at road KP5.0 and 5.5
- PAR-PS4 at road KP0.25
- ERU-PRS2 at road KP1.1 and 1.5.
- the ephemeral floodplains at PS3 (KP405.4), PS4 (KP610), the pipe coating facility (KP701), PS5 (KP824.9)
- the ephemeral watercourses at PS6 (KP931.1), PRS1 (KP1171.5), PRS2 (KP1330)
- land (there is no watercourse) at the MST.

Surface water (runoff) contamination from the disposal of waste and the accidental release of oil or chemicals at the MST.
Table 8.6-1 Surface Water – Generic Impacts

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<th>Impact</th>
<th>Phase</th>
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<td>Management of waste and accidental release of oil or chemicals</td>
<td>C</td>
<td>Y</td>
<td>Soil management plan Reinstatement plan Waste management plan</td>
<td>2</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>O</td>
<td>Y</td>
<td>Pollution prevention plan Waste management plan Emergency preparedness and response plan</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Impeded flow of river or channel</td>
<td>C</td>
<td>Y</td>
<td>Biodiversity management plan Soil management plan Pollution prevention plan</td>
<td>2</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Altered drainage pattern</td>
<td>C&amp;O</td>
<td>Y</td>
<td>Reinstatement plan</td>
<td>2</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity (which may be a range); SS= significance score; Y = stakeholder concern; Yes; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.6-2  Surface Water – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>VEC</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kigosi River (KP604.7)</td>
<td>Erosion and increased suspended sediment in watercourses</td>
<td>Surface water</td>
<td>Erosion of river or channel banks, scour, sediment contamination of surface waters</td>
<td>C</td>
<td>-</td>
<td>Reinstatement plan</td>
<td>4 2 1 3 10</td>
</tr>
<tr>
<td>Nawa River (KP713.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Soil management plan</td>
<td></td>
</tr>
<tr>
<td>Floodplain (KP729) draining to the Nzega urban water-supply reservoir</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ephemeral watercourses (KP739.8, 796.7 and 813.6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kinkungu River (KP854.8)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Bubu River (KP1044)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Bubu tributary (KP1064)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mnyuzi River (KP1337.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Watercourse at MCPY11 (KP914.7), 13 (KP1143.6) and 15 (KP1318.1), PS1 (KP931.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

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Table 8.6-2  Surface Water – Location-Specific Impacts

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<tr>
<th>Location</th>
<th>Aspect</th>
<th>VEC</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERU-MCPY6 at road KP3.5 and 5.9. ERU-MCPY12 at road KP2.7, 4.1, 6.0 and 7.4 ERU-MCPY13 at road KP0.46, 2.4, 3.1, 3.5, 3.9, 4.7, 6.4, 10.2 and 11.1 ERU-MCPY14 at road KP7.3 and 11.4 Land at MCPY5, 10, and 14 Watercourses at MCPY6, 11, 12, 13, 15 and 16 Permanent wetland KP458.1–458.3 Floodplain KP1208.6–1209.3 Watercourse KP1228.4–1229.5. PAR-PS3 at pipeline KP410 ERU-PS3 at road KP5.0 and KP5.5 PAR-PS4 at road KP0.25 ERU-PRS2 at road KP1.1 and KP1.5. Land at PS4, pipe coating facility, PS5, PRS1 and 2, and MST Watercourses at PS3 and 6</td>
<td>Management of waste and accidental release of oil or chemicals</td>
<td>Surface water</td>
<td>Contamination of surface water</td>
<td>C</td>
<td>Y</td>
<td>Soil management plan Reinstatement plan Waste management plan</td>
<td>2</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity (which may be a range); SS= significance score; Y = stakeholder concern; Yes; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.6-2  Surface Water – Location-Specific Impacts

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<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAR-PS4 (KP610) at road KP0.2</td>
<td>Impeded flow in watercourses</td>
<td>Surface water</td>
<td>Deterioration in surface water quality</td>
<td>C</td>
<td>-</td>
<td>Biodiversity management plan&lt;br&gt;Soil management plan&lt;br&gt;Pollution prevention plan</td>
<td>4 2 1 3 10</td>
</tr>
<tr>
<td>ERU-PRS2 (KP1330) at road KP1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>To be determined</td>
<td>Surface Water Use</td>
<td></td>
<td>Decreased water level due to abstraction for project use</td>
<td>C</td>
<td></td>
<td>Biodiversity management plan&lt;br&gt;Natural resource management plan</td>
<td></td>
</tr>
<tr>
<td>To be determined</td>
<td>Hydrotest Water Disposal</td>
<td></td>
<td>Deterioration of water quality</td>
<td>C</td>
<td></td>
<td>Pollution prevention plan</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:** C= construction; O= operation; C&O= construction and operation; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity (which may be a range); SS= significance score; Y = stakeholder concern; Yes; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
Table 8.6-2  Surface Water – Location-Specific Impacts

<table>
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<tr>
<th>Location</th>
<th>Aspect</th>
<th>VEC</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
</table>
| Pangani River (KP1370) | Open-cut crossing | Surface water     | Deterioration in water quality    | C     | -                        | Reinstatement plan  
Soil management plan  
Natural resource management plan  
Pollution prevention plan | 6 1 1 3 11      |

NOTES: C= construction; O= operation; C&O= construction and operation; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity (which may be a range); SS= significance score: Y = stakeholder concern; Yes; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.

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8.6.5 Transboundary Project Impacts
No transboundary project impacts were identified.

8.6.6 Cumulative Impacts
EACOP’s contribution to cumulative impacts on the surface water VEC is negligible and no further mitigation measures other than those described in Section 8.6.3 are considered necessary.

8.7 Groundwater
This section describes potential impacts on groundwater during construction, commissioning and operation of the EACOP project and the associated mitigation measures to be adopted.

Appendices E2 and E3 include all pre-mitigation and post-mitigation generic and location-specific impacts. This includes two types of construction and operation impacts, those from construction facilities and those from the pipeline and AGIs. For impacts on groundwater, the construction facility and pipeline and AGI impacts have been aggregated and are described as either construction or operation impacts. If a construction facility or pipeline and AGIs impact was greater than the other before the aggregation, the greater impact was applied. If a pre-mitigation or post-mitigation impact was determined to be significant, it is noted in the text when the other aggregated impact is not significant. All disaggregated impacts are included in Appendices E2 and E3.

8.7.1 Key Sensitivities and Considerations.
The groundwater baseline conditions are described in Section 6.4.2.3, as well as:

- groundwater key valued environmental components (VEC) and their sensitivity ranking based on the relevant table in Appendix D.
- key considerations for the groundwater impact assessment.

In all regions crossed by the pipeline groundwater is ranked as very highly sensitive, based on the quality of the water and because it is used for drinking and domestic purposes. However, based on vulnerability of the aquifers the sensitivity of groundwater varies from moderate to very high. This impact assessment has applied the vulnerability criteria to the sensitivity ranking to distinguish between aquifers along the route. The location specific impacts have only included VECs that are ranked as either high or very high in sensitivity for vulnerability.

A key consideration is that groundwater is an important ecosystem service.
8.7.2 Potential Project Impacts

8.7.2.1 Construction Phase

Generic Impacts

Management of Waste and Accidental Release of Oil or Chemicals

Impact: Contamination of groundwater

Potential direct impacts on groundwater quality may occur due to the storage, transportation, treatment and disposal of solid and liquid waste, chemicals and fuel. These impacts on groundwater quality may lead to indirect impacts associated with the need to use alternative water sources or restricted access to existing sources such as increased costs with consequent impacts on livelihoods (see socio-economic and health VECs, Section 8.13).

The pre-mitigation impact of waste management and accidental release of oil or chemicals during construction is considered not significant because the magnitude is negligible, the duration is transient and the extent is site based.

Location-Specific Impacts

Location: All MCPYs, CF, PS3, PS4, PS5, PS6, PRS2 and MST

Management of Waste and Accidental Release of Oil or Chemicals

Impact: Contamination of groundwater

Potential direct impacts on groundwater quality may occur due to the storage, transportation, treatment and disposal of solid and liquid waste, chemicals and fuel. These impacts on groundwater quality may lead to indirect impacts associated with the need to use alternative water sources or restricted access to existing sources such as increased costs with consequent impacts on livelihoods (see socio-economic and health VECs, Section 8.13).

The sensitivity ranking based on vulnerability, based on the ground conditions (permeability) and depth to the water table, is very high for PS3 and PS5, MCPY5, 6, 7, 8, 9, 10, 14, 15 and 16 and the CF, and high for PS6 and MCPY11. MCPY12 and 13 are ranked as moderate.

The pre-mitigation impact for the management of waste and accidental release of oil or chemicals during construction is considered not significant because the magnitude of the impact is ranked as small, the duration is transient and the extent is the site.

Location: All MCPYs and CF

Management of Black and Grey Water

Impact: Contamination of groundwater

Black water is waste water from bathrooms and toilets that contains faecal matter and urine. Also called sewage or brown water, it can carry disease-causing bacteria
that are harmful to humans. Grey water is waste water that comes from sinks, washing machines, bathtubs and other site activities.

Black water from camp facilities used during the development of the MCPYs and grey water from vehicle washdown areas, roads and hardstanding will be produced and will be treated and disposed of as outlined in the project description (see Section 2). Potential direct impacts on groundwater quality may occur through inappropriate disposal practices such as the use of pit latrines. This may lead to indirect impacts on other groundwater users, including the need to use alternative water sources or restricted access to existing sources with consequent increased costs and impacts on livelihoods (see socio-economic and health VECs, Section 8.13).

The sensitivity ranking based on vulnerability, based on the ground conditions (permeability) and depth to the water table, is very high for MCPY5, 6, 7, 8, 9, 10, 14, 15 and 16 and the CF, and high for MCPY11. MCPY12 and 13 are ranked as moderate.

The pre-mitigation impact for the management of black and grey water during construction is considered not significant because the magnitude of the impact is ranked as small, the duration is transient and the extent is local.

**Location: All MCPYs and CF**

**Abstraction of Groundwater**

Impact: Decreased water level due to abstraction for project use

The abstraction of groundwater to supply MCPYs may have a direct impact on the water table near the well through drawdown, which may have an indirect impact on the yield of nearby boreholes and wells. In all the districts that the pipeline traverses, groundwater is the most important source of public water supply, so abstraction in districts where MCPYs are located may indirectly affect communities (see socio-economic and health VECs, Section 8.18) and ecosystems (see biodiversity VECs, Section 8.2).

The pre-mitigation impact for the abstraction of groundwater during construction, based on currently available information on the planned abstraction is ranked as not significant because for all MCPYs the magnitude is ranked as small, the duration is transient, and the extent is local.

As described in Section 2.3.7 and 2.4.6.1, the land required for facilities will be leased from the government. When the construction phase has been completed and after decommissioning, the leases will be surrendered and some of the facilities, such as the MCPYs and CF may be transferred to the government with some structures left in place. Project-related construction-phase location-specific impacts will be controlled by the generic mitigation described in Section 8.6.3. It is expected pumps and power supply will be removed and the wells decommissioned; there will not be any project-related location-specific impacts to groundwater once project related construction activities are concluded irrespective of whether the MCPYs and CF are retained by the government or reinstated.
8.7.2.2 Project Operation

**Generic Impacts**

It is considered that there are no potential generic impacts from normal operation. The impacts from abnormal operations and unplanned events are described in Section 9.

**Location-Specific Impacts**

**Location: PS3, PS4, PS5, PS6, PRS1, PRS2 and MST**

Management of Waste and Accidental Release of Oil or Chemicals

Impact: Contamination of groundwater

Direct impacts on groundwater quality may occur from the management of solid and liquid waste and accidental releases during the operation of the AGIs and MST. The MST, PS3, PS4, PS5 and PRS2 are ranked as very high in sensitivity based on vulnerability and PS6 is high. PRS1 is ranked as moderate.

The pre-mitigation impact of waste management and accidental release of oil or chemicals during AGI and MST operation is considered not significant because the magnitude of the above impact is ranked as small, the duration short and the extent is site based.

**Location: PS3, PS5 and MST**

Abstraction of Groundwater

Impact: Decreased water level due to abstraction for project use

Direct impacts on groundwater availability may occur from the abstraction of groundwater at the AGIs and the MST. The magnitude rankings are based on potential reductions to local groundwater elevations and water scarcity at the location in question (see surface water baseline, Section 6.4.2.2). At the AGI and MST locations, the magnitude is ranked as:

- small at the MST (low water scarcity)
- medium at PS3 (moderate water scarcity)
- small at PS5 (low water scarcity).

The pre-mitigation impact for abstraction is ranked as not significant at the MST, PS3 and PS5 because the impact magnitude is ranked as small for the MST and PS5 and medium for PS3, the duration long, and the extent local.

8.7.3 Mitigation Measures

This section describes the impact avoidance and mitigation measures that will be applied to the aspects and activities that could affect groundwater.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management
plan and other measures that are included Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.

8.7.3.1 Design
Design, routing and siting measures to avoid or reduce project impacts on groundwater are described in Sections 2.2, 2.3 and 2.4.

8.7.3.2 Construction

Generic Impacts
Management of Waste and Accidental Release of Oil or Chemicals
Impact: Potential for groundwater contamination if disposal is uncontrolled
The waste management plan, pollution prevention plan and natural resource management plan will include measures that collectively contribute to the management of impact from the management of solid and liquid waste and accidental releases.

Grey water will be separated from black water, treated in accordance with the project environment standards, treated wastewater will be reused where possible or discharged as per permit conditions. Kitchen facilities will be fitted with industry standard grease traps. The waste management plan will identify requirements for waste collection, storage, transfer and disposal. An environmental and social evaluation of treated effluent discharge locations will be undertaken; treated effluent which is not reused will be discharged to land.

In the event of a spillage of hazardous materials a trained rapid response team will be mobilised to contain, clean and remEDIATE spills. Spill response equipment will be available at all work sites. The storage of hazardous materials will be restricted to designated hazardous materials storage areas at least 50 m from surface waters; storage will be covered, bunded (no drainage valves/holes) and have impermeable floor. A refuelling procedure will be developed to address mobile and static refuelling, spill prevention techniques and training.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a site-based extent, transient duration and negligible magnitude.

Location-Specific Impacts

Location: All MCPYs, CF, PS3, PS4, PS5, PS6, PRS2 and MST
Management of Waste and Accidental Release of Oil or Chemicals
Impact: Contamination of groundwater
The pollution prevention plan, waste management plan and the emergency preparedness and response plan will include measures to manage solid and liquid waste and accidental releases during construction; relevant measures are outlined above.
Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a transient duration and site-based extent, although the magnitude will be reduced to negligible.

**Location: All MCPYs and CF**

**Management of Black and Grey Water**

Impact: Contamination of groundwater

The waste management plan and the pollution prevention plan will include measures that collectively contribute to the management of impact from management of black and grey water.

Grey water will be separated from black water, treated in accordance with the project environment standards, treated wastewater will be reused where possible or discharged as per permit conditions. Kitchen facilities will be fitted with industry standard grease traps. Contingency will be provided for wastewater treatment plant maintenance.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a transient duration and site-based extent, although the magnitude will be reduced to negligible.

**Abstraction of Groundwater**

Impact: Decreased water level due to abstraction for project use

The natural resource management plan and hydrotest management plan will describe measures that will be undertaken to evaluate the potential impact on local groundwater abstraction points, such as the undertaking of hydrogeological evaluations; if significant impacts are predicted by these evaluations then alternative borehole locations will be considered; the water quality and sustainability of water abstracted from either new or existing boreholes will be monitored.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a transient duration and site-based extent, although the magnitude will be reduced to negligible.

### 8.7.3.3 Project Operation

**Location-Specific Impacts**

**Location: PS3, PS4, PS5, PS6, PRS1, PRS2 and MST**

**Management of Waste and Accidental Release of Oil or Chemicals**

Impact: Potential for groundwater contamination

The natural resource management plan will describe the stormwater drainage to be provided at aboveground installations. The pollution prevention plan and waste management plan will include measures to manage solid and liquid waste and
accidental release of oil and chemicals. The waste management plan will identify requirements for waste collection, storage, transfer and disposal.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a transient duration and site-based extent, although the magnitude will be reduced to negligible.

**Location: PS3, PS5 and MST**

**Abstraction of Groundwater**

Impact: Decreased water level due to abstraction for project use

The generic mitigation for decreased water level described in Section 8.7.3.2 will contribute to the management of abstraction of groundwater; no additional mitigation is required.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a long duration and local extent, although the magnitude will be reduced to negligible.

### 8.7.4 Residual Impacts and Significance Summary

This section summarises the residual impacts on groundwater after mitigation measures have been implemented.

Table 8.7-1 summarises the potential generic groundwater impacts, the proposed mitigation measures and the significance of the residual impacts after mitigation. Table 8.7-2 summarises the location-specific impacts.

The residual impact of the following is considered not significant after the mitigation measures are taken into account:

- management of solid and liquid waste
- management of black and grey water
- abstraction of groundwater
- accidental release of oil or chemicals.

The pre-mitigation measure impacts of groundwater abstraction during the operation of AGIs were ranked as significant at PS4, PS6 and at both PRS locations. The implementation of the mitigation measures stated above should reduce the magnitude of the impact to negligible (no reduction in water levels within the likely area of influence of planned project abstractions). The residual impacts are, therefore, not significant.
### Table 8.7-1  Groundwater – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>VEC</th>
<th>Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management of waste and accidental release of oil or chemicals</td>
<td>Groundwater</td>
<td>Potential for groundwater contamination</td>
<td>C&amp;O</td>
<td>–</td>
<td>Waste management plan, Pollution prevention plan, Natural resource management plan, Emergency preparedness and response plan</td>
<td>2   1  1–2  5  9–10</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity (which may be a range); SS= significance score; Y = stakeholder concern; Yes; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.7-2  Groundwater – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>VEC</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>All MCPYs and CF</td>
<td>Management of black and grey water</td>
<td>Groundwater</td>
<td>Contamination of groundwater</td>
<td>C</td>
<td>Y</td>
<td>Pollution prevention plan</td>
<td>2 1 1 4–5 8–9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Waste management plan</td>
<td></td>
</tr>
<tr>
<td>All MCPYs, CF, PS3, PS4,</td>
<td>Management of waste and accidental release of oil or chemicals</td>
<td>Groundwater</td>
<td>Contamination of groundwater</td>
<td>C</td>
<td>Y</td>
<td>Waste management plan</td>
<td>2 1 1 4–5 8–9</td>
</tr>
<tr>
<td>PS5, PS6, PRS1, PRS2 and</td>
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</tr>
<tr>
<td>MST</td>
<td></td>
<td></td>
<td></td>
<td>O</td>
<td>Y</td>
<td>Natural resource management plan</td>
<td>2 4 1 4–5 11–12</td>
</tr>
<tr>
<td>All MCPYs and CF</td>
<td>Abstraction of groundwater</td>
<td>Groundwater</td>
<td>Decreased water level due to water abstraction for project use</td>
<td>C</td>
<td>Y</td>
<td>Natural resource management plan</td>
<td>2 1 1 5 9</td>
</tr>
<tr>
<td>PS3, PS5 and MST</td>
<td>Abstraction of groundwater</td>
<td>Groundwater</td>
<td>Decreased water level due to water abstraction for project use</td>
<td>O</td>
<td>Y</td>
<td>Natural resource management plan</td>
<td>2 4 2 5 13</td>
</tr>
</tbody>
</table>

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8.7.5 Transboundary Project Impacts

No transboundary project impacts were identified.

8.7.6 Cumulative Impacts

No cumulative impacts have been identified at the time of writing.

8.8 Landscape

This section describes potential impacts on landscape and views during construction, commissioning and operation of the EACOP project, and the associated mitigation measures to be adopted.

Appendices E2 and E3 include all pre-mitigation and post-mitigation generic and location-specific impacts. This includes two types of construction and operation impacts, those from construction facilities and those from the pipeline and AGIs. For impacts on landscape, the construction facility and pipeline and AGI impacts have been aggregated and are described as either construction or operation impacts. If a construction facility or pipeline and AGI impact was greater than the other before the aggregation, the greater impact was applied. If a pre-mitigation or post-mitigation impact was determined to be significant, it is noted in the text when the other aggregated impact is not significant. All disaggregated impacts are included in Appendices E2 and E3.

8.8.1 Key Sensitivities and Considerations

The landscape baseline conditions are described in Section 6.4.2.4 as well as:

- landscape, seascape and visual sensitivity ranking based on Table D15, Appendix D
- key considerations for the landscape and visual impact assessment.

Landscape and seascape sensitivity has been ranked according to the key characteristics and value placed on them. Areas of biodiversity value were considered, as these areas may be associated with features of higher landscape sensitivity, such as having a greater degree of naturalness and absence of modern infrastructure.

Visual sensitivity is associated with receptors that have a particular interest in their surroundings, such as tourists, or views that are associated with features of aesthetic, cultural or religious importance.

Key considerations are:

- PS3, moderate landscape sensitivity within a natural tree and scrub landscape with little human influence
- KP420.5–KP469, moderate or high landscape sensitivity within the Ruiga River Forest Reserve and Burigi-Biharamulo Game Reserve
- KP1082–KP1106, moderate landscape sensitivity within a natural scrub, tree and rock landscape with little human influence
- PRS1, high landscape sensitivity within the Talamai Open Area
• the MST and LOF, high landscape and seascape sensitivity within the Tanga Bay area
• part of the AOI of MC and PY 13 is within the Talamai Open Area of high landscape sensitivity
• other permanent and temporary facilities are situated in low sensitivity landscapes

Receptors of high visual sensitivity were limited to the tourist area at Tanga and the marine areas used by tourists. No view of features of aesthetic, cultural or religious importance or tourist attractions, except Tanga, were identified by stakeholders.

Landscape is recognised for having the potential to provide cultural ecosystem services, including nonmaterial benefits from the sense of wellbeing and value provided to people by living in an attractive environment. However, stakeholders did not perceive proposed project infrastructure as negative visual intrusions in the landscape (see Section 7.6.2) and none of the areas attract tourists, except for Tanga.

8.8.2 Potential Project Impacts

8.8.2.1 Construction

Generic Impacts

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character and views caused by project components

During construction, the RoW will be cleared of vegetation, stripped of topsoil and construction plant and machinery will be visible, which will have a direct impact on the landscape and visual receptors. Tree removal will be confined to small sections of tree lines and small areas; no large-scale tree removal is required except for KP420.5–KP469, see below.

When construction is complete, agricultural areas will be reinstated as grassland and non-agricultural areas will be reinstated using natural revegetation to avoid the introduction of invasive species, see Section 2.3.7.1 and 2.4.3.4. Landscape and visual impacts will therefore be short term during construction and for the period afterwards required to re-establish vegetation cover. The magnitude will be small, the extent local and therefore landscape and visual pre-mitigation impacts will be not significant.

Disposal of Surplus Subsoil and Aggregate

Impact: Permanent change of views from disposal of surplus subsoil and aggregate

There may be a direct permanent impact (small magnitude, permanent, local, not significant) from the disposal of excess subsoil created by trench excavation, if imported fill is needed to pad the pipe. However, this can normally be spread without creating any visual impact within the RoW before the topsoil is replaced. Any excess will be disposed as waste off-site.
There may be a direct impact (small magnitude, permanent, local, not significant pre-mitigation) from the disposal of surplus aggregate during the decommissioning of construction facilities.

**Location-Specific Impacts**

**Location: RoW KP420.5–KP469**

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character due to tree removal in RoW within Ruiga River Forest Reserve and Burigi-Biharamulo Game Reserves

Impact: Change of views due to tree removal in RoW within Ruiga River Forest Reserve and Burigi-Biharamulo Game Reserves

Tree removal will be required within Ruiga River Forest Reserve and Burigi-Biharamulo Game Reserves (KP420.5–KP469), which will have a direct impact on the landscape and visual receptors. The RoW is characterised by landscape of moderate or high natural scenic qualities and therefore of high landscape sensitivity. The magnitude of impact will be medium as there will be restoration to natural vegetation, although to avoid tree roots affecting the integrity of the pipeline it will not be possible for all trees along the RoW to be replaced. Owing to the local extent and short-term duration, the pre-mitigation impact on landscape will be not significant.

The population is widely dispersed, and areas of habitation are limited to small, quiet agricultural settlements and isolated farms accessed by unsealed roads, so the number of visual receptors is limited. Visibility of the proposed work is limited to a 1-km radius, although vegetation often screens views. Owing to the short-term duration and small magnitude, the pre-mitigation impact on visual receptors is considered not significant.

**Location: KP1082 to KP1106**

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character due to blasting in an area of natural scenic value

Impact: Change of views due to blasting on views from small settlements, farms and unsealed roads

Blasting will be required to create the pipeline trench between KP1082 and KP1106 in areas of hard surface rock which cannot be excavated by machinery. This will have a direct, permanent landscape impact because the reinstated trench line will be flat and the blasting will create excess rock. The landscapes are associated with natural scrub, tree and rock scenic features and have been assessed as being of moderate landscape sensitivity. Combined with the small magnitude and local extent, the pre-mitigation landscape impacts will not be significant.

The area is remote, with a widely dispersed population. There are no large settlements in the AOI and habitation is limited to small, quiet agricultural settlements and isolated farms surrounded by grazing land, so the number of visual
receptors is limited. Visibility of the proposed work is limited to the local area. Visual impacts on the dispersed population will therefore be of small magnitude and not significant pre-mitigation.

**Location: Side Slope Areas with Permanent Benching**

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character due to permanent benching of RoW in side slope areas

Impact: Change of views in areas of permanent benching of RoW in side slope areas affecting views from small settlements, farms and unsealed roads

The RoW will need to be benched on side slopes to create a safe working area for construction. The impacts will mostly be short term, as most of the RoW will be reinstated to original profiles and natural vegetation. However, on some steep slopes it may not be possible to completely reinstate the RoW to pre-existing profiles and there will be a permanent landscape impact.

Precise locations and reinstatement plans will be defined in subsequent development phases. Landscape or visual impacts experienced because of permanent benching, due to the small magnitude and local nature of the impacts, are considered not significant pre-mitigation.

**Location: Main Camps and Pipe Yards and Coating Facility**

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character due to site clearance and fencing for construction camp affecting landscape character

Impact: Change of landscape character due to operation and reinstatement of construction camp affecting landscape character

Impact: Change of views due to site clearance and fencing of construction camps affecting views from small towns, other settlements, farms and roads

Impact: Change of views due to operation and reinstatement of construction camps affecting views from small towns, other settlements, farms and roads

MCPY construction will include the removal of vegetation, topsoil stripping, fencing and construction of MCPY buildings and facilities, and will have a direct impact on the landscape and visual receptors. The AOIs for MCPYs 5, 7, 8, 10, 11, 15 and 16 are not in any sensitive landscapes.

The AOIs of MCPY 6, 9, 12, 13 and 14, and the CF contain landscapes identified to have biodiversity value that could be expected to be of high landscape sensitivity for their natural scenic qualities. However, except for MC and PY13 (Talamai Open Area), all the areas of biodiversity value have been encroached on by agriculture and have experienced habitat loss and degradation so are of low landscape sensitivity.

The landscape of MC and PY13 is intact within the AOI and is of high sensitivity; however, bushland and trees screen views of MC and PY13 from the Talamai Open Area...
Area. Combined with the small to medium magnitude and short-term duration, the pre-mitigation impacts for all of the MCPYs is considered not significant.

Visual receptors are users of:

- main roads and small towns for MCPYs 5, 8, 10, 11, 15 and 16
- unsealed roads, farms and small settlements for MCPYs 6, 7, 9, 12, 14 and the CF
- unsealed roads for MCPY13.

All visual receptors have been assessed as being of low sensitivity because:

- there will generally be limited views of plant and machinery, the stripped working area and construction activity from settlements, farms and roads
- stakeholders did not perceive proposed project infrastructure as negative visual intrusions in the landscape (see Section 7.6.2).

Where viewed, these will be of small magnitude and short-term duration and pre-mitigation visual impacts will therefore be not significant pre-mitigation.

As described in Section 2.3.7 and 2.4.6.1, the land required for facilities will be leased from the government. When the construction phase has been completed, and after decommissioning, the leases will be surrendered. Some of the facilities, such as the camps, after the construction phase, may be transferred to the government with some structures left in place, except MCPY12 and MC13 which will be fully decommissioned and actively revegetated. The government may convert the structures into community facilities and manage them on behalf of the host communities.

Therefore, the impacts of two options have been assessed:

- MCPY and CF reinstatement after the construction phase. This option is assessed as short-term impact, as the land would be reinstated to a capability similar to that which existed before pipeline construction. Owing to the short-term duration and small magnitude, the pre-mitigation impact on landscape and visual receptors is considered not significant.
- MCPY and CF transfer to the Government with some structures left in place, see Section 8.8.2.2, except MCPY12 and MC13.

**Location: Pumping Stations, Pressure Reduction Stations, Marine Storage Terminal and Load-out Facility**

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character due to construction and commissioning of the AGIs, MST and LOF.

Impact: Change of views due to construction and commissioning of the AGIs, MST and LOF

The PS, PRS, MST and LOF have been located to limit the extent of impact within more sensitive landscapes and seascapes. Naturally scenic landscapes and seascapes that are of high landscape sensitivity have been identified at:

- PRS1, high landscape sensitivity within the Talamai Open Area
- the MST and LOF, high seascape sensitivity within the Tanga Bay area.
PS3 is in an area of natural scenic value of moderate landscape sensitivity. No significant pre-mitigation landscape or seascape impacts will be experienced during these facilities’ construction due to the short term and local nature of the construction phase.

Stakeholders did not perceive proposed project infrastructure as negative visual intrusions in the landscape (see Section 7.6.2). All visual receptors are assessed as being of low sensitivity except for views from within the Tanga Bay area, which are assessed as being of high visual sensitivity due to the value that tourists place on views. Owing to the short-term duration and local extent, the pre-mitigation visual impacts are considered not significant.

Other AGIs (electric substations and block valves) were screened out of the impact assessment due to their small size and not significant landscape and visual effects).

8.8.2.2 Operation

Generic Impacts

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character and views caused by project components

There will be a permanent change of land use on the RoW from crop land to grassland in agricultural areas during the operational phase of the project (see Section 2.4.3.4). This will have a direct biodiversity benefit and a not significant landscape or visual impact, due to the low sensitivity of receptors, small magnitude and local extent of the impact.

Location-Specific Impacts

Location: Main Camps and Pipe Yards and Coating Facility

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character due to retention of part of the construction camp by government affecting landscape character

Impact: Change of views due to retention of part of the construction camp by government, affecting views from small towns, other settlements, farms and roads

This option is assessed as long-term impact as permanent buildings are left in place. Other project components that are no longer required will be removed. The MCPYs, except MCPY12 and MC13, will therefore have permanent landscape and visual impacts, but the low-level buildings retained will be of small magnitude and the sensitivity of all landscapes impacted is low except for PY13 which is close to the Talamai Open Area, where the magnitude is medium and the sensitivity is high. The pre-mitigation landscape and visual impacts associated with the remaining buildings will be local in extent and not significant, including for PY13.
Location: Pumping Stations, Pressure Reduction Stations, Marine Storage Terminal and Load-out Facility

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character due to operation of the AGIs, MST and LOF

Impact: Change of views due to operation of the AGIs, MST and LOF

Views and landscape character will be modified at the PSs and PRSs for the project life span (approximately 25 years). The sites will comprise low-level equipment, single storey buildings and a communications tower that may be approximately 100 m high, see Section 2.3.3.2. Landscapes are assessed as being of low sensitivity at PS4, PS5, PS6 and PRS2 as they are characterised by farmland and grazing land and so not considered particularly wild or scenic. As PS3 is in a landscape that is characterised by scrubland and forest that has not been substantially modified by human activity, it retains much of its natural character and is considered of moderate landscape sensitivity. Owing to the local extent, the pre-mitigation permanent landscape impacts for these five sites are considered not significant.

Visual receptors at the PSs are mainly farms, small villages and road users, which are all low sensitivity. Visibility of the proposed AGIs is summarised as follows and figures showing views toward the PSs are included in Appendix A8:

- **PS3:**
  - 0–1-km radius: some views of PS3, but often screened by vegetation
  - 1–3-km radius: views limited to the taller elements of PS3, such as the communications antenna, except for views from the ridge to the east
  - 3–5-km radius: views limited to the taller elements of PS3, with exception of views from the ridge to the north

- **PS4:**
  - 0–1-km radius: some views of the AGI, but often screened by vegetation
  - 1–3-km radius: views limited to glimpses of the communications antenna
  - 3–5-km radius: views limited to distant glimpses of the communications antenna

- **PS5:**
  - 0–1-km radius: open views from scattered farms over the flat and sparsely vegetated landscape
  - 1–3-km radius: views predominantly open, with some views of the taller elements of the AGI from the outskirts of Mkomero, Buyumba and the B3 road
  - 3–5-km radius: distant views of the taller elements of the AGI from the outskirts of Igunga and Mwanzugi (Mwamaganga)

- **PS6:**
  - 0–1-km radius: views from scattered farms, although partially screened by undulating land and scrub vegetation
  - 1–3-km radius: views limited to the taller elements of the AGI, primarily the communications tower
  - 3–5-km radius: views limited to distant glimpses of the communications tower from the south
• PRS2:
  o 0–1-km radius: views, but often screened by hills and vegetation
  o 1–3-km radius: views limited to the taller elements of the AGI
  o 3–5-km radius: views limited to the taller elements of the AGI.

Permanent visual impacts will be small magnitude. Owing to the low sensitivity of the receptors and the local extent of the impact, the pre-mitigation impact is considered not significant.

PRS1 (KP1172) is in the gently undulating landscape of the Talamai Open Area which contains large areas of intact natural habitat. This is a typical savannah landscape characterised by scrub, woodland and grassland. The area is remote, with a widely dispersed population and no larger settlements. The landscape is assessed as being of high sensitivity and permanent landscape impacts will be medium in magnitude. However, due to the local extent of the impact, the pre-mitigation impact is considered not significant. Visibility of the proposed PRS1 is summarised as follows and figures showing views toward the PRSs are included in Appendix A8:

• 0–1-km radius: views, but partially screened by scrub vegetation and undulating land
• 1–3-km radius: views of the taller elements of the AGI, from the northwest through to the east, with other views screened by undulating land
• 3–5-km radius: distant views of the taller elements of the AGI from higher ground to the northwest and east.

Permanent visual impacts at PRS1 will be small in magnitude. Owing to the low sensitivity of the receptors and the local extent of the impact, the pre-mitigation impact is considered not significant.

The MST (KP1443) AOI consists of landscape that slopes gently to the coastline of the Indian Ocean from low hills inland. The landscape of the MST is characterised by farmland with a mix of tree crops and is assessed as being of low landscape sensitivity. Permanent landscape impacts will be medium in magnitude. Owing to the low sensitivity of the receptors and the local extent the pre-mitigation impact is considered not significant.

The MST and LOF AOI extends to seascape that is characterised by the partially enclosed Tanga Bay, which opens out to the Indian Ocean. The intact mangrove forest reserve, with the marine reserves and other islands and sandbanks, creates an attractive seascape along the coastal edge. The sensitivity of the seascape is considered high based on its natural scenic value and potential interest to tourists. Only a very small element of coastal forest will be removed because of the LOF and due to the small magnitude and local extent the pre-mitigation permanent seascape impacts are considered not significant.

Visual receptors of the MST from the towns, villages and roads to the landward-side are predominantly screened by trees and low hills as illustrated by Photomontage MST-A, and MST-C, see Appendix G2. Where views are available, such as from the outskirts of Chongoleani, they are limited to glimpses of higher-level structures such as the antenna as illustrated by Photomontage MST-B, see Appendix G2. Visual receptors are of low sensitivity and the permanent visual pre-mitigation
impacts will be, at most, small in magnitude and local in extent and therefore are considered not significant.

Visibility of the proposed MST and LOF is summarised as:

- 0–1-km radius – some views from the landward side, but often screened by vegetation. The MST and LOF are visible from the seaward side.
- 1–5-km radius – views limited to the taller elements of the MST and LOF, such as the proposed storage tanks and communications antenna from Tanga Bay
- 5–10-km radius – views limited to the taller elements of the MST and LOF from the port of Tanga to the south, offshore to the southeast and from high ground to the west.

The port of Tanga is a major trading centre to the south of the MST and LOF. As a highly urbanised area, most visual receptors are considered of low visual sensitivity. Although specific concerns were not raised about visual impacts on visitors and tourists, areas of tourism importance are to the coastal edge of the city that have clear views in the direction of the proposed MST and LOF. These include the Mkonge Hotel and the nearby yacht and swimming clubs. Visual sensitivity is considered high as visitor focus will be on prolonged enjoyment of views. Permanent visual impacts will be small in magnitude (owing to the distance of view) and local in extent and are therefore considered not significant pre-mitigation.

Photomontage MST-D, see Appendix G2, provides realistic views of the MST and LOF from the Mkonge Hotel which is in Tanga overlooking the bay.

Photomontage MST-E, see Appendix G2, provides realistic views of the project facilities from the Niule Reef. Visual sensitivity is again considered high as visitor focus will be on prolonged enjoyment of views. Permanent visual impacts will be small in magnitude due to the distance of view, local in extent and therefore not significant pre-mitigation.

8.8.3 Mitigation Measures

This section describes the impact avoidance and mitigation measures that will be applied to the aspects and activities that could affect landscape and visual impacts.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management plan and other measures that are included Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.

8.8.3.1 Design

**Generic Mitigation Measures**

Visual intrusion of project components into landscape

Impact: Change of landscape character and views caused by project components

Route selection has been an iterative process of gradual route refinement based on a set of technical, environmental and social criteria. The final proposed route, construction facilities and AGIs have been located to strike the optimum balance
between the relevant socio-economic, environmental and technical factors. The route has been designed to have a minimum negative impact on:

- areas of high biodiversity value
- sites of cultural heritage and religious value.

Consequently, the route will avoid the majority of:

- sensitive landscape receptors, which are often associated with natural scenic landscapes
- sensitive visual receptors, which are often associated with natural, cultural or religious value.

The pipeline will be buried and not be visible along its entire length.

**Location-Specific Mitigation Measures**

**Location: RoW KP420.5–KP469**

Visual Intrusion of Project Components into Landscape

Impact: Change of views and landscape character due to tree removal in RoW within Ruiga River Forest Reserve and Burigi-Biharamulo Game Reserves

Route selection reduced impacts on the landscape through avoidance.

**Location: Side Slope Areas with Permanent Benching**

Visual Intrusion of Project Components into Landscape

Impact: Change of views and landscape character due to permanent benching of RoW in side slope areas

Route optimisation has been undertaken to limit traversing steep side slopes, see Section 3.5.2.

**Location: Pumping Stations, Pressure Reduction Stations, Marine Storage Terminal and Load-out Facility**

Visual Intrusion of Project Components into Landscape

Impact: Change of views and landscape character due to operation of PRS1 and the MST and LOF

Measures to keep light impact to a minimum will be implemented at PRS1 and the MST and LOF to reduce light spill.

**Location: Marine Storage Terminal and Load-out Facility**

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character and views

Design and colours for AGIs will be selected to reduce the visual impact of the MST and LOF.
8.8.3.2 Construction

Generic Mitigation Measures

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character and views caused by project components

The soil management plan, reinstatement plan and biodiversity management plan will include measures that contribute to the management of the change of landscape character.

Soil handling, soil reinstatement and revegetation measures are key to mitigation of landscape and visual impacts. These are described in Section 2.4.3 and the soil and biodiversity VEC impact assessments (Sections 8.2, 8.3, 8.4 and 8.5). The measures include erosion control, replacement of excavated soil following construction, natural revegetation, implementation of a tree replanting strategy and monitoring of the re-establishment of vegetation.

Although the pre-mitigation impact on both landscape and views is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain short term and local in extent but the magnitude is reduced from medium to small.

Disposal of Surplus Subsoil and Aggregate

Impact: Permanent change of views from disposal of surplus subsoil and aggregate

The soil management plan, reinstatement plan, waste management plan and biodiversity management plan will include measures that contribute to the management of permanent change of views.

The impact of disposal of excess spoil from the trench will be eliminated by treating surplus spoil that cannot be spread on the RoW as waste. Environmental and social evaluations, including landscape and visual, will be undertaken to identify suitable offsite disposal sites for waste soil and rock and appropriate management measures implemented. All temporary soil and rock disposal sites will be reinstated, unless instructed otherwise by the regulatory authorities, in accordance with pre-entry agreements with landowner and location-specific reinstatement plans will be prepared and implemented.

Although the pre-mitigation impact on views is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain very long term and local in extent but the magnitude is reduced from medium to small.

Location-Specific Mitigation Measures

Location: RoW KP420.5–KP469

Visual Intrusion of Project Components into Landscape

Impact: Change landscape character due to tree removal in RoW within Ruiga River Forest Reserve and Burigi-Biharamulo Game Reserves
Impact: Change of views due to tree removal in RoW within Ruiga River Forest Reserve and Burigi-Biharamulo Game Reserves

The soil management plan, reinstatement plan and biodiversity management plan will include measures that contribute to the change of views and landscape character.

The project will complete preconstruction surveys within the RoW to inform location specific biodiversity management plans to reduce impacts during construction (exploring options to avoid, reduce, mitigate or compensate for loss); a vegetation removal method statement will be developed to ensure vegetation outwith the RoW is not impacted. A strategy for tree removal and replanting will be developed.

Location specific biodiversity management plans will allow for progressive, active habitat restoration; ways to achieve an increasing trend in vegetation regrowth and diversity of desired species will be explored.

Although the pre-mitigation impacts on both landscape and views are considered not significant, the application of the above measures will further reduce impacts; the residual impacts on landscape and views will remain very long term and local in extent but the magnitude will reduce from medium to small.

**Location: KP1082 to KP1106**

Visual Intrusion of Project Components into Landscape

Impact: Change landscape character due to blasting in an area of natural scenic value

Impact: Change of views due to blasting on views from small settlements, farms and unsealed roads

The soil management plan, reinstatement plan and biodiversity management plan will include measures that contribute to the change of views and landscape character.

Options will be considered for the use of surplus rock from blasting to reduce the landscape and visual impact including crushing and onsite reuse, offsite reuse, offsite disposal and onsite placement if this is in keeping with the local landscape character.

Although the pre-mitigation impacts on both landscape and views are considered not significant, the application of the above measures will further reduce impacts; the residual impacts on both landscape and views will remain very long term and local in extent but the magnitude is reduced from medium to negligible.

**Location: Side Slope Areas with Permanent Benching**

Visual Intrusion of Project Components into Landscape

Impact: Change landscape character due to permanent benching of RoW in side slope areas

Impact: Change of views in areas of permanent benching of RoW in side slope areas affecting views from small settlements, farms and unsealed roads
The soil management plan, reinstatement plan, waste management plan and biodiversity management plan will include measures that contribute to the change of views and landscape character.

Areas where benching is required will be recontoured to original profiles. Side casting in areas of steep terrain will be prohibited and mitigation such as installation of fences or geotextile fabric on steep slopes will reduce the risk of soil slippage.

In areas of permanent benching, recontouring will be sympathetic and in keeping with pre-construction profiles where this does not cause risk to pipeline. The waste management plan will identify reuse and disposal options for surplus rock.

Although the pre-mitigation impacts on both landscape and views are considered not significant, the application of the above measures will further reduce impacts; the residual impacts on both landscape and views will be very long term and local in extent but the magnitude is reduced from medium to small.

**Location: Main Camps and Pipe Yards and Coating Facility**

Visual Intrusion of Project Components into Landscape

Impact: Change landscape character due to site clearance and fencing for construction camp affecting landscape character

Impact: Change landscape character due to operation and reinstatement of construction camp affecting landscape character

Impact: Change of views due to site clearance and fencing of construction camps affecting views from small towns, other settlements, farms and roads

Impact: Change of views due to operation and reinstatement of construction camps affecting views from small towns, other settlements, farms and roads

The soil management plan, reinstatement plan and biodiversity management plan will include measures that contribute to the management of change of views and landscape character.

If construction facilities are reinstated temporary buildings and equipment, aboveground and belowground infrastructure, utilities, tools and any excess material brought onsite or generated during construction and commissioning will be removed; where applicable off RoW sites will be reinstated to meet pre-entry agreements.

Although the pre-mitigation impacts on both landscape and views are considered not significant, the application of the above measures will further reduce impacts; the residual impacts on both landscape and views will remain transient to short term and local although magnitude is reduced from medium to small or small to negligible, depending on the location of the MCPY.

Section 8.8.3.3 describes the mitigation measures and the significance of the impacts if the MCPYs and CF, except for MCPY12 and PY13, are transferred to the government.
Location: Pumping Stations, Pressure Reduction Stations, Marine Storage Terminal and Load-out Facility

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character due to construction and commissioning of the AGIs, MST and LOF

Impact: Change of views due to construction and commissioning of the AGIs, MST and LOF

The soil management plan, reinstatement plan and the biodiversity management plan will include measures that will contribute to the management of impacts associated with loss of habitat.

The pre-mitigation impacts on both landscape and views are considered not significant. The application of the above measures will not further reduce these medium or small magnitude and local extent impacts, as the changes are permanent.

8.8.3.3 Operation

Generic Mitigation Measures

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character and views caused by project components

The reinstatement plan and the biodiversity management plan will include measures that will contribute to the management of impacts associated with loss of habitat.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain short term and local in extent but the magnitude is reduced from medium to small.

Location-Specific Mitigation Measures

Location: Main Camps and Pipe Yards and Coating Facility

Visual Intrusion of Project Components into Landscape

Impact: Change of landscape character due to retention of part of the construction camp by government affecting landscape character

Impact: Change of views due to retention of part of the construction camp by government, affecting views from small towns, other settlements, farms and roads

The reinstatement plan will include measures that contribute to the management of change of views and landscape character.

If sites with structures are transferred to the Government or third parties, the procedure stated in Section 2.4.6.1 will be followed.

Although the pre-mitigation impacts on both landscape and views are considered not significant, the application of the above measures will further reduce the
magnitude of impacts; the magnitude of the residual is reduced to medium–small to negligible, depending on the location of the MCPY.

Location: Pumping Stations, Pressure Reduction Stations, Marine Storage Terminal and Load-out Facility

Visual Intrusion of Project Components into Landscape

Impact: Change landscape character due to operation of the AGIs, MST and LOF
Impact: Change of views due to operation of the AGIs, MST and LOF

See Section 8.8.3.1 for design mitigation measures for PRS1 and the MST and LOF.

The pre-mitigation impacts on both landscape and views at all the AGIs are considered not significant. The application of the above measures will further reduce the magnitude of impacts on landscape and views, generally from medium to small at the MST, and at PRS1 but not sufficient to reduce the magnitude from small. At other AGIs the landscape and visual impacts will remain the same.

8.8.4 Residual Impacts and Significance Summary

This section summarises the residual impacts on landscape after mitigation measures have been implemented.

8.8.4.1 Generic and Location-Specific Impacts

Table 8.8-1 summarises the potential generic landscape impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation. Table 8.8-2 summarises location-specific impacts.

No significant impacts were predicted pre-mitigation due to careful route and site selection. The implementation of the mitigation measures described in Section 8.8.3 will further reduce impacts. No significant residual landscape and visual impacts are predicted.

8.8.4.2 Ecosystem Services

Section 6.4.2.4 identifies ecosystem services associated with landscape. Landscape has the potential to provide cultural ecosystem services, including nonmaterial benefits from the sense of wellbeing and value provided to people by living in an attractive environment. However, stakeholders did not perceive proposed project infrastructure as negative visual intrusions in the landscape (see Section 7.6.2) and none of the areas attract tourists, except for Tanga.
Table 8.8-1  Landscape – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
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<td>Visual intrusion of project components into landscape</td>
<td>Change of landscape character and views caused by project components</td>
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<td>Biodiversity management plan</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Reinstatement plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Soil management plan</td>
<td></td>
</tr>
<tr>
<td>Disposal of surplus subsoil and aggregate</td>
<td>Permanent change of views as a result of disposal of surplus subsoil and aggregate</td>
<td>C</td>
<td>-</td>
<td>Soil management plan</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Waste management plan</td>
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<td></td>
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<td></td>
<td>Reinstatement plan</td>
<td></td>
</tr>
</tbody>
</table>

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## Table 8.8-2  Landscape – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Impact Detail</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>KP420.5–KP469</td>
<td>Visual intrusion of project components into landscape</td>
<td>Change of landscape character</td>
<td>Tree removal in RoW within Ruiga River Forest Reserve and Burigi-Biharamulo Game Reserves</td>
<td>C</td>
<td>-</td>
<td>Biodiversity management plan</td>
<td>4 5 2 3–4 16–17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change of views</td>
<td>Tree removal in RoW affecting views from settlements and roads</td>
<td>C</td>
<td>-</td>
<td>Biodiversity management plan</td>
<td>4 5 2 2 13</td>
</tr>
<tr>
<td>KP1082 to KP1106</td>
<td>Visual intrusion of project components into landscape</td>
<td>Change of landscape character</td>
<td>Impact of blasting in area of natural scenic value</td>
<td>C</td>
<td>-</td>
<td>Waste management plan</td>
<td>2 5 2 3 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change of views</td>
<td>Impact of blasting on views from small settlements, farms and unsealed roads</td>
<td>C</td>
<td>-</td>
<td>Waste management plan</td>
<td>2 5 2 2 11</td>
</tr>
<tr>
<td>Side Slope Areas with Permanent Benching</td>
<td>Visual intrusion of project components into landscape</td>
<td>Change of landscape character</td>
<td>Permanent benching of RoW in side slope areas</td>
<td>C</td>
<td>-</td>
<td>Reinstatement plan Soil management plan</td>
<td>4 5 2 2–4 13–15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change of views</td>
<td>In areas of permanent benching of RoW in side slope areas affecting views from small settlements, farms and unsealed roads</td>
<td>C</td>
<td>-</td>
<td>Reinstatement plan Soil management plan</td>
<td>4 5 2 2 13</td>
</tr>
</tbody>
</table>

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<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Site clearance and fencing for construction camp affecting landscape character</td>
<td>C</td>
<td>-</td>
<td>Reinstatement plan</td>
<td>2–4 1 2 2-4 7–11</td>
</tr>
<tr>
<td>MCPY5–16 and Coating Facility</td>
<td>Visual intrusion of project components into landscape character</td>
<td></td>
<td>Change of landscape character</td>
<td>C</td>
<td>-</td>
<td>Reinstatement plan</td>
<td>2–4 2 2 2-4 8–12</td>
</tr>
<tr>
<td></td>
<td>Retention of part of the construction camp by government affecting landscape character, except MCPY12 and MC13</td>
<td></td>
<td>Change of views</td>
<td>O</td>
<td>-</td>
<td>Reinstatement plan</td>
<td>2–6 5 2 2-4 11–16</td>
</tr>
<tr>
<td></td>
<td>Site clearance and fencing of construction camps affecting views from small towns, other settlements, farms and roads</td>
<td></td>
<td>Change of views</td>
<td>C</td>
<td>-</td>
<td>Reinstatement plan</td>
<td>2–6 1 2 2 7–11</td>
</tr>
<tr>
<td></td>
<td>Operation and reinstatement of construction camps affecting views from small towns, other settlements, farms and roads</td>
<td></td>
<td>Change of views</td>
<td>C</td>
<td>-</td>
<td>Reinstatement plan</td>
<td>2–6 2 2 2 8–12</td>
</tr>
</tbody>
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</tr>
</thead>
<tbody>
<tr>
<td>PS3–PS6, PRS1 and PRS2, MST and LOF</td>
<td>Visual intrusion of project components into landscape</td>
<td>Change of landscape character</td>
<td>Construction and commissioning of the AGIs, MST and LOF</td>
<td>C</td>
<td>-</td>
<td>Reinstatement plan</td>
<td>2–6 4 2 2–4 12–16</td>
</tr>
<tr>
<td></td>
<td>Change of landscape character</td>
<td>Operation of the AGIs, MST and LOF</td>
<td></td>
<td>O</td>
<td>-</td>
<td>Reinstatement plan Pollution prevention plan</td>
<td>4–6 4 2 2–4 12–16</td>
</tr>
<tr>
<td></td>
<td>Visual intrusion of project components into landscape</td>
<td>Change of views</td>
<td>Construction and commissioning of the AGIs, MST and LOF</td>
<td>C</td>
<td>-</td>
<td>Reinstatement plan</td>
<td>2–8 2 2 2–4 8–14</td>
</tr>
<tr>
<td></td>
<td>Change of views</td>
<td>Operation of the AGIs, MST and LOF</td>
<td></td>
<td>O</td>
<td>-</td>
<td>Reinstatement plan Pollution prevention plan</td>
<td>2–6 4 2 2–4 10–14</td>
</tr>
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8.8.5 Transboundary Project Impacts
There are no transboundary project impacts.

8.8.6 Cumulative Impacts
EACOP’s contribution to cumulative impacts on the landscape VEC is negligible and no further mitigation measures other than those described in Section 8.8.3 are considered necessary.

8.9 Air Quality
This section describes potential impacts on ambient air quality during construction, commissioning and operation of the EACOP project and associated mitigation measures to be adopted.

Appendices E2 and E3 include all pre-mitigation and post-mitigation generic and location-specific impacts. This includes two types of construction and operation impacts, those from construction facilities and those from the pipeline and AGIs. For impacts associated with air quality, the construction facility and pipeline and AGI impacts have been aggregated and are described as either construction or operation impacts. If a construction facility or pipeline and AGIs impact was greater than the other before the aggregation, the greater impact was applied. If a pre-mitigation or post-mitigation impact was determined to be significant, it is noted in the text when the other aggregated impact is not significant. All disaggregated impacts are included in Appendices E2 and E3.

8.9.1 Key Sensitivities and Considerations
The air quality baseline conditions are described in Section 6.4.2.5 as well as:
- air quality key valued environmental components (VEC) and their sensitivity ranking based on the relevant tables in Appendix D
- key considerations for the air quality impact assessment

The sensitivity ranking of air quality VECs ranges from very low to very high dependent on the level of each type of substance relative to PES\(^\text{11}\), and the potential for exposure.

Key considerations include:
- much of the project traverses sparsely populated and infrequently occupied areas
- there is capacity in the atmospheric environment for gaseous emissions without risking harmful levels being reached
- moderate to high levels of airborne fine PM were consistently detected by the baseline survey.

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\(^{11}\) Meeting the PES is a project target.
8.9.2 Potential Project Impacts

8.9.2.1 Construction

The impacts to air quality from all project construction activities are from similar activities and often use similar equipment. Consequently, the impacts and generic mitigation measures are similar.

Generic Impacts

The nature and quantity of atmospheric emissions from construction activities depend on the type of activity, the prevailing weather conditions and the effectiveness of management measures.

Three sources of emissions have the potential for environmental effects:

• release of gases, exhausts and vapours to atmosphere from combustion of fuel in construction equipment, vehicles and vessels
• release of gases, exhausts and vapours to atmosphere during refuelling
• dust emissions from site activities

Release of Gases, Exhausts and Vapours to Atmosphere

Impact: Reduced air quality from combustion of fuel in construction equipment, vehicles and vessels

The operation of equipment, vehicles and vessels powered by internal combustion engines results in the emission of exhaust gases containing the substances nitrogen oxides (NOx), sulphur dioxide (SO2), volatile organic compounds (VOC), particulate matter less than 10 and 2.5 μm in diameter (PM_{10} and PM_{2.5}) and carbon monoxide (CO). The quantities emitted depend on factors such as engine type, service history, usage pattern and fuel composition.

Movements of vehicles (carrying pipe, equipment, materials and people) and nonroad mobile machinery such as excavators, dozers and graders will cause exhaust emissions. These emissions are considered not significant\(^{12}\), as vehicle, machinery and construction vessel movements will be short term, localised and intermittent.

Emissions will be generated from the operation of construction equipment including compressors and generators.

Exhaust emissions before mitigation are considered not significant owing to the short-term nature and medium magnitude of impact associated with these emission sources.

Impact: Hydrocarbon vapour emissions from refuelling operations causing reduced air quality

Minor releases of hydrocarbon vapour emissions will occur from the refuelling of vehicles at filling stations in the construction camps and mobile bowers on the pipeline spreads, and the refilling of the tanks and bowers from fuel tanker trucks. Most vehicles and machinery will be diesel powered. Diesel storage and handling

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\(^{12}\) If a standard is predicted to be exceeded the impact is automatically deemed significant.
causes far less vapour generation than the equivalent operations with gasoline, as diesel is much less volatile. The use of diesel fuel will therefore mostly remove evaporative losses of hydrocarbons. Before mitigation, the impacts associated with these emissions are considered small and short term. They are considered not significant.

Dust

Impact: Nuisance from dust emissions from construction site activities

Dust emissions from construction activities will be variable in nature and depend on the type and extent of the activity, the soil type and its moisture content, road surface conditions and weather conditions. Dry weather and higher wind speeds will generate more dust.

Activities with the greatest potential to cause dust emission are expected to occur during earthworks and include:

- excavating (including ripping and blasting)
- haulage
- tipping and stockpiling
- levelling and landscaping
- other vehicle movements.

Stockpiling and movement of construction materials can also potentially cause dust emissions.

Once airborne, dust will travel downwind before settling. The distance travelled depends primarily on wind speed and particle size. Smaller particles and stronger winds cause greater dilution effects but create deposition over a larger area. Dust impacts typically occur within a few hundred metres of the dust emission.

Dust generated from construction activities is mainly of a particle size greater than the PM$_{10}$ fraction that is of most concern in terms of human health impacts.

Project dust emissions will be transient and localised. The impacts will be short term and, before mitigation, will be of medium magnitude. They are therefore considered not significant.

The potential effects of dust include nuisance for affected local residents, the impairment of the biological function of plants and animals through smothering or other means, and effects on human health from particles that are small enough to enter the lungs.

Whether dust deposition becomes a nuisance is subjective. It depends on a variety of factors including the sensitivity of nearby locations, the frequency of any deposit occurring and the nature of the dust. Owing to this subjectivity, there are no statutory limits or widely used standards for dust deposition.
**Location-Specific Impacts**

**Location: All MCPYs and Hydrotest Sections**

**Release of Gases, Exhausts and Vapours to Atmosphere**

Impact: Emissions of gaseous substances causing reduced air quality from operation of generators

Impact: Emissions of fine particulate matter causing reduced air quality from operation of generators

Air emissions at each main camp and pipe yard (MCPY) will be generated primarily from the operation of diesel-powered generators to produce electricity for the camp and from the use of vehicles at and near the camp.

Mobile, diesel-powered compressors will provide power to produce compressed air used to dry the interior surface of each pipeline section after hydrotesting; each drying period will last two to three days.

The impact to air quality from the above emissions is considered not significant owing to the small magnitude and short duration.

**Dust**

Impact: Nuisance from mobilisation of dust by project vehicles

The movement of vehicles to, from and around the MCPYs will generate dust. Vehicle-related dust generation will be similar to that described in the generic impact section.

The impact to air quality from the above emissions is considered not significant owing to the small magnitude and short duration.

**Location: Coating Facility**

**Release of Gases, Exhausts and Vapours to Atmosphere**

The location-specific impacts described above for all MCPYs and hydrotest sections associated with atmospheric emissions from combustion equipment and dust are also applicable at the coating facility; these are not repeated here. Impacts unique to the coating facility are described below.

Impact: Emissions of gaseous substances to air from the coating facility during operation

Impact: Emissions of fine particulate matter to air from the coating facility during operation

The pipe coating process will use chemicals to create and apply the insulating polyurethane foam layer and protective high-density polyethylene outer jacket to the pipe sections. Small quantities of VOCs used in the coating process are likely to be released to atmosphere during the coating process.

A total of 6.25 MW of diesel-powered power generation capacity will be installed at the coating facility. Emissions of NO₂ and particulate matter are expected to cause a localised impact on air quality.
A qualitative assessment has informed the evaluation of impacts from emissions to atmosphere from the operation of the coating facility; during detailed engineering the project will achieve compliance with PES. Considering the short-term duration, the qualitative assessment indicates that the impacts from emissions to atmosphere from the operation of the coating facility are not significant.

**8.9.2.2 Operation**

**Generic Impacts**

**Release of Gases, Exhausts and Vapours to Atmosphere**

**Impact:** Exhaust emissions from vehicles causing reduced air quality during operation

The generic impacts during operation will be from vehicle use to move people, materials and equipment for operations and maintenance works.

Vehicle movements will occur for short periods at each location and be widely dispersed and hence of small magnitude; therefore, the generic operational impacts on air quality are considered not significant.

**Dust**

**Impact:** Nuisance from mobilisation of dust by project vehicles.

The movement of vehicles to, from and around the AGIs will cause dust generation. Vehicle-related dust generation will be similar to that during construction, although it will be limited to designated access roads and site roads.

Vehicle movements will occur for short periods at each location and be widely dispersed and hence of small magnitude; therefore, the generic operational impacts on air quality are considered not significant.

**Location-Specific Impacts**

**Location: Pumping Stations and Marine Storage Terminal**

**Release of Gases, Exhausts and Vapours to Atmosphere**

Location-specific air quality impacts during the operation are from generators at pumping stations and at the MST. Later in the life of the project the use of oil heaters at the pumping stations will contribute to project-related emissions to atmosphere. The fuel for these stationary combustion emission sources will be crude oil from the pipeline.

**Use of Dispersion Modelling to Inform the Impact Assessment**

Various operational scenarios were assessed for both long-term (LT) and short-term (ST) impacts. LT impacts are assessed relative to annual average air quality standards; ST relative to 1, 8 and 24-hour average standards.

LT assessment is presented as an annual figure and scenarios were determined by examining the power and heat demands at the varying hydrocarbon flow rates throughout the project life.
ST assessment is typically presented conservatively. For the pumping stations the ST scenarios relate to periods of abnormal operational state (nonflowing condition, preservation mode) which will be short. Such events will be rare and predicted to occur approximately 0.37% of the time during operations. This figure is derived using the production availability value of 99.63%. The air modelling results do not account for the probability of the meteorological conditions required to yield the modelling results occurring at the same time as the abnormal operational state. Therefore, it can be stated that the modelling results are very conservative and with a very low probability of occurrence.

For the MST, the worst-case ST operational state is same as the worst-case LT event. This occurs when the flow drops below 110 kbpd, all the turbines at MST are still operated at full load.

Generators will be installed at PS3, PS5 and the MST. At these locations, impacts were assessed using the AERMOD dispersion modelling software. Appendix G3 describes the modelling, including the software used, the operational scenarios modelled, an emissions inventory and the model input parameters. As described in Section 8.9.4, the model predictions reported in this section represent worst-case conditions.

Owing to the low emission levels of the bulk heaters that may be installed later in project life, relative to the generators, the effects of emissions from PS4 and PS6 are assessed qualitatively.

For the areas surrounding PS3, PS5 and the MST, receptors at which human health or ecological effects could occur have been identified. Additionally, a grid of offsite (outside the facility boundary) locations within a 5-km radius of the AGI is considered.

The AERMOD model has been used to predict the ground-level concentrations from project operations of substances which may be substantial in relation to the measured background levels and project environmental standards. The modelled substances were nitrogen dioxide (NO2), NOx, PM10 and PM2.5. These project contribution values were then added to the highest measured baseline levels described in Appendix A9 to derive the total concentrations and compared with project environmental standards for ambient concentrations.

The secondary effects of emissions on:

- ecologically sensitive receptors are considered in Section 8.3
- constraints to future development in the area of influence (AOI) are considered in this section
- human health are considered in Section 8.18.

**Location: PS3, PS5 and the MST**

Impact: Increased NO2 concentrations at ground level from operation of generators and bulk heaters (long and short term)

Table 8.9-1 shows the predicted highest ground-level concentrations, averaged over a period that allows direct comparison with relevant environmental standards at the identified receptor and gridded output points around PS3, PS5 and the MST. The ground level concentrations from the project alone are shown in the maximum predicted project contribution column, and the concentrations from the combination
of the project and existing background levels are shown in the total project contribution plus baseline column.

Table 8.9-1 shows these concentrations as percentages of the relevant Tanzanian and East African Community limits and guidelines and the project environmental standards (PES) described in Appendix F.

The results are interpreted in Section 8.9.4.1.
Table 8.9-1 Predicted Highest Ground-Level Concentrations of NO₂

<table>
<thead>
<tr>
<th>Location ↓</th>
<th>Maximum Predicted Project Contribution (µg/m³)</th>
<th>Highest Measured Baseline Concentration (µg/m³)</th>
<th>Total Project Contribution Plus Baseline (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Averaging Period → Annual 24 h 8 h 1 h</td>
<td>Annual 24 h 8 h 1 h</td>
<td>Annual 24 h 8 h 1 h</td>
</tr>
<tr>
<td>PS3</td>
<td>Receptor¹ 33 56 112 211 6 12 12 12</td>
<td>39 68 124 223</td>
<td>47 355 1029 2269</td>
</tr>
<tr>
<td></td>
<td>Offsite¹ 41 343 1017 2257</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS5</td>
<td>Receptor 19 65 110 279 5 10 10 10</td>
<td>24 75 120 289</td>
<td>64 130 233 703</td>
</tr>
<tr>
<td></td>
<td>Offsite 59 120 223 693</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MST</td>
<td>Receptor 21 55 104 166 2 4 4 4</td>
<td>23 59 108 170</td>
<td>28 86 139 182</td>
</tr>
<tr>
<td></td>
<td>Offsite 26 82 135 178</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanzanian or East African Community limit or guideline</td>
<td></td>
<td>100 150 120 400</td>
<td></td>
</tr>
<tr>
<td>Project environmental standard</td>
<td></td>
<td>40 150 120 200</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: ¹ ‘Receptor’ and ‘offsite’ refer to the maximum concentrations predicted at the identified receptors and the gridded output points respectively.
Table 8.9-2  Predicted Highest NO₂ Concentrations Relative to Project Standards

<table>
<thead>
<tr>
<th>Location</th>
<th>Averaging Period</th>
<th>Maximum Total Concentration as Percentage of Tanzanian or EAC Limits or Guidelines</th>
<th>Maximum Total Concentration as Percentage of PES</th>
<th>Maximum Project Contribution as Percentage of Annual Average PES¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Annual 24 h 8 h 1 h</td>
<td>Annual 24 h 8 h 1 h</td>
<td>Annual</td>
</tr>
<tr>
<td>PS3</td>
<td>Receptor</td>
<td>39% 45% 103% 56%</td>
<td>97% 45% 103% 112%</td>
<td>82%</td>
</tr>
<tr>
<td></td>
<td>Offsite</td>
<td>47% 237% 857% 568%</td>
<td>116% 237% 857% 1135%</td>
<td>102%</td>
</tr>
<tr>
<td>PS5</td>
<td>Receptor</td>
<td>24% 50% 100% 73%</td>
<td>60% 50% 100% 145%</td>
<td>48%</td>
</tr>
<tr>
<td></td>
<td>Offsite</td>
<td>64% 87% 195% 176%</td>
<td>161% 87% 195% 351%</td>
<td>148%</td>
</tr>
<tr>
<td>MST</td>
<td>Receptor</td>
<td>22% 39% 90% 43%</td>
<td>56% 39% 90% 85%</td>
<td>52%</td>
</tr>
<tr>
<td></td>
<td>Offsite</td>
<td>28% 57% 116% 46%</td>
<td>69% 57% 116% 91%</td>
<td>64%</td>
</tr>
</tbody>
</table>

NOTE:¹ This column compares the project contribution to ground-level concentrations (i.e., excluding baseline levels) to the PES of 40 µg/m³ annual average and is presented to allow comparison with the separate airshed use criterion (based on the IFC General EHS Guidelines) stating that projects should not normally consume more than 25% of the relevant ambient air quality standards. Data in this column greater than 25% indicate exceedance of this criteria, whereas for the other columns, data greater than 100% indicate that the relevant standard, limit or guideline level is exceeded.
There are no exceedances of the annual average NO₂ Tanzanian guideline. The 24-hour average NO₂ Tanzanian limit is exceeded only at offsite locations near PS3 where receptors have not been identified. The 8-hour average NO₂ Tanzanian limit is exceeded at locations around all the facilities, which for PS3 and PS5 includes locations where receptors have been identified. The EAC 1-hour average NO₂ limit is exceeded only at offsite locations near PS3 and PS5 where receptors have not been identified.

The 8- and 24-hour average PES are the same as the Tanzanian limits described above. The annual and 1-hour average PES are more stringent than the Tanzanian or EAC limits.

The annual average PES is exceeded at the nonreceptor locations near PS3 and PS5. The 1-hour average PES is exceeded at locations around both PS3 and PS5 including where receptors have been identified. A ridge to the east of PS3 has a notable effect on substance dispersal.

There are no predicted exceedances of PES at the MST by either the annual or 1-hour average concentrations.

The geographical extents over which exceedances of PES are predicted are shown by Figure 8.9-1 to Figure 8.9-5. The red-line isopleth boundaries show the areas in which the PES exceedances are contained.

Project contributions for all three facilities are predicted to exceed the airshed use criteria (see footnote to Table 8.9-2).

Impact from long term ground level concentrations of NO₂ at PS3 and PS5 are considered significant; while impact from long term ground level concentrations of NO₂ at the MST is considered not significant.

Impact from short term ground level concentrations of NO₂ at PS3, PS5 and the MST are considered significant.

The project contribution to airshed is more than 25% of the relevant ambient air quality standard for NO₂ at PS3 and PS5.
Figure 8.9-1  Annual Average NO₂ Concentrations at PS3
Figure 8.9-2  1-Hour Average NO$_2$ Concentrations at PS3
Figure 8.9-3  Annual Average NO$_2$ Concentrations at PS5
Figure 8.9-4  1-Hour Average NO₂ Concentrations at PS5
Figure 8.9-5  8-Hour Average NO₂ Concentrations at MST
**Location: PS4 and PS6**

Impact: Increased NO₂ concentrations at ground level from operation of generators and bulk heaters (long and short term)

Emissions of NO₂ from the bulk heaters, which may be installed later in project life at PS4 and PS6, have been quantified and found to be less than 2% of the aggregate emissions from the generators at any of the three installations with power generation. Owing to the relatively small quantities of emissions that are considered a medium magnitude impact before mitigation, the effects of NO₂ emissions from PS4 and PS6 during operation from bulk heaters are considered not significant.

**Location: PS3, PS5 and the MST**

Impact: Increased PM₁₀ and PM₂.₅ concentrations at ground level from operation of generators and bulk heaters (long and short term)

Table 8.9-3 (PM₁₀) and Table 8.9-5 (PM₂.₅) show the predicted highest ground-level concentrations, averaged over a period for comparison with environmental standards at the identified receptor and gridded output points around each of PS3, PS5 and the MST. Table 8.9-4 and Table 8.9-6 compare these concentrations to the relevant Tanzanian and EAC limits and guidelines, and the PES. The ground level concentrations from the project alone are shown in the maximum predicted project contribution column, and the concentrations from the combination of the project and existing background levels are shown in the total project contribution plus baseline column.

The results are interpreted in Section 8.9.4.
### Table 8.9-3  Predicted Highest Ground-Level Concentrations of PM$_{10}$

<table>
<thead>
<tr>
<th>Location ↓</th>
<th>Maximum Predicted Project Contribution (µg/m$^3$</th>
<th>Highest Measured Baseline Concentration (µg/m$^3$)</th>
<th>Total Project Contribution Plus Baseline (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Averaging Period → Annual 24 h 1 h</td>
<td>Annual 24 h 1 h</td>
<td>Annual 24 h 1 h</td>
</tr>
<tr>
<td>PS3</td>
<td>Receptor$^1$ 2 6 21</td>
<td>10 31 52</td>
<td>12 37 73</td>
</tr>
<tr>
<td></td>
<td>Offsite$^1$ 2 34 223</td>
<td>12 65 275</td>
<td></td>
</tr>
<tr>
<td>PS5</td>
<td>Receptor 1 6 28</td>
<td>8 24 40</td>
<td>9 30 68</td>
</tr>
<tr>
<td></td>
<td>Offsite 3 12 68</td>
<td>11 36 108</td>
<td></td>
</tr>
<tr>
<td>MST</td>
<td>Receptor 1 6 17</td>
<td>5 16 27</td>
<td>6 22 44</td>
</tr>
<tr>
<td></td>
<td>Offsite 1 8 18</td>
<td>6 24 45</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tanzanian or East African Community limit or guideline 50 100 200</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project environmental standard 20 50 200</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: $^1$‘Receptor’ and ‘offsite’ refer to the maximum concentrations predicted at the identified receptors and the gridded output points respectively.
### Table 8.9-4 Predicted Highest PM$_{10}$ Concentrations Relative to Project Standards

<table>
<thead>
<tr>
<th>Location</th>
<th>Averaging Period</th>
<th>Maximum Total Concentration as Percentage of Tanzanian or EAC Limits or Guidelines</th>
<th>Maximum Total Concentration as Percentage of PES</th>
<th>Maximum Project Contribution as Percentage of Annual Average PES$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Annual</td>
<td>24 h</td>
<td>1 h</td>
<td>Annual</td>
</tr>
<tr>
<td>PS3</td>
<td>Receptor</td>
<td>24%</td>
<td>36%</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td>Offsite</td>
<td>25%</td>
<td>65%</td>
<td>137%</td>
</tr>
<tr>
<td>PS5</td>
<td>Receptor</td>
<td>18%</td>
<td>30%</td>
<td>34%</td>
</tr>
<tr>
<td></td>
<td>Offsite</td>
<td>21%</td>
<td>36%</td>
<td>54%</td>
</tr>
<tr>
<td>MST</td>
<td>Receptor</td>
<td>13%</td>
<td>22%</td>
<td>22%</td>
</tr>
<tr>
<td></td>
<td>Offsite</td>
<td>14%</td>
<td>25%</td>
<td>22%</td>
</tr>
</tbody>
</table>

NOTE:$^1$ This column compares the project contribution to ground-level concentrations (i.e., excluding baseline levels) to the PES of 40 µg/m$^3$ annual average and is presented to allow comparison with the separate airshed use criterion (based on the IFC General EHS Guidelines) stating that projects should not normally consume more than 25% of the relevant ambient air quality standards. Data in this column greater than 25% indicate exceedance of this criteria, whereas for the other columns, data greater than 100% indicate that the relevant standard, limit or guideline level is exceeded.
Table 8.9-5  Predicted Highest Ground-Level Concentrations of PM$_{2.5}$

<table>
<thead>
<tr>
<th>Location</th>
<th>Maximum Predicted Project Contribution (µg/m$^3$)</th>
<th>Highest Measured Baseline Concentration (µg/m$^3$)</th>
<th>Total Project Contribution Plus Baseline (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Averaging Period → Annual 24 h</td>
<td>Annual 24 h</td>
<td>Annual 24 h</td>
</tr>
<tr>
<td>PS3</td>
<td>Receptor$^1$ 2 6</td>
<td>10 30</td>
<td>12 36</td>
</tr>
<tr>
<td></td>
<td>Offsite$^1$ 2 34</td>
<td></td>
<td>12 64</td>
</tr>
<tr>
<td>PS5</td>
<td>Receptor 1 6</td>
<td>6 19</td>
<td>8 25</td>
</tr>
<tr>
<td></td>
<td>Offsite 3 12</td>
<td></td>
<td>9 31</td>
</tr>
<tr>
<td>MST</td>
<td>Receptor 1 6</td>
<td>5 15</td>
<td>6 21</td>
</tr>
<tr>
<td></td>
<td>Offsite 1 8</td>
<td></td>
<td>6 23</td>
</tr>
<tr>
<td>Project environmental standard</td>
<td></td>
<td></td>
<td>10 25</td>
</tr>
</tbody>
</table>

NOTE: $^1$ ‘Receptor’ and ‘offsite’ refer to the maximum concentrations predicted at the identified receptors and the gridded output points respectively.
Table 8.9-6  Predicted Highest PM$_{2.5}$ Concentrations Relative to Project Standards

<table>
<thead>
<tr>
<th>Location ↓</th>
<th>Averaging Period →</th>
<th>Maximum Total Concentration as Percentage of PES</th>
<th>Maximum Project Contribution as Percentage of Annual Average PES$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS3</td>
<td>Annual</td>
<td>120%</td>
<td>142%</td>
</tr>
<tr>
<td></td>
<td>24 h</td>
<td>125%</td>
<td>256%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18%</td>
<td>23%</td>
</tr>
<tr>
<td>PS5</td>
<td>Receptor</td>
<td>73%</td>
<td>101%</td>
</tr>
<tr>
<td></td>
<td>Offsite</td>
<td>93%</td>
<td>123%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9%</td>
<td>29%</td>
</tr>
<tr>
<td>MST</td>
<td>Receptor</td>
<td>63%</td>
<td>84%</td>
</tr>
<tr>
<td></td>
<td>Offsite</td>
<td>66%</td>
<td>95%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11%</td>
<td>14%</td>
</tr>
</tbody>
</table>

NOTE: $^1$This column compares the project contribution to ground-level concentrations (i.e., excluding baseline levels) to the PES of 10 µg/m$^3$ annual average and is presented to show compliance with the separate airshed use criterion (based on the IFC General EHS Guidelines) stating that projects should not normally consume more than 25% of the relevant ambient air quality standards. Data in this column greater than 25% indicate exceedance of the criteria, whereas for the other columns, data greater than 100% indicate that the relevant standard, limit or guideline level is exceeded.

There are no exceedances of the annual and 24-hour average PM$_{10}$ Tanzania or EAC limits, with no annual average total concentration around PS3, PS5 or MST being greater than 25% of the 50 µg/m$^3$ EAC limit. The 1-hour average PM$_{10}$ Tanzanian limit is exceeded only at PS3 and only at nonreceptor locations at that facility. A ridge to the east of PS3 has a notable effect on the dispersion of substances.

The 1-hour and 24-hour maximum total concentration of PM$_{10}$ PES is exceeded at PS3.

There are no applicable Tanzanian or EAC limits or guidelines for PM$_{2.5}$.

The IFC General EHS Guidelines include interim targets recognising the need for a phased approach to achieving the recommended guidelines. The predicted PM$_{10}$ and PM$_{2.5}$ concentrations are also compared with these interim targets in this discussion. Table 8.9-7 shows the interim targets.

Table 8.9-7  IFC Interim Targets and Guidelines for PM Concentrations

<table>
<thead>
<tr>
<th>Interim Target or Guideline Type</th>
<th>PM$_{10}$ Concentration (µg/m$^3$)</th>
<th>PM$_{2.5}$ Concentration (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Annual Average</td>
<td>24-h Average</td>
</tr>
<tr>
<td>Interim target level 1</td>
<td>70</td>
<td>150</td>
</tr>
<tr>
<td>Interim target level 2</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>
### Table 8.9-7  IFC Interim Targets and Guidelines for PM Concentrations

<table>
<thead>
<tr>
<th>Interim Target or Guideline Type</th>
<th>PM$_{10}$ Concentration (µg/m$^3$)</th>
<th>PM$_{2.5}$ Concentration (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Annual Average</td>
<td>24-h Average</td>
</tr>
<tr>
<td>Interim target level 3</td>
<td>30</td>
<td>75</td>
</tr>
<tr>
<td>Guideline¹</td>
<td>20</td>
<td>50</td>
</tr>
</tbody>
</table>

NOTE: ¹The guidelines have been adopted as the PES

There are no exceedances of the annual average PM$_{10}$ standard. The greatest predicted concentration occurs at PS3 and is 65% of the 20 µg/m$^3$ guideline.

Exceedances of the 24-hour average PM$_{10}$ PES are predicted only at nonreceptor locations around PS3. The highest level, 65 µg/m$^3$, meets interim target level 3.

Exceedances of the annual average PM$_{2.5}$ PES are predicted at PS3, including locations where receptors have been identified. However, the predicted concentrations are below the interim target level 3. At the other facilities, the annual average concentrations meet the guideline.

Exceedances of the 24-hour PM$_{2.5}$ PES are predicted at both PS3 and PS5 including at locations where receptors have been identified. However, the predicted maximum concentrations are below the interim target level 1 at PS3 and level 3 at PS5.

The project contributions in terms of annual average PM$_{10}$ and PM$_{2.5}$ at all locations at PS3 and MST are predicted to be below the airshed use criteria. For PM$_{10}$, the contribution never exceeds 14% of the standard. At PS5, the maximum PM$_{2.5}$ contribution reaches 29% of the air quality standard over a small area.

The geographical extents over which these exceedances are predicted are shown by Figure 8.9-6 to Figure 8.9-9. The red-line isopleth boundaries show the areas in which the PES exceedances are contained.

There are no exceedances of PES, Tanzanian or EAC PM$_{10}$ or PM$_{2.5}$ standards at the MST.

Impact from short term ground level concentrations of PM$_{10}$ at PS3 is considered significant; impact from short term ground level concentrations of PM$_{10}$ at PS5 and the MST and, impacts from long term concentrations of PM$_{10}$ at PS3, PS5 and the MST are considered not significant.

Impact from long term ground concentrations of PM$_{2.5}$ at PS3 is considered significant¹³; impact from short term ground concentrations of PM$_{2.5}$ at PS3 and PS5 are considered significant¹⁴.

¹³ Significant because of exceedance of PES as per Section 5.6.2.5. and 8.9.2.1.
¹⁴ Significant because of exceedance of PES as per Section 5.6.2.5. and 8.9.2.1.
Impact from long term ground concentrations of PM$_{2.5}$ at PS5 and the MST are considered not significant; impact from short term ground concentrations of PM$_{2.5}$ at the MST is considered not significant.

The project contribution to airshed is more than 25% of the relevant ambient air quality standard for PM$_{2.5}$ at PS5.
Figure 8.9-7  Annual Average PM$_{2.5}$ Concentrations at PS3
Figure 8.9-8  24-Hour Average PM$_{2.5}$ Concentrations at PS3
Figure 8.9-9   24-Hour Average PM$_{2.5}$ Concentrations at PS5
Location: PS4 and PS6
Impact: Increased PM$_{10}$ and PM$_{2.5}$ concentrations at ground level from operation of generators and bulk heaters (long and short term)
Emissions of particulate matter from the bulk heaters at PS4 and PS6 have been quantified and found to be less than 7% of the aggregate emissions from the generators at any of the three installations with power generation. Owing to the medium magnitude and local extent, the pre-mitigation impact of particulate matter emissions from PS4 and PS6 during operation are considered not significant.

Pre-mitigation Impacts and Significance Summary
The impact assessment has determined that there are significant impacts before mitigation because of exceedance of PES. The modelling described in Appendix G3 on which these conclusions are based predicts the worst-case conditions which may occur, for example by predicting the ground level concentrations when greatest project emissions occur at the same time as the worst case meteorological conditions.
Table 8.9-8 shows where exceedances of standards before mitigation have been predicted.

Table 8.9-8 Summary of Predicted Exceedances of Air Quality Standards

<table>
<thead>
<tr>
<th>Substance</th>
<th>Type of Standard</th>
<th>Impact Type</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>PS3</td>
</tr>
<tr>
<td>NO$_2$</td>
<td>PES</td>
<td>LT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ST</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>AS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tz/EAC</td>
<td>LT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ST</td>
<td></td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>PES</td>
<td>LT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ST</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>AS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tz/EAC</td>
<td>LT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ST</td>
<td></td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>PES</td>
<td>LT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ST</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>AS</td>
<td></td>
</tr>
</tbody>
</table>

NOTES: Shaded cells indicate exceedances. Type of standard: PES = project environmental standard. Tz/EAC = Tanzanian or East African Community limit or guideline. See Appendix F
Impact type: LT and ST = long and short term. Standards are set for the protection of chronic (LT) and acute (ST) human health impacts respectively. LT = annual average, ST = all other averaging periods used in this assessment (1-, 8- and 24-hour). AS = airshed use criterion – the PES (based on the IFC General EHS Guidelines) aimed at allowing future development in the same airshed.
There are no Tanzanian or East African Community standards for PM$_{2.5}$.
8.9.3 Mitigation Measures

This section describes impact avoidance and mitigation measures that will be applied to the aspects and activities that could affect air quality.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management plans and other measures that are included in Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.

8.9.3.1 Design

The project will design the operations combustion equipment to comply with national regulations and meeting the PES will be the project target.

8.9.3.2 Construction

Generic Impacts

Release of Gases, Exhausts and Vapours to Atmosphere

Impact: Reduced air quality from combustion of fuel in construction equipment, vehicles and vessels

The pollution prevention plan will include measures that contribute to the management of this impact.

Project vehicles, vessels, plant and equipment will be in good condition, regularly maintained and appropriate for the task being undertaken.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude will be reduced from medium to small while duration will remain short term.

Impact: Hydrocarbon vapour emissions from refuelling operations causing reduced air quality

The pollution prevention plan will include measures that contribute to the management of this impact.

A refuelling procedure will be developed and implemented which will include measures to limit loss of fuel or vapours to the environment.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude will be reduced from small to negligible while duration will remain short term.

Dust

Impact: Nuisance from dust emissions from construction site activities

The pollution prevention plan and the transport and road safety management plan will include measures that contribute to the management of this impact.
Dust will be management where necessary by means such as covering fine materials and wetting roads where appropriate and, project speed driving limits will be enforced; awareness training will be provided to project personnel.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the magnitude will be reduced from medium to small while duration will remain short term.

**Location-Specific Impacts**

**Location: All MCPYs and Hydrotest Sections**

**Release of Gases, Exhausts and Vapours to Atmosphere**

Impact: Emissions of gaseous substances causing reduced air quality from operation of generators

Impact: Emissions of fine particulate matter causing reduced air quality from operation of generators

The pollution prevention plan will include measures that contribute to the management of these impacts.

Combustion equipment will be designed to meet national regulations and project standards regarding air quality and emission limits and will be in good condition, regularly maintained and appropriate for the task being undertaken.

Although the pre-mitigation impacts are considered not significant, application of the above mitigation measures will further reduce impact; the magnitude will be reduced from medium to small while duration remains short term.

**Dust**

Impact: Nuisance from mobilisation of dust by project vehicles

The pollution prevention plan and the transport and road safety management plan will include measures that contribute to the management of this impact.

Dust will be management where necessary by means such as covering fine materials and wetting roads where appropriate and, project speed driving limits will be enforced; awareness training will be provided to project personnel.

Although the pre-mitigation impact is considered not significant, application of the above measures will further reduce the impact; the magnitude will be reduced from small to negligible while duration remains short term.

**Location: Coating Facility**

**Release of Gases, Exhausts and Vapours to Atmosphere**

Impact: Emissions to Air from the Coating Facility during its Operation

The pollution prevention plan will include measures that contribute to the management of this impact.

The pipe coating facility will be designed to abate process VOC emissions within the relevant emission limits and or air quality guidelines.
Although the pre-mitigation impact is considered not significant, application of the above measures will further reduce impact; the magnitude will be reduced from small to negligible while duration remains short term.

8.9.3.3 Project Operation

Generic Impacts

Release of Gases, Exhausts and Vapours to Atmosphere

Impact: Exhaust emissions from vehicles causing reduced air quality during operation

The pollution prevention plan will include measures that contribute to the management of this impact.

Project vehicles, vessels, plant and equipment will be in good condition, regularly maintained and appropriate for the task being undertaken.

Although the pre-mitigation impact is considered not significant, application of the above measures will further reduce impact; the magnitude will be reduced from small to negligible.

Dust

Impact: Nuisance from mobilisation of dust by project vehicles.

The pollution prevention plan and the transport and road safety management plan will include measures that contribute to the management of this impact.

Dust will be managed where necessary by means such as covering fine materials and wetting roads where appropriate and, project speed driving limits will be enforced; awareness training will be provided to project personnel.

Although the pre-mitigation impact is considered not significant, application of the above measures will further reduce impact; the magnitude will be reduced from small to negligible.

Location-Specific Impacts

Location: PS3, PS5 and MST

Release of Gases, Exhausts and Vapours to Atmosphere

Impact: Increased NO₂ concentrations at ground level from operation of generators and bulk heaters (long and short term)

The pollution prevention plan will include measures that contribute to the management of this impact.

The project will design combustion plant to comply with national regulations and meeting the PES will be the project target. Equipment will be in good condition, regularly maintained and appropriate for the task being undertaken.

Although pre-mitigation impact from long term ground level concentrations of NO₂ at the MST is considered not significant, application of the above measures will further reduce impact.
Ensuring that combustion plant is designed to comply with national regulations and meeting the PES will be the project target will reduce the magnitude of impact from long term and short term NO\textsubscript{2} ground concentrations at PS3, PS5 and the MST (short term only) from very large to small; hence residual impact is considered not significant.

**Location: PS4 and PS6**

Release of Gases, Exhausts and Vapours to Atmosphere

Impact: Increased NO\textsubscript{2} concentrations at ground level from operation of generators and bulk heaters (long and short term)

The pollution prevention plan will include measures that contribute to the management of this impact.

Equipment will be in good condition, regularly maintained and appropriate for the task being undertaken

The project will design combustion plant to comply with national regulations and meeting the PES will be the project target. Equipment will be in good condition, regularly maintained and appropriate for the task being undertaken.

Although the pre-mitigation impact is considered not significant, application of the above measures will further reduce impact; the magnitude of impact will reduce from medium to small.

**Location: PS3, PS5 and MST**

Release of Gases, Exhausts and Vapours to Atmosphere

Impact: Increased PM\textsubscript{10} and PM\textsubscript{2.5} concentrations at ground level from operation of generators and bulk heaters (long and short term)

The pollution prevention plan will include measures that contribute to the management of this impact.

The project will design combustion plant to comply with national regulations and meeting the PES will be the project target. Equipment will be in good condition, regularly maintained and appropriate for the task being undertaken.

Although pre-mitigation impact from short term ground level concentrations of PM\textsubscript{10} at PS5 and the MST is considered not significant and, impacts from long term concentrations of PM\textsubscript{10} at PS3, PS5 and the MST are considered not significant, application of the above measures will further reduce impact.

Similarly, although pre-mitigation impact from long term ground concentrations of PM\textsubscript{2.5} at PS5 and the MST is considered not significant, impact from short term ground concentrations of PM\textsubscript{2.5} at the MST is considered not significant, application of the above measures will further reduce impact.

Ensuring that combustion plant is designed to comply with national regulations and meeting the PES as a project target will reduce the magnitude of impact from: short term ground level concentrations of PM\textsubscript{10} at PS3; long term ground concentrations of PM\textsubscript{2.5} at PS3 and; short term ground concentrations of PM\textsubscript{2.5} at PS3 and PS5 from very large to small; hence residual impact is considered not significant.
Location: PS4 and PS6

Release of Gases, Exhausts and Vapours to Atmosphere

Impact: Increased PM10 and PM2.5 concentrations at ground level from operation of generators and bulk heaters (long and short term)

The pollution prevention plan will include measures that contribute to the management of this impact.

The project will design combustion plant to comply with national regulations and meeting the PES will be the project target. Equipment will be in good condition, regularly maintained and appropriate for the task being undertaken.

Although the pre-mitigation impact is considered not significant, application of the above measures will further reduce impact; the magnitude will be reduced from medium to small.

8.9.4 Residual Impacts and Significance Summary

This section summarises the residual impacts on air quality after mitigation measures have been implemented.

Table 8.9-9 summarises the potential generic air quality impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation. Table 8.9-10 summarises location-specific impacts.

No significant residual air quality impacts are predicted.
### Table 8.9-9  Air Quality – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>VEC</th>
<th>Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Release of gases, exhausts and vapours to atmosphere</td>
<td>Air Quality</td>
<td>Release of gases, exhausts and vapours to atmosphere</td>
<td>C</td>
<td>–</td>
<td>Pollution Prevention Plan</td>
<td>4</td>
</tr>
<tr>
<td>Release of gases, exhausts and vapours to atmosphere</td>
<td>Air Quality</td>
<td>Hydrocarbon vapour emissions from refuelling operations causing reduced air quality</td>
<td>C</td>
<td>–</td>
<td>Pollution Prevention Plan</td>
<td>2</td>
</tr>
<tr>
<td>Release of gases, exhausts and vapours to atmosphere</td>
<td>Air Quality</td>
<td>Exhaust emissions from vehicles causing reduced air quality during operation</td>
<td>O</td>
<td>–</td>
<td>Pollution Prevention Plan</td>
<td>2</td>
</tr>
<tr>
<td>Dust</td>
<td>Air Quality</td>
<td>Nuisance from dust emissions from construction site activities</td>
<td>C</td>
<td>–</td>
<td>Pollution Prevention Plan, Traffic and Road Safety Management Plan</td>
<td>4</td>
</tr>
<tr>
<td>Dust</td>
<td>Air Quality</td>
<td>Nuisance from mobilisation of dust by project vehicles</td>
<td>O</td>
<td>–</td>
<td>Pollution Prevention Plan, Traffic and Road Safety Management Plan</td>
<td>2</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.9-10 Air Quality – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Impact Detail</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>All MCPYs and hydrotest sections</td>
<td>Release of gases, exhausts and vapours to atmosphere</td>
<td>Emissions of gaseous substances causing reduced air quality from operation of generators</td>
<td>C</td>
<td>–</td>
<td>–</td>
<td>Pollution Prevention Plan</td>
<td>4 1-2 2 1-2 8–10</td>
</tr>
<tr>
<td></td>
<td>Release of gases, exhausts and vapours to atmosphere</td>
<td>Emissions of fine particulate matter causing reduced air quality from operation of generators</td>
<td>C</td>
<td>–</td>
<td>–</td>
<td>Pollution Prevention Plan</td>
<td>4 1-2 2 2–4 9–12</td>
</tr>
<tr>
<td></td>
<td>Dust</td>
<td>Nuisance from mobilisation of dust by project vehicles</td>
<td>C</td>
<td>–</td>
<td>–</td>
<td>Pollution Prevention Plan</td>
<td>2 4 2 1–3 9–11</td>
</tr>
<tr>
<td>Coating facility</td>
<td>Release of gases, exhausts and vapours to atmosphere</td>
<td>Emissions to air from the coating facility during operation</td>
<td>C</td>
<td>–</td>
<td>–</td>
<td>Pollution Prevention Plan</td>
<td>8 2 2 1–2 13–14</td>
</tr>
<tr>
<td>PS3, PS5 and MST</td>
<td>Release of gases, exhausts and vapours to atmosphere</td>
<td>Increased NO₂ concentrations at ground level from operation of generators and bulk heaters (long and short term)</td>
<td>O</td>
<td>–</td>
<td>–</td>
<td>Pollution Prevention Plan</td>
<td>4 4 2 2 12</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
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<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS4, PS6</td>
<td>Release of gases, exhausts and vapours to atmosphere</td>
<td>Increased NO₂ concentrations at ground level from operation of bulk heaters (long and short term)</td>
<td>O –</td>
<td></td>
<td>Pollution Prevention Plan</td>
<td>2 4 2 1 9</td>
<td></td>
</tr>
<tr>
<td>PS3, PS5</td>
<td>Release of gases, exhausts and vapours to atmosphere</td>
<td>Increased PM₁₀ and PM₂,₅ concentrations at ground level from operation of generators and bulk heaters (long and short term)</td>
<td>O –</td>
<td></td>
<td>Pollution Prevention Plan</td>
<td>4 4 2 3-5 13-15</td>
<td></td>
</tr>
<tr>
<td>PS4, PS6</td>
<td>Release of gases, exhausts and vapours to atmosphere</td>
<td>Increased PM₂,₅ and PM₁₀ concentrations at ground level from operation of bulk heaters (long and short term)</td>
<td>O –</td>
<td></td>
<td>Pollution Prevention Plan</td>
<td>2 4 2 2-3 10-11</td>
<td></td>
</tr>
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Predictive modelling has been completed considering absolute worst-case conditions for the purpose of informing the evaluation of potential impacts. The project is progressing design solutions to ensure that emissions from operation combustion equipment complies with national regulations and and meeting the PES will be the project target. When considering the results of the worst-case predictive modelling, the following factors should be considered:

- the number and nature of the receptors in the affected area. Table 8.9-8 shows exceedances beyond the site boundary irrespective of whether identified receptors are present.
- the geographical extent and the location of any area of exceedance. Some of the exceedances are only predicted to occur in small areas as indicated on Figure 8.9-6–Figure 8.9-9.
- the frequency of the exceedance. The short-term modelling results summarised in this document do not indicate whether an exceedance is predicted just once in the year at a given location or on multiple occasions in the year. These data can be found in Appendix G3.
- the relative contributions of the baseline levels of substances and the project contribution to the overall ground-level concentrations. Process contributions of NO₂ are a higher proportion of the total NO₂ concentrations than baseline levels. For PM, the background concentration is a higher proportion of the total PM concentration than process contributions.
- the low likelihood of further development taking place that would share the airshed of the AGI. This is of particular relevance when considering the airshed use criteria, which is intended to ensure that future development can take place.

All these factors can be reviewed in Appendix G3.

**8.9.4.1 Further Emissions Management Design**

The dispersion modelling results at PS3, PS5 and MST predict significant impact before mitigation. Further design mitigation is being progressed during detailed design to reduce the impacts to not significant levels; the project will design operation combustion equipment to comply with national regulations and meeting the PES will be the project target.

**8.9.5 Transboundary Project Impacts**

None of the impacts described above are transboundary, except for the limited occurrence of construction work immediately adjacent to the Tanzania-Uganda border, where low levels of emissions will cross the border. Based on prior experience and professional judgement, effects will not occur beyond around 300 m from the source activities.

No construction facilities or AGIs are close enough to national borders for their emissions to have a transboundary impact.
8.9.6 Cumulative Impacts

8.9.6.1 Context

The baseline condition of air quality in the EACOP project’s AOI, the trends and sensitivity to change are described in Section 6.4.2.5. Residual project impacts are summarised in Table 8.9-9 and Table 8.9-10.

Air quality is characterised as having very low or low sensitivity to NOx, VOC, CO and SO2 emissions, and low to very high sensitivity to changes in PM for which measured baseline levels are moderate to high. NOx and VOC are the primary precursors of low level ozone, which has moderate baseline levels.

The primary, construction-related project impacts are reductions in air quality from dust emissions from construction activities, exhaust emissions from equipment and vehicles and emissions from refuelling operations. These are predicted to be transient and limited in extent to the immediate vicinity and residual impacts are therefore considered not significant. The primary project operation impacts are reductions in air quality from the operation of generators and bulk heaters at the pumping stations.

The criterion for assessing whether the cumulative impacts are significant is that the limit of acceptable change is not exceeded. The limit of acceptable change is that no PES is exceeded from the combined effects of the project and other developments.

Third-party developments that are in the AOI of the EACOP project are shown in the cumulative impacts matrix, described and mapped in Appendix H. No cumulative impacts with the associated facilities were identified.

Potential cumulative impacts are possible on air quality where the EACOP project and the third-party developments AOIs overlap, see Table 8.9-11.

There are no third-party developments included in the CIA that are within the operational AOI of the EACOP AGIs.

Table 8.9-11 Air Quality – Third-Party Developments

<table>
<thead>
<tr>
<th>ID</th>
<th>Third-Party Development</th>
<th>Nearest KP or Where Third-Party Development Crosses EACOP</th>
<th>Potentially Affected Communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ03</td>
<td>Rural electrification</td>
<td>Crosses the EACOP project at KP358, 366.5, 378, 404 and 425.5</td>
<td>20–30 communities within the overlapping AOI identified by satellite imagery</td>
</tr>
<tr>
<td>TZ05</td>
<td>Geita airport</td>
<td>0.7 km from KP498.5</td>
<td>Up to 20 communities within the overlapping AOI identified by satellite imagery</td>
</tr>
<tr>
<td>TZ14</td>
<td>Transmission line project</td>
<td>Crosses the EACOP project at KP952.5</td>
<td>20–30 communities within the overlapping AOI identified by satellite imagery</td>
</tr>
</tbody>
</table>
Table 8.9-11 Air Quality – Third-Party Developments

<table>
<thead>
<tr>
<th>ID</th>
<th>Third-Party Development</th>
<th>Nearest KP or Where Third-Party Development Crosses EACOP</th>
<th>Potentially Affected Communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ16</td>
<td>Extension water supply project from Lake Victoria to Tabora, Nzega and Igunga</td>
<td>Crosses the EACOP project at KP730 and 739.5</td>
<td>A group of structures which might be a dwelling attached to a farm have been identified by satellite imagery</td>
</tr>
<tr>
<td>TZ27</td>
<td>Road upgrade</td>
<td>Crosses the EACOP project at KP1061 and 1080</td>
<td>Up to 10 communities within the overlapping AOI identified by satellite imagery</td>
</tr>
</tbody>
</table>

8.9.6.2 Cumulative Impacts

Construction timeframes for the third-party developments are not known at the time of writing. Albeit unlikely, a worst-case scenario has therefore been assumed that if the construction activities are conducted concurrently generating emissions to air this could lead to potential direct cumulative impacts on the ambient air quality and indirect impacts on communities. The EACOP project and the third-party development construction activities will be transient therefore the overlap with third-party projects in construction schedules would be for a short period of time.

If timeframes for third-party developments become known during project construction, the project will engage with the third-party developers and planning authorities to schedule activities to avoid overlap.

With these mitigation measures implemented, it is predicted that the residual cumulative impacts will be within the limit of acceptable change, and therefore not significant.

8.9.6.3 Transboundary Cumulative Impacts

No transboundary cumulative impacts were identified.

8.10 Acoustic Environment

This section describes potential impacts on the terrestrial acoustic environment during commissioning, construction and operation of the EACOP project and associated mitigation measures to be adopted.

Appendices E2 and E3 include all pre-mitigation and post-mitigation generic and location-specific impacts. This includes two types of construction and operation impacts, those from construction facilities and those from the pipeline and AGIs. For impacts from noise and vibration, the construction facility and pipeline and AGI impacts have been aggregated and are described as either construction or operation impacts. If a construction facility or pipeline and AGIs impact was greater than the other before the aggregation, the greater impact was applied. If a pre-mitigation or post-mitigation impact was determined to be significant, it is noted in
8.10.1 Key Sensitivities and Considerations

The acoustics baseline conditions are described in Section 6.4.2.6, as well as:

- acoustics key valued environmental components (VEC) and their sensitivity ranking based on the relevant tables in Appendix D
- key considerations for the acoustics impact assessment.

The acoustic baseline study identified very low to high sensitivity VECs with none ranked as very high.

The noise environment across most of the AOIs, particularly around AGIs is dominated by human induced sources such as road traffic, farming and general human interactions.

For the acoustic VEC, regardless of magnitude, unless there is a current or proposed receptor (i.e., an existing or proposed dwelling) there is no impact.

Further information about receptors is presented in Section G4.2.3 of Appendix G4.

8.10.1.1 Approach to Quantifying Impacts

Section G4.2.6 of Appendix G4 provides information and methodology on the quantitative modelling undertaken to support this acoustic impact assessment.

Noise

Construction and operational noise have been predicted using internationally recognised computer modelling software (SoundPlan V7.4). This software can account for environmental parameters including meteorological conditions, ground absorption, terrain and structures (dwellings and barriers). Tables G4.2.8 and G4.2.9 in Appendix G4 describe how each of these parameters has been defined in the model.

Operational noise from aboveground installations (AGI) and main camp pipe yards (MCPY) has been predicted across the AOI using engineering layouts and equipment information. Given the large number of potential receptors, operational noise levels are predicted across the area rather than at specific receptors, although the number of receptors within specific operational-noise bands are identified (see Attachment G4.6 in Appendix G4).

Construction noise is transient for the pipeline right-of-way (RoW). The model predicts the construction noise for each construction activity across the AOI based on all equipment being in the worst-case position (i.e., tracking along the RoW and within AGI boundaries with the highest possible noise level).

Traffic noise has been predicted using internationally accepted algorithms and is quantified and reported as change in noise rather than predictions of absolute levels (see Section G4.2.7.5 of Appendix G4 for assumptions).
Vibration

Vibration calculation methods are described in Section G4.2.7 of Appendix G4. They evaluate construction-generated vibration (including rock breaking, blasting and traffic movements). Predictions are based on empirical formula using construction activity specifications (i.e., rock hammer weight or blast charge) and specified distances between the source and prediction points. Assumptions are made, including the ground conditions and other environmental parameters.

8.10.2 Potential Project Impacts

8.10.2.1 Construction

Where similar construction equipment and activities are used in different parts of the project, the noise impacts and generic mitigation measures are similar and therefore assessed in the same way.

Construction activities are expected to change the noise environment close to the works. The level to which the existing noise environment is affected depends on the project noise source levels and distances between the source and receptors. Construction noise can also change or add a new noise character to the existing noise environment. Therefore, regardless of the level of change, the change in character is likely to make the construction noise noticeable by local receivers.

A change in the noise environment will have a primary impact on people within the AOI. The impacts include sleep and rest disturbance, lack of concentration and, according to the World Health Organization (WHO), may cause cardiovascular and psychophysiological effects, reduce performance and provoke annoyance responses and changes in social behaviour. Although less research is available, the same effects can apply to the wildlife that frequents (for food, security, water and reproduction) or inhabits the area.

Secondary impacts on humans, which can include longer-term health or social effects associated with elevated noise levels in an inhabited environment, are considered in Section 8.18 and secondary impacts on wildlife are considered in Section 8.3.

Quantification of construction noise impacts is presented in Section G4.3.1.6 and G.4.3.1.7 (development of MCPYs and coating facilities), Section G4.3.1.8 (decommissioning), Section G4.3.1.1 (pipeline construction) and Sections G4.3.1.2–G4.3.1.4 (construction of pumping stations, pressure reductions stations, the MST and LOF) of Appendix G4. The results show that construction noise will be audible, but short in duration.
**Generic Impacts**

**Noise**

Impact: Disturbance or nuisance from noise from construction on the RoW

The construction activities associated with development of the RoW is expected to use standard construction methods. The noise sources include trenchers, excavators, dozers, dump trucks and graders.

Noise levels are predicted to range between 50 dB(A) and 70 dB(A) $L_{Aeq,T}$. When compared with the baseline noise environment, levels are in general higher than the existing ambient noise environment (compared with $L_{eq,th}$) and are likely to be perceptible because of the different character to the existing environment and increase over the baseline $L_{A90}$. No exceedances of the PES are predicted.

Noise levels are predicted to be of a very large magnitude and are likely to be perceptible. Owing to the transient and intermittent nature of RoW construction, the impacts on the acoustic environment before mitigation are considered not significant.

Impact: Disturbance or nuisance from noise from traffic movement

Many vehicles are required for the construction of all project components. These vehicles will use existing roads and new permanent or temporary access roads.

The movement of vehicles may generate noise levels above the existing noise environment. This is particularly the case for new roads where a new source will be introduced into the area with the potential to change the noise character. The level of impact is determined by the magnitude of exposure, which relates to variables including vehicle numbers, speed, type and load; road condition (including surface); and the distance between the noise receptors and the noise source (the road). For traffic-related noise, it is noted that a 3-dB change is typically required to be perceivable by humans, and for this to occur a 100% increase in traffic would be required. Similarly, a 1 dB increase in traffic noise represents a 25% increase in traffic, whereas a 20% reduction represents a 1 dB reduction.

Primary road-traffic impacts will be similar to those for fixed-source noise. However, due to the intermittent nature of vehicle movements, the fluctuation in noise levels can be greater than for fixed-noise emissions. The constant change in noise level from traffic movements has potentially more impact on human and wildlife health and sleep disturbance than a steady-state, high-noise environment.

Quantification of access-road use (to facilitate construction) is presented in Section G4.3.1.9 of Appendix G4. The movement of construction traffic will have the potential to increase the baseline noise environment by up to 10 dB for new access roads, and up to 5 dB for existing. No exceedances of PES are predicted.

Owing to the transient and intermittent nature of construction traffic at any one location, the impacts on the acoustic environment before mitigation are not significant.
Impact: Disturbance or nuisance from noise during commissioning of the pipeline

Commissioning, hydrostatic-testing, pigging and pipeline-drying facilities will require the operation of pumps, compressors and blowers. Use of this equipment will introduce new, high-magnitude noise sources into the environment which will operate continuously for 24–48 hours.

The locations at which these activities will occur are not yet known. However, a generic quantitative assessment, undertaken to determine the impact, is presented in Section G4.3.2 of Appendix G4. This assessment predicts a level of 68 dB(A) at a distance of 10 m from the noise source (assuming local acoustic screening is included in the site layout). No exceedances of PES are predicted.

The modelling predicts the magnitude of the impact could be very large, however owing to the transient and intermittent nature of commissioning noise, the impacts on the acoustic environment before mitigation are not significant.

Vibration

Impact: Disturbance, nuisance or cosmetic/structural damage from vibration

Standard excavation and trenching techniques will be unsuitable for some relatively short sections of the RoW because of local ground conditions or buried obstructions. At these locations, rock breakers or, in exceptional cases, blasting may be required. Locations where blasting may be required are known, and blasting is considered below as a location-specific impact. The locations at which other rock-breaking techniques may be required will be identified as the project progresses.

The primary impacts associated with the use of rock-breaking equipment (excluding blasting) will be the exposure to low-level vibration. The vibration may be felt by people less than 20 m from the rock-breaking equipment. However, the equipment typically used will not startle people or cause damage to structures. There is a potential secondary social impact associated with these new experiences considered in sections 8.15.

Quantification of rock-breaking vibration is presented in Section G4.4.1.1 of Appendix G4.

Owing to the transient and intermittent nature of rock breaking at any one location, the impacts from vibration are considered not significant.

Location-Specific Impacts

Location: All MCPYs and the Coating Facility

Noise

Impact: Disturbance or nuisance from noise generation during development of construction facilities

The construction activities associated with development of the MCPYs, coating facility and access roads are similar, and are expected to use standard construction methods. The noise sources include excavators, dozers, dump trucks and graders.
Noise levels at the fenceline of the MCPYs and coating facility and access roads are predicted to range between 50 dB(A) and 75 dB(A) $L_{Aeq,T}$. When compared with the baseline noise environment, levels are in general higher than the existing ambient noise environment (compared with $L_{eq,1hr}$) and are likely to be perceptible because of the different character to the existing environment and increase over the baseline $L_{A90}$.

During the construction of the MCPYs the noise levels from some activities have the potential to exceed the ‘very large’ magnitude ranking at up 23 receptors at any one MCPY, where receptors are classed as ‘high sensitivity’.

During the construction of the coating facility, the noise levels from some activities have the potential to exceed the ‘very high’ magnitude ranking at up to 7 receptors classed as ‘high sensitivity’.

Noise levels are likely to be perceptible and of a very large magnitude, however due to the transient and intermittent nature of construction impacts, the impacts on the acoustic environment before mitigation are considered not significant. No exceedances of the PES are predicted.

Vibration

Impact: Disturbance or damage due to vibration generation during development of construction facilities

The expected construction methods at the MCPYs and coating facility are not expected to introduce sources of vibration with the potential to be perceptible within the AOI. The magnitude of any impact will be small, and the impact is considered not significant.

Location: All MCPYs

Noise

Impact: Disturbance or nuisance from operation of the MCPYs

Construction facility operation will add to the noise environment in the immediate vicinity. However, the level to which it affects the existing noise levels depends on noise source magnitude and distances of receptors from the source. In addition to affecting the baseline magnitude, construction noise can change or add a new noise character to the existing environment.

Although these facilities are required for the construction phase, they have an operational character to them, with fixed noise sources (e.g., generators and water treatment plants).

The impacts of a change in the noise environment will have a primary effect on the users of the area exposed to the change (as described in Section 8.10.2 above). Although less research is available, the same effects can apply to wildlife that frequents (for food, security, water and reproduction) or inhabits the area.

Secondary impacts can include the longer-term health or social effects associated with elevated noise levels in human- and wildlife-inhabited environments. These impacts are described in Sections 8.15 and 8.18 for human environments and 8.3 for wildlife environments.
Quantification of likely noise generated through construction facility operation is presented in Section G4.3.1 of Appendix G4. During the operation of the MCPYs noise levels are predicted to range between 40 dB(A) and 65 dB(A) $L_{Aeq,T}$. When compared with the baseline, noise environment levels are in general higher than the existing ambient noise environment (compared with $L_{eq,1hr}$) and are likely to be perceptible because of the different character to the existing environment and increase over the baseline $L_{A90}$.

The magnitude of impacts has the potential to be very large, however owing to their short-term operation, the impacts of MCPY operation on the acoustic environment before mitigation are considered not significant. No exceedances of PES are identified at MCPY locations.

**Location: Coating Facility**

**Noise**

Impact: Disturbance or nuisance from operation of the coating facility

At the coating facility, before mitigation, the predicted noise levels at the closest receptors have a very large magnitude and exceed PES during night time periods and are therefore considered significant before mitigation is applied. The predicted exceedance of PES is because of the 24-hour nature of operations and the presence of receptors within 63 m of the coating facility boundary.

**Location: Potential Blasting Locations between KP1082 and KP1106**

**Vibration**

Impact: Damage to structures from blasting

Blasting may be required at KP1082–1106 during pipeline construction. Further detailed engineering studies will be undertaken, and blasting will be avoided wherever possible. However, should it be required, there are over 150 potential high-sensitivity receptors adjacent to this RoW section that have the potential to be affected by blast-induced vibration and overpressure.

Where blasting is required, a rock blasting management plan (a sub plan of the pollution prevention plan) will be prepared during final design to detail procedures to reduce impact and describe the extent and intensity of blasting$^{15}$. It is expected that blasting charges will be 0.25–12 kg/m$^3$ (with 9–12 holes), but the maximum instantaneous charge (MIC$^{16}$) will be limited to less than 2 kg. To enable impact evaluation, blasting with charges of approximately 0.25 and 2 kg have been considered.

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$^{15}$ Flyrock (rock that can be ejected from the blast hole/site in a controlled explosion) is a risk to structures, people and fauna, however a higher risk is usually associated with high charge blasting around mineral extraction sites rather than small scale blasting, as proposed for this project

$^{16}$ MIC is the maximum mass of charge (explosive material) per delay. In simple terms, it is the maximum explosive charge per hole with a series of detonations or as a single hole. Blast design includes designing the detonation sequence with delays between holes so that the blast waves from individual holes do not arrive simultaneously at a receptor. This means that only the charge per hole is considered in calculations
Quantitative assessments can be found in Section G4.4.1.2 of Appendix G4, and a summary of predicted impacts is provided below.

Vibration from Blasting

Quantitative assessment (see Section G4.3.1.6 (CF) and G4.3.1.7 (MCPY) of Appendix G4) predicts that, with a 2-kg MIC, high and very high sensitivity receptors\(^{17}\) will be subject to very high-magnitude vibration impacts within 27 m of the blast hole, causing significant impacts on high-sensitivity receptors. It should be noted that at least part of the 27 m distance from the blast hole will be within the RoW (i.e., the trench) and so there could only be impacts in that part of the impact zone outside the RoW. The rock blasting management plan will identify the final blasting locations and whether sensitive receptors will be exposed to magnitudes of vibration which will cause cosmetic or structural damage.

The quantitative assessment has also shown that, when blasting with a 0.25-kg MIC close to lightweight structures in good condition, large-magnitude impacts are predicted within 8 m of the blast hole, potentially causing significant impacts from vibration for high-sensitivity receptors. As with the larger charge, there is potential impact only for that part of the 8 m impact radius that is outside the ROW. However, the nearest receptor is 19 m away, with no receptors identified within 8 m of the RoW. At this distance from the blast hole, the receptors would be exposed to ‘large’ magnitude impacts, which are not likely to be sufficient to cause damage.

When blasting is close to buildings which are vulnerable or in poor condition, or heritage structures:

- with a 2-kg MIC, potentially damaging vibration levels could occur up to 58 m from the blast hole
- with a 0.25-kg MIC, potentially damaging vibration levels could occur up to 21 m from the blast hole.

Owing to the nature of blasting, the close proximity of dwellings and other structures to the potential blasting area, potential very high magnitude of the impact and the potential very long-term impacts on the surrounding community, the impacts of blast-induced vibration before mitigation are considered significant and will have the potential to exceed PES.

Overpressure from Blasting

Air overpressure (causing a shock wave above normal atmospheric pressure) is associated with blasting. Air overpressure is a very short-duration impact. However, pressure waves can contain enough energy to cause damage to structures. Structural damage can occur at overpressure of around 180 dB(lin) and windows can crack at 150–170 dB(lin) (British Standard BS 5228-2:2009).

Quantitative assessment (see Section G4.4.1.2 of Appendix G4) has shown that blasting overpressure has the potential to cause damage and therefore may have an impact on lightweight structures:

\(^{17}\) Receptors in this sense include buried utilities, buildings and walls. They are defined in the sensitivity tables in Appendix D.
• up to 10 m from the blast hole for a MIC of up to 2 kg
• up to 5 m from the blast hole for a MIC of less than 0.25 kg.

No receptors have been identified within 10 m of the RoW between KP1082 and KP1106 where blasting may be required, and therefore the impacts of air overpressure are not significant. No exceedances of PES are identified.

Blasting activity will introduce a new noise, vibration and air-pressure character to the AOI. Therefore, regardless of the direct impact, there is a potential secondary social impact associated with these new experiences. This is considered in Section 8.19.

In addition to blast-induced vibration and overpressure, flyrock\(^{18}\) is always a risk with blasting; however, a higher risk is usually associated with high charge blasting around mineral extraction sites rather than small scale blasting, as proposed for this project. Although impacts associated with flyrock are not ‘true acoustic’ concerns, the damage to property can be similar to the cosmetic damage associated with blast induced vibration. In addition, flyrock can be a risk to people (workers and community). Flyrock is not predictable and therefore has not been quantified as part of this study; however, it is assumed that flyrock impacts and management would be included in a rock blasting management plan.

**Location: All MCPYs and the Coating Facility**

When construction has been completed and after decommissioning, the leases will be surrendered and some of the facilities, such as the MCPYs and CF may be transferred to the government with some structures left in place or removed. Noise impacts will occur only if structures are removed and then the impacts described below apply.

Noise

Impact: Disturbance or damage due to noise generation during decommissioning of construction facilities

Where structures are to be removed at the end of their use by the project, the machines and equipment used and nature of operations are expected to be similar to those used for construction. The impacts on the acoustic environment from decommissioning are therefore expected to be similar to those for disturbance from noise from traffic movement, and disturbance or nuisance from noise generation during development of construction facilities described above. Identification and assessment of acoustic impacts will be included in the decommissioning plan.

**Location: All MCPYs and the Coating Facility**

Vibration

Impact: Disturbance or damage due to vibration generation during decommissioning of construction facilities

Where structures are to be removed at the end of their use by the project, the machines and equipment used and nature of operations are expected to be similar

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\(^{18}\) Flyrock is rock that can be ejected from the blast hole/site in a controlled explosion.
to those used for construction. The impacts of vibration from decommissioning are therefore expected to be similar to those for disturbance from vibration from traffic movement, and disturbance or nuisance from vibration during construction of construction facilities. Identification and assessment of vibration impacts will be included in the decommissioning plan.

**Location: Sigi and Kagera River Crossings at KP1424 and KP324**

**Noise**

Impact: Disturbance or nuisance from noise generated by horizontal directional drilling

Horizontal directional drilling (HDD) will be used to cross the Sigi and Kagera Rivers at KP1424 and 324 respectively. HDD activities include sheet piling, the use of drilling equipment, and the movement of equipment and machinery which will affect the AOI. The HDD noise will be perceived in the surrounding community.

Quantification of likely HDD noise is presented in Section G4.3.1.1 of Appendix G4. Although the magnitude is very high and the Kagera River is of high sensitivity, the transient nature of HDD activities means that the impacts on the noise environment before mitigation are not significant at this location. At the Sigi River location, no sensitive receptors were identified within the AOI, and the impact is also not significant. No exceedances of PES are identified.

**Location: Sigi and Kagera River Crossings at KP1424 and KP324**

**Vibration**

Impact: Generation of ground-borne vibration causing potential structural or cosmetic damage

Sheet piling for the purposes of shoring excavations, and drilling associated with HDD has the potential to generate vibration. This vibration has been quantified and assessed (see Section G4.4.1.1 of Appendix G4). The results show that:

- no receptor more than 9 m from the entry or exit pits will experience ‘large’ magnitude impacts
- vibration may be perceived by occupants of dwellings up to 73 m from entry or exit pits
- although the vibration generated has the potential to be perceptible, it would not be at a magnitude capable of cosmetic or structural damage.

Owing to the transient nature of HDD activities, and the predicted medium magnitude of impacts, the vibration impacts before mitigation are considered not significant. No exceedances of PES are identified.
8.10.2.2 Operation

Generic Impacts

Noise
Impact: Disturbance or nuisance from noise from traffic movement

The generic impacts during operation will be restricted to operational vehicle movements. These operations will be widely dispersed, at a low intensity and transient at each location. Therefore, generic operational impacts on the acoustic environment are expected to be not significant.

Location-Specific Impacts

Location specific acoustic impacts during operation have been identified. These relate to the operation of power-generation equipment and bulk oil heaters at PS3, PS5, and the MST, and to the operation of bulk oil heaters at PS4 and 6 (that may be installed later in the project life). These stationary noise sources will affect the areas surrounding the AGIs.

The level of impact depends on the noise source level and distances between the receivers and the source. In addition to affecting the baseline noise levels, operational machines noise can change or add a new noise character to the existing environment.

The existing noise environment across the AOI was found not to be influenced by industrial noise. Therefore, noise from the operation of the pumping stations and the MST is likely to add a new noise character to the existing baseline environment.

Quantification of likely noise generated through AGI operation is presented in Section G4.3.3.1 (pumping stations) and Section G4.3.3.2 (pressure reduction stations) of Appendix G4. The levels and impacts reported below are taken from Appendix G4 and represent the range of operational noise predictions across each AOI, before the application of specific mitigation measures.

Before mitigation, pumping-station operation is predicted to have a significant impact on the existing baseline environment and, in some circumstances, the noise levels are predicted to exceed PES.

The impact of the onshore and offshore components of the LOF on terrestrial receptors is presented in this section.

Location: PS3, PS4, PS5, PS6, MST,

Noise
Impact: Increase in existing baseline noise environment causing disturbance and nuisance

PS3: During operation, the long-term noise levels for up to 97 receptors have the potential to exceed the ‘very large’ magnitude ranking at receptors ranked as ‘high sensitivity’. Noise levels at 232 receptors around PS3 are predicted to exceed PES. Quantitative assessment in Section G4.3.3.1 of Appendix G4 predicts pre-mitigation noise levels of 40–70 dB(A) LAeq,T in the 1-km study area around PS3. Day time noise levels re not predicted to exceed PES. Night time impacts from noise are
predicted to be of very large magnitude with noise levels predicted to exceed the night time PES for receptors.

PS4: quantitative assessment in Section G4.3.3.1 of Appendix G4 predicts pre-mitigation noise levels of 40–55 dB(A) $L_{Aeq,T}$ in the 1 km study area around PS4. Night time impacts from noise are predicted to be of large magnitude with noise levels predicted to exceed the night-time PES for receptors.

PS5: quantitative assessment described in Section G4.3.3.1 of Appendix G4 predicts pre-mitigation noise levels of 40–70 dB(A) $L_{Aeq,T}$ in the 1 km area around PS5. Day time impacts from noise are predicted to be of large magnitude and night impacts from noise are predicted to be of very large magnitude; noise levels are predicted to exceed the day and night time PES at receptors.

PS6: quantitative assessment described in Section G4.3.3.1 of Appendix G4 predicts pre-mitigation noise levels of 40–55 dB(A) $L_{Aeq,T}$ in the 1 km area around PS6. Night time impacts from noise are predicted to be of large magnitude with noise levels predicted to exceed the night-time PES for receptors.

MST: quantitative assessment described in Section G4.3.3.3 of Appendix G4 predicts pre-mitigation noise levels of 40–70 dB(A) $L_{Aeq,T}$ in the 1 km area around MST Day time impacts from noise are predicted to be of medium magnitude and night impacts from noise are predicted to be of very large magnitude; noise levels are predicted to exceed the night time PES at receptors.

Predicted noise levels in the AGI AOI are mostly higher than baseline ambient noise levels and, being of different character to baseline noise, are likely to be perceptible. The greater the distance from the AGIs the less perceptible the noise will be; receptors typically habituate to noise over time.

Impacts from noise at PS3, PS4, PS5, PS6 and the MST are considered significant before mitigation is applied.

**Location: LOF, PRS1, PRS2**

Noise

Impact: Increase in existing baseline noise environment causing disturbance and nuisance

LOF: no receptors are identified within the AOI of the LOF and therefore a detailed assessment has not been undertaken.

PRS1: no receptors are identified within 1 km of PRS1 and therefore a detailed assessment has not been undertaken.

PRS2: quantitative assessment described in Section G4.3.3.2 of Appendix G4 predicts pre-mitigation noise levels of 30–60 dB(A) $L_{Aeq,T}$ in the 1 km study area around PRS2. It is unlikely that exceedance of the PES will occur at any receptor. The operational noise is unlikely to be audible day or night at distances beyond 200 m. The area around PRS2 is of high sensitivity. Day and night time impacts from noise are predicted to be local in extent, long term and of small magnitude.

Impacts from noise at the LOF, PRS1 and PRS2 are considered not significant.
8.10.3 Mitigation Measures

This section describes the impact avoidance and mitigation measures that will be applied to the aspects and activities that could affect the acoustic environment. Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management plans and other measures that are included in Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.

8.10.3.1 Design

Generic Mitigation Measures

To limit the impacts of noise generated by project activities, the design process will continue to minimise the impact of noise emissions through appropriate design. This includes giving preference to the selection of low noise and vibration emitting equipment and construction techniques, specifying equipment mitigation devices as standard where these are available (for example exhaust muffler), and laying out sites to maximise distance and acoustic screening between noisy equipment and sensitive receptors.

Location-Specific Mitigation Measures

Modelling results predict that before mitigation PES at receptor locations will be exceeded in the AOI of the coating facility (construction phase), PS3, PS4, PS5, PS6 and MST (operational phase), which is a function of project design. Further design mitigation is being progressed during detailed engineering to ensure that meeting the PES will be the target for noise emissions at any receptor.

8.10.3.2 Construction

Generic Mitigation Measures

Noise

Impact: Disturbance or nuisance from noise from construction on the RoW

The pollution prevention plan will include measures that contribute to the management of noise impacts.

Noise emissions will be reduced by giving preference to low noise emitting equipment, acoustic screening and, where necessary, undertaking additional assessment to identify other mitigation that may be required. Equipment will be serviced and maintained on schedule.

Meeting the PES will be the target for noise emissions.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain short term and intermittent while magnitude will reduce from very large to small.
Impact: Disturbance or nuisance from noise from traffic movement

The pollution prevention plan and the transport and road safety management plan will include measures that contribute to manage noise emissions from traffic movement.

To limit the impacts of noise generated by traffic movements, measures to ensure project vehicles are in good condition, regularly maintained and appropriate for the task will be implemented. Where possible, new access roads will be constructed a minimum of 100 m from sensitive receptors, such as schools. Speed limits will be enforced, night time driving will be by exception and vehicle movements will be restricted to defined access routes. There is a potential secondary social impact associated with these new experiences considered in sections 8.15 and 8.18.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain short term and intermittent while magnitude will reduce from very large to large.

Impact: Disturbance or nuisance from noise during commissioning of the pipeline

The pollution prevention plan will include measures that contribute to the management of commissioning noise impacts.

Noise emissions will be reduced by giving preference to low noise emitting equipment, acoustic screening and, where necessary, undertaking additional assessment to identify other mitigation that may be required. Equipment will be serviced and maintained on schedule.

Meeting the PES will be the target for noise emissions.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain short term and intermittent while magnitude will reduce from very large to small.

Vibration

Impact: Disturbance, nuisance or cosmetic/structural damage from vibration

The pollution prevention plan and the stakeholder engagement plan will include measures that will manage vibration impacts.

To minimise the impact of vibration, the project will give preference to the selection of low-vibration-emitting equipment and require additional assessments to be undertaken where activities generating high levels of vibration are near sensitive receptors. Where damage to property from project activities has been identified, the project will complete repairs and / or compensate as appropriate; repairs will be on a like-for-like or better basis. The compensation framework will be included in the RAP.

Communities will have access to the project grievance procedure to register concerns regarding disturbance or damage from vibration.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain short term and intermittent while magnitude will reduce from very large to small.
Location-Specific Mitigation

Location: All MCPYs and the Coating Facility

Noise

Impact: Disturbance or nuisance from noise generation during development of construction facilities

The pollution prevention plan will include measures that contribute to the management of noise impacts.

Noise emissions will be reduced by giving preference to low noise emitting equipment, acoustic screening and, where necessary, undertaking additional assessment to identify other mitigation that may be required. Equipment will be serviced and maintained on schedule.

Meeting the PES will be the target for noise emissions.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain short term and intermittent while magnitude will reduce from very large to small.

Vibration

Impact: Disturbance or damage due to vibration generation during development of construction facilities

The pollution prevention plan and stakeholder engagement plan will include measures that contribute to the management of vibration impacts.

Vibration will be reduced by preferentially selecting low-vibration-generating equipment undertaking additional assessments where activities generating high levels of vibration are near sensitive receptors. Where damage to property from project activities has been identified, the project will complete repairs or compensate as appropriate; repairs will be on a like-for-like or better basis.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain short term and intermittent while magnitude will reduce from very large to small.

Location: All MCPYs

Noise

Impact: Disturbance or nuisance from operation of the MCPYs

The pollution prevention plan will include measures that manage MCPY noise impacts.

During operation of the MCPYs preference will be given to the selection of low noise emitting equipment. Power plants and equipment will be kept in good condition, regularly maintained and appropriate for the task being undertaken.

Meeting the PES will be the target for noise emissions.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain short term and intermittent while magnitude will reduce from very large to small.
Location: Coating Facility

Noise

Impact: Disturbance or nuisance from operation of the coating facility

The pollution prevention plan will include measures that contribute to management of coating facility noise emissions.

During operation of the coating facility preference will be given to the selection of low noise emitting equipment. Power plants and equipment will be kept in good condition, regularly maintained and appropriate for the task being undertaken.

Meeting the PES will be the target for noise emissions.

The implementation of the mitigation measures will reduce the magnitude of impact from very large to small; the residual impact will be not significant.

Location: Potential Blasting Locations between KP1082 and KP1106

Vibration

Impact: Damage to structures from blasting

The pollution prevention plan and the stakeholder engagement plan will include measures that contribute to the management of damage to structures from blasting.

Blasting will only be used where other excavation methods are considered technically impracticable or uneconomic. Where blasting is undertaken, a rock blasting management plan will be developed by a competent person that will include mitigation addressing impact to dwellings and structures in accordance with the mitigation hierarchy. Where damage to property from project activities is identified, the project will complete repairs or compensate as appropriate; repairs will be on a like-for-like or better basis. Communities will have access to the project grievance procedure to register concerns regarding disturbance or damage from vibration.

The implementation of the mitigation measures will reduce the magnitude of impact from very large to small; the residual impact will be not significant.

Location: All MCPYs and the Coating Facility

Noise

Impact: Disturbance or damage due to noise generation during decommissioning of construction facilities

The pollution prevention plan will include measures that contribute to the management of this impact.

The impacts to the acoustic environment during decommissioning are expected to be similar to those during construction. The mitigation measures within the pollution prevention plan, particularly those described under generic impacts in Section 8.10.3.2 will apply.

The pre-mitigation impact for the development of construction facilities is considered not significant, similarly, the pre-mitigation impact for decommissioning construction facilities is considered not significant and the application of the above
measures will further reduce impact; the residual impact will remain short term and intermittent while magnitude will reduce from very large to small.

Vibration
Impact: Disturbance or damage due to vibration generation during decommissioning of construction facilities

The pollution prevention plan and the stakeholder engagement plan will include measures that contribute to the management of this impact.

The impacts to the acoustic environment during decommissioning are expected to be similar to those during construction. The mitigation measures within the pollution prevention plan, particularly those described under generic impacts in Section 8.10.3.2 will apply.

Although the pre-mitigation impact for the development of construction facilities is considered not significant, and similarly, the pre-mitigation impact for decommissioning construction facilities is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain short term and intermittent while magnitude will reduce from very large to small.

Location: Sigi and Kagera River Crossings at KP1424 and KP324

Noise
Impact: Disturbance or nuisance from noise generated by horizontal directional drilling

The pollution prevention plan will include measures that contribute to the management of this impact.

Where night-time HDD operations are required near sensitive receptors, additional location-specific assessments will be undertaken to identify appropriate mitigation. Noise emissions will be reduced by giving preference to low noise emitting equipment, acoustic screening and, where necessary, undertaking additional assessment to identify other mitigation that may be required.

Meeting the PES will be the target for noise emissions.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain short term while magnitude will reduce from very large to small.

Location: Sigi and Kagera River Crossings at KP1424 and KP324

Vibration
Impact: Generation of ground-borne vibration causing potential structural or cosmetic damage

The pollution prevention plan and the stakeholder engagement plan will include measures that contribute to the management of this impact.

Where night-time operations are required near sensitive receptors, additional location specific assessments will be undertaken to identify appropriate mitigation.
To minimise the impact of vibration, the project will give preference to the selection of low-vibration-emitting equipment and require additional assessments to be undertaken where activities generating high levels of vibration are near sensitive receptors. Where damage to property from project activities has been identified, the project will complete repairs and or compensate as appropriate; repairs will be on a like-for-like or better basis.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain short term and intermittent while magnitude will reduce from very large to small.

8.10.3.3 Project Operation

Generic Mitigation

Noise
Impact: Disturbance or nuisance from noise from traffic movement

The pollution prevention plan and the transport and road safety management plan will include measures that contribute to the management of this impact.

The generic impacts during operation will be restricted to operational vehicle movements. Speed limits will be enforced, night time driving will be by exception and vehicle movements will be restricted to defined access routes. Additionally, project vehicles will be in good condition, regularly maintained and work appropriate.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will remain short term and intermittent while magnitude will reduce from very large to large.

Location-Specific Mitigation

Location: PS3, PS4, PS5, PS6, MST

Noise
Impact: Increase in existing baseline noise environment causing disturbance and nuisance from operation of the pump stations and MST.

The pollution prevention plan will include measures that contribute to the management of noise emissions from the PSs and MST.

During operation of these AGIs, preference will be given to the selection of low noise emitting equipment. Power plants and equipment will be kept in good condition, regularly maintained and appropriate for the task being undertaken.

Meeting the PES will be the target for noise emissions.19

The implementation of the mitigation measures will reduce the magnitude of impact from very large (PS3, PS5, MST) or large (PS2, PS4) to small; the residual impact will be not significant.

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19 Where predictive modelling has indicated PES will be exceeded as a result of project contribution to ambient noise levels, pre-mitigation impacts are automatically designated significant.
Location: LOF, PRS1, PRS2

Noise

Impact: Increase in existing baseline noise environment causing disturbance and nuisance

The pollution prevention plan will include measures that contribute to the management of this impact.

To minimise the impact of noise emissions during operation of these AGIs preference will be given to the selection of low noise emitting equipment. Power plants and equipment will be kept in good condition, regularly maintained and appropriate for the task being undertaken.

Meeting the PES will be the target for noise emissions

The pre-mitigation impact magnitude at PRS2 was identified as being small, and the application of these mitigation measures will not reduce this further. There will be no significant residual impact.

As no receptors were identified within the AOI of PRS1 or LOF, there are no impacts predicted.

8.10.4 Residual Impacts and Significance Summary

This section summarises the residual impacts on the acoustic environment after mitigation has been implemented.

Table 8.10-1 summarises the potential generic acoustic impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation.

Table 8.10-2 summarises location-specific impacts after mitigation.

No significant residual acoustic environment impacts are predicted.
Table 8.10-1 Acoustic Environment – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>VEC</th>
<th>Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise</td>
<td>Acoustic Environment</td>
<td>Disturbance or nuisance from noise from construction on the RoW</td>
<td>C</td>
<td>-</td>
<td>Pollution prevention plan</td>
<td>10 1 2 4 17</td>
</tr>
<tr>
<td>Noise</td>
<td>Acoustic Environment</td>
<td>Disturbance or nuisance from noise from traffic movement</td>
<td>C&amp;O</td>
<td>–</td>
<td>Pollution prevention plan, Transport and road safety management plan</td>
<td>8 1 2 5 16</td>
</tr>
<tr>
<td>Vibration</td>
<td>Acoustic Environment</td>
<td>Disturbance, nuisance or cosmetic / structural damage from vibration</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan, Stakeholder engagement plan</td>
<td>4 1 2 4 11</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.

August 2019
### Table 8.10-2  Acoustic Environment – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>VEC</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>All MCPYs and coating facility</td>
<td>Noise</td>
<td>Acoustic Environment</td>
<td>Disturbance or nuisance from noise generation during development of construction facilities</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan</td>
<td>4 1 2 4 11</td>
</tr>
<tr>
<td>All MCPYs and coating facility</td>
<td>Vibration</td>
<td>Acoustic Environment</td>
<td>Disturbance or damage from vibration generation during development of construction facilities</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan Stakeholder engagement plan</td>
<td>4 1 2 4 11</td>
</tr>
<tr>
<td>All MCPYs</td>
<td>Noise</td>
<td>Acoustic Environment</td>
<td>Disturbance or nuisance from operation of the MCPYs</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan</td>
<td>4 2 2 4 12</td>
</tr>
<tr>
<td>Coating facility</td>
<td>Noise</td>
<td>Acoustic Environment</td>
<td>Disturbance or nuisance from operation of the coating facility</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan</td>
<td>4 2 2 4 12</td>
</tr>
<tr>
<td>Potential Blasting Locations between KP1082 and KP1106</td>
<td>Vibration</td>
<td>Acoustic Environment</td>
<td>Damage to structures from blasting during construction with charges up to 2 kg MIC</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan Stakeholder engagement plan</td>
<td>4 5 2 5 16</td>
</tr>
<tr>
<td>All MCPYs and coating facility</td>
<td>Noise</td>
<td>Acoustic Environment</td>
<td>Disturbance or damage due to noise generation during decommissioning of construction facilities</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan</td>
<td>4 1 2 4 11</td>
</tr>
<tr>
<td>All MCPYs and coating facility</td>
<td>Vibration</td>
<td>Acoustic Environment</td>
<td>Disturbance or damage due to vibration generation during decommissioning of construction facilities</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan Stakeholder engagement plan</td>
<td>4 1 2 4 11</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
Table 8.10-2  Acoustic Environment – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>VEC</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sigi and Kagera River Crossings at KP1424 and KP324</td>
<td>Noise</td>
<td>Acoustic Environment</td>
<td>Disturbance or nuisance from noise generated by horizontal directional drilling</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan</td>
<td>4 1 2 4 11</td>
</tr>
<tr>
<td>Sigi and Kagera River Crossings at KP1424 and KP324</td>
<td>Vibration</td>
<td>Acoustic Environment</td>
<td>Generation of ground borne vibration causing potential structural or cosmetic damage during HDD</td>
<td>C</td>
<td>–</td>
<td>Pollution prevention plan Stakeholder engagement plan</td>
<td>4 1 2 4 11</td>
</tr>
<tr>
<td>Pumping Stations (PS3-PS6) and MST</td>
<td>Noise</td>
<td>Acoustic Environment</td>
<td>Increase in existing baseline noise environment causing disturbance and nuisance from operation of the pump stations and MST.</td>
<td>O</td>
<td>–</td>
<td>Pollution prevention plan</td>
<td>4 4 2 4 14</td>
</tr>
<tr>
<td>LOF, PRS1, PRS2</td>
<td>Noise</td>
<td>Acoustic Environment</td>
<td>Increase in existing baseline noise environment causing disturbance and nuisance from operation of PRS2</td>
<td>O</td>
<td>–</td>
<td>Pollution prevention plan</td>
<td>4 4 2 4 14</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
8.10.4.1 Further Emissions Management Design

Preliminary acoustic modelling results for operations at all pumping stations, MST and coating facility predict significant impacts at receptors within 1.25 km before mitigation, significant being more than PES.

As a result, further design mitigation is being assessed to reduce the impacts to not significant levels and the pollution prevention plan includes a commitment that meeting the PES will be the target for noise emissions. The regulator will be updated on the progression of mitigation results following detailed design assessment.

8.10.5 Transboundary Project Impacts

There are no transboundary project impacts predicted.

8.10.6 Cumulative Impacts

8.10.6.1 Context

The baseline condition of acoustic environment in the EACOP project's AOI, the trends and sensitivity to change are described in Section 6.4.2.6. Residual impacts are summarised in Table 8.10-1 and Table 8.10-2.

Although the landscape and environment change throughout the acoustics AOI, the baseline noise sources are similar due to the scarcity of fixed structures or a substantial transport network. The main noise sources are:

- wind through vegetation
- insects, birds and amphibians
- traffic (with a high proportion of small-engine motorbikes, some cars and more trucks when close to sealed roads)
- human interactions
- farming (mostly hand tools, some livestock movements).

As such, the noise environment across the acoustics AOI does not vary considerably and is consistent with the levels expected in a rural environment away from major road networks, towns and industry. Based on the acoustic survey, engagement with stakeholders and the trend in condition and sensitivity to change, the sensitivity of the acoustic environment for AGIs, construction facilities, the RoW and access roads across the AOI has been ranked from low to high.

The criterion for assessing whether cumulative impacts are significant is that the limit of acceptable change is not exceeded. The limit of acceptable change is that no PES is exceeded as a result of the combined effects of the project and other developments.

Third-party developments in the AOI of the EACOP project are shown in the cumulative impacts matrix, described and mapped in Appendix H. No cumulative impacts with the associated facilities were identified. Potential cumulative impacts
are possible on the acoustic environment where the EACOP project and the third-party development AOIs overlap, see Table 8.10-3.

### Table 8.10-3  Acoustic Environment – Third-Party Developments

<table>
<thead>
<tr>
<th>ID</th>
<th>Third-Party Development</th>
<th>Nearest KP or Where Third-Party Development Crosses EACOP</th>
<th>Potentially Affected Communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ03</td>
<td>Rural electrification</td>
<td>Crosses the EACOP project at KP358, 366.5, 378, 404 and 425.5</td>
<td>Between 20 and 30 communities within the overlapping AOI identified by satellite imagery</td>
</tr>
<tr>
<td>TZ05</td>
<td>Geita airport</td>
<td>0.7 km from KP498.5</td>
<td>Up to 20 communities within the overlapping AOI identified by satellite imagery</td>
</tr>
<tr>
<td>TZ14</td>
<td>Transmission line project</td>
<td>Crosses the EACOP project at KP952.5</td>
<td>Between 20 and 30 communities within the overlapping AOI identified by satellite imagery</td>
</tr>
<tr>
<td>TZ16</td>
<td>Extension water supply project from Lake Victoria to Tabora, Nzega and Igunga</td>
<td>Crosses the EACOP project at KP730 and 739.5</td>
<td>A group of structures which might be a dwelling attached to a farm have been identified by satellite imagery</td>
</tr>
<tr>
<td>TZ27</td>
<td>Road upgrade</td>
<td>Crosses the EACOP project at KP1061 and 1080</td>
<td>Up to 10 communities within the overlapping AOI identified by satellite imagery</td>
</tr>
</tbody>
</table>

### 8.10.6.2 Cumulative Impacts

Construction timeframes for the third-party developments are not known at the time of writing. In the unlikely worst-case scenario where noise generating construction activities are conducted concurrently, there could be cumulative impacts on communities.

The EACOP project and the third-party development construction activities will be transient therefore the overlap with third-party projects in construction schedules would be for a short period of time.

If timeframes for third-party developments become known during project construction, the project will engage with the third-party developers and planning authorities to schedule noise generating activities to avoid overlap.

With these mitigation measures implemented, noise is not likely to exceed the PES and the cumulative impact will be within the limit of acceptable change, and therefore not significant.

Cumulative impacts will not occur for vibration and blasting because the impacts are based on a single event rather than a combination of events.

There will be no cumulative impacts in relation to operation of the AGIs as there are no third-party developments within the AOI for the AGIs.
8.10.6.3 Transboundary Cumulative Impacts

No transboundary cumulative impacts were identified.

8.11 Economy

This section describes potential impacts on the Tanzania economy, subsequently referred to as benefits, during construction, commissioning and operation and of the EACOP project and associated enhancement measures to be adopted. This assessment has focused on:

- employment
- provision of goods and services
- contribution to the economy.

8.11.1 Key Sensitivities and Considerations

The economic baseline conditions are described in Section 6.4.3.6 as well as:

- economic key valued and environmental components (VECs) and their sensitivity ranking based on the relevant tables in Appendix D
- key considerations for the economy impact assessment

Sensitivity ranking in the economy area of influence (AOI) is included in the various livelihood activities described in Section 8.13 and 8.14.

Key considerations include:

- major projects create employment opportunities.
- international projects provide training and capacity building of the Tanzanian workforce and local companies to satisfy Tanzania’s local content policy
- the increasing importance of the oil and gas sector in the Tanzanian economy, coupled with additional regulatory attention, supports the development of oil and gas infrastructure, which may enhance the viability of Tanzanian reserves.

8.11.2 Project Benefits

8.11.2.1 Construction

Employment

The project is expected to create three categories of employment:

- direct employment – employees and principal contractors
- indirect employment – subcontractors and suppliers
- induced employment – employment generated by increased spending by businesses and households earning an income from the project.

Benefit: The generation of national employment opportunities leading to an increase in household income and an improvement in living standards

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20 Induced or “multiplier” employment in local communities generated by the spending of direct and indirect employees, such as employment in local businesses and services (e.g., shops, transport and public services).
This may lead to direct and indirect impacts. It is estimated that, on average, some 4000 direct construction jobs may be generated in Tanzania over the three-year construction phase, of which 3600 may be skilled and semiskilled and 400 unskilled. Based on local content requirements, approximately 2400 workers (60% of the workforce) will be nationals, while up to 1600 (40% of the workforce) may be foreign workers.

Information on the anticipated wage bill is not available. Assuming all national workers earn the Tanzanian average annual wage of USD 1235 (TZS 2.8 million), employment of 2400 national workers during construction generates an annual income of USD 3 million (TZS 6.8 billion).

In addition to direct jobs, the project will create indirect and induced employment in other sectors such as logistics and supply chains, catering and security. Opportunities will increase as local businesses develop the capacity to supply goods and services during the construction and operation phases (local content) (IMF 2014).

Induced employment generation may be relatively restrained for this project caused by:

- The EACOP project is capital, rather than labour intensive, implying that for every USD in capital expenditure (Capex), a small proportion is for labour remuneration.
- The project has a relatively high “leakage”, as some goods and services that are not available locally at the required standard must be sourced internationally (e.g., pipe manufactured to international standards, highly skilled pipeline construction supervisors).

MacGillivray et al. (2017) calculated that the average employment multiplier in developing countries is 7.8 (i.e., each direct worker is associated with (generates) more than seven indirect and induced jobs). Based on this multiplier, direct Tanzania-based employment by the project may generate:

- Approximately 18,700 indirect and induced short-term employment opportunities in Tanzania during construction.
- At an average annual Tanzanian wage of USD 1235 (TZS 2.8 million) (which overestimates income in the informal sector), indirect and induced employment generates an annual income of approximately USD 23 million (TZS 52.5 billion) during construction.
- During construction, the EACOP project may generate jobs (through direct, indirect and induced employment) for a total of approximately 21,100 Tanzanians, 11% of whom will be directly employed.
- The project may, therefore, generate total annual household income of USD 26 million (TZS 59.4 billion), (direct construction income of USD 3 million (TZS 6.8 billion) plus indirect and induced income of USD 23 million (TZS 52.5 billion)).
- People who benefit directly or indirectly from the project also support several dependants. Based on the average household size of 4.7 persons in Tanzania

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21 Conversions based on exchange rate on 24/08/2018. Source: https://www.xe.com/currencyconverter/.

22 The average monthly income of employed persons in Tanzania is approximately US$103 (NBS 2013).
(NBS 2017) and assuming one income earner per household, each income earner supports, on average, 3.7 dependants. Income from direct, indirect and induced employment (or reduced underemployment) for 21,120 nationals during construction could therefore benefit 78,100 dependants.

Provision of Goods and Services

Benefit: Project procurement providing opportunities for national businesses

This may lead to direct and indirect impacts.

The Tanzanian Petroleum (Local Content) Regulations (2017) specify that goods and services must be preferentially procured from local providers. The regulations further specify that, where goods and services are not available in Tanzania, such goods and services must be provided by a joint venture with at least 25% of shares held by a local company. Local content requirements will be fully integrated into EACOP’s contracting and procurement strategy. The project is developing a local content plan to guide the implementation process.

- It is assumed that 40% of Capex, approximately USD 379 million (TZS 865 billion) annually, will be spent on goods and services procured nationally over the three-year construction period.
- Project activities comprise fairly standard civil works (e.g., MCPYs and access road and upgrades). It is expected that suitably qualified businesses in Tanzania will participate in the execution of these project components.
- Regional changes in the demand for consumer goods have the potential to increase inflation; however, this is not expected to occur at a national scale and is assessed in the section on local economy (Nonland-Based Livelihoods) (see Section 8.12).

Contribution to Economy

Benefit: Contribution to national economy from investment over a three-year period

This may lead to direct and indirect impacts.

It is assumed that:

- of the total Capex for the construction of the 1443 km pipeline, USD 3.523 billion (TZS 8 trillion), nearly USD 3 billion (TZS 6.8 trillion) will be expended on the 1147 km of pipeline and marine facilities in Tanzania
- with Tanzanian Capex evenly expended, direct annual investment amounts to nearly USD 1 billion (TZS 2.3 trillion)
- assuming 40% of Capex is spent on nationally procured goods and services, direct annual in-country spending amounts to approximately USD 379 million (TZS 865 billion)
- Mendez-Parra (2015) calculated output multipliers for different sectors of the Tanzanian economy. Sectors that will directly benefit from the EACOP project have relatively high multipliers: these include business services (2.89), government administration (2.75) and construction (2.21). This implies that for each USD 1 (TZS 2282) invested in these sectors, a further USD 1.89 (TZS 4314), USD1.75 (TZS 4000) and USD 1.21 (TZS 2761) of indirect and induced

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23 All EACOP related values are in 2016 terms.
output will be generated in the economy by the multiplier effect\textsuperscript{24}. Applying an averaged multiplier of 2.62 for the above three sectors, direct EACOP Capex expended in Tanzania generates and contributes an additional annual indirect and induced amount of USD 613 million (TZS 1.4 trillion) in Tanzania.

The total direct, indirect and induced economic impact of EACOP Capex on the Tanzanian economy amounts to approximately USD 1 billion (TZS 2.3 trillion) per annum for the three-year construction period, approximately to 2.1% of 2015 GDP.

These estimates apply primarily to the formal (measured) economy. Owing to the importance of the informal economy in Tanzania, the project will also increase demand (and therefore production) in the informal economy. The benefits of economic growth include increased income (including in the local informal economy), lower unemployment and underemployment and increased tax base and revenues.

Multipliers are typically derived through an evaluation of backward and forward linkages of economic sectors with other sectors (e.g., procurement, and household expenditure). However, the indirect and induced economic stimulus of the EACOP project is likely to exceed the value provided by multipliers, as the EACOP project more generally results in:

- Improved infrastructure, notably upgraded and new access roads.
- Exposure of a large workforce and associated businesses to technical training and work opportunities to international standards.
- Possible stimulation of exploration activity for Tanzanian onshore oil reserves, as the pipeline may provide a cost-effective transportation and export opportunity for Tanzanian onshore oil.

The World Bank (2017) specifically concluded that Tanzania's economic prospects hinge on investment in infrastructure, improving the business environment, increasing agricultural productivity and processing, improving service delivery to build a healthy and skilled workforce and better managing urbanisation. The project has the potential to contribute toward some of these aspects.

Benefit: Changes to the fiscal balance

This may lead to direct and indirect impacts.

During construction, the EACOP project is not expected to generate substantial government revenue and income.

The wage bill and income distribution are not known, but Tanzanian wages from direct EACOP employment were estimated at USD 2–3 million (TZS 4.6–6.8 billion) annually during construction. If all incomes are taxed at the maximum tax rate of 30% (TRA 2017), this will yield government revenue of approximately USD 1 million (TZS 2.3 billion) per annum during the three-year construction phase. Additional income will be derived from indirect and induced wages; many may, however, lie below tax thresholds.

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\textsuperscript{24} For comparison, a World Bank (2006) study on developing countries estimated a broad rural output multiplier of 2.5 and an urban output multiplier of 2, given the higher import content (leakage) of urban output that reduces the multiplier effect.
Government expenditure might increase during this phase to finance the national equity share and any supporting infrastructure.

Although it is too preliminary to estimate corporate or income tax on local businesses that will provide goods and services to EACOP, due to numerous factors involved in the determination of these figures, this is a source of revenue and benefit to government by increasing the fiscal balance. The same applies to companies down the value chain (or through the multiplier effect) that will be required to pay value added tax (VAT).

8.11.2.2 Operation

The following benefits described for construction are also applicable to operation.

Employment

Benefit: The generation of national employment opportunities leading to an increase in household income and an improvement in living standards

This may lead to direct and indirect impacts.

Pipeline operation will require a workforce to 300 people, of whom approximately 200 workers (approximately 70% of the workforce) may be nationals in the first ten years, increasing to at least 255 workers (approximately 85% of the workforce) after 10 years. The percentage of skilled professionals is expected to increase during operations.

Assuming all workers earn a Tanzanian average annual wage of USD 1235 (TZS 2.8 million) employment of 255 national workers generates an annual income of approximately USD 315,000 (TZS 719 million) during the operational life of the pipeline.

Indirect and induced employment opportunities from the project may generate approximately 2000 long-term employment opportunities during operation. At an average annual Tanzanian wage of USD 1235 (TZS 2.8 million) (which overestimates income in the informal sector), indirect and induced employment generates an annual income of USD 2.5 million (TZS 5.7 billion) during operation.

Provision of Goods and Services

Benefit: Project procurement providing opportunities for national businesses

This may lead to direct and indirect impacts.

During operation, in Tanzania the EACOP procurement will be associated with maintenance activities for a total Opex of approximately USD 90 million (TZS 205.4 billion). The local content of operation phase procurement is expected to be higher, and to increase over time as national suppliers acquire the required tools and skills.

Based on the previously stated multipliers the estimated indirect and induced output is USD 150 million (TZS 342 billion).
**Contribution to Economy**

**Benefit: Contribution to national economy from investment**

This may lead to direct and indirect impacts.

The total direct, indirect and induced economic effect of the EACOP Opex on the Tanzanian economy amounts to an estimated USD 240 million (TZS 547.9 billion) per annum for the duration of pipeline operation, equivalent to 0.5% of 2015 GDP.

In addition, if the pipeline can in future be utilised by other regional oil producers, as envisaged in the original announcements by the Tanzanian and Ugandan governments (The Observer 2017), the EACOP project could be of wider regional economic importance.

**Benefit: Changes to the fiscal balance**

This may lead to direct and indirect impacts.

The application of taxes on profits and other taxes will be reviewed by the Governments of Uganda and Tanzania when the pipeline company structure is finalised. This government income stream from taxes has not been quantified in the assessment. As an equity partner, the government will derive income from its equity share of the tariff and profits from pipeline operation (or incur losses if the pipeline is not profitable). The income cannot be estimated based on the currently available information, but it is expected to be positive (i.e., profitable).

In addition, it is expected that certain taxes waived during the construction period (such as VAT, corporate income tax and import duties) will become effective and generate additional income for the government during the operational life of the pipeline.

The wage bill and income distribution are not known, but Tanzanian wages from direct EACOP employment were estimated at USD 315,000 (TZS 719 million) annually during operation. If all incomes are taxed at the maximum tax rate of 30% (TRA 2017), this will yield government revenue of approximately USD 100,000 (TZS 228 million) per annum during operation. Additional income will be derived from indirect and induced wages; many of those may, however, lie below tax thresholds.

Although revenue from the pipeline will not grow to be a substantial contribution to the budget, it will likely be large and countervail a possible longer-term decline in government grants and concessional loans. Given the exhaustibility of oil reserves, the boost to revenue collections will be finite, but likely long-term, assuming Ugandan oil production is sustained in the foreseeable future (IMF 2014).

**8.11.3 Summary of Benefits**

Table 8.11-1 summarises the project annual economic benefits.
Table 8.11-1  Project Annual Economic Benefits

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Construction</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment</td>
<td>21,000 direct, indirect or induced jobs USD $26 million (TZS 59.4 billion)</td>
<td>2255 direct, indirect or induced jobs USD $2.8 million (TZS 6.4 billion)</td>
</tr>
<tr>
<td>Provision of goods and services</td>
<td>USD $379 million (TZS 865 billion, direct) USD $613 million (TZS 1.4 trillion) (indirect and induced)</td>
<td>USD $90 million USD $150 million (indirect and induced)</td>
</tr>
<tr>
<td>Revenue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contribution to national economy</td>
<td>USD $1 billion (TZS 2.3 trillion) 2.1% of 2015 GDP</td>
<td>USD $240 million (TZS 548 billion) 0.5% of 2015 GDP</td>
</tr>
<tr>
<td>Changes to fiscal balance</td>
<td>USD $1 million (TZS 2.3 billion)</td>
<td>Positive (taxes and equity partnership)</td>
</tr>
</tbody>
</table>

8.11.4  Enhancement Measures

This section describes the enhancement measures, listed in Table 8.11-2, that will be applied to enhance benefits to the economy.

8.11.4.1 Design

As described in Section 3, Alternatives, route identification for the pipeline has considered social aspects relating to the economy such as minimising impacts on businesses and infrastructure. The selected Kabaale, Uganda to Tanga, Tanzania pipeline route was chosen partly because it had the lowest number of social constraints of the routing options available.

8.11.4.2 Construction

Generic Enhancement Measures

Employment

Benefit: The generation of national employment opportunities leading to an increase in household income and an improvement in living standards

Provision of Goods and Services

Benefit: Project procurement providing opportunities for national businesses.

The procurement and supply chain management plan, local content plan and the labour management plan will include measures that collectively contribute to the support of project opportunities for national businesses.

The procurement and supply chain management plan and local content plan will be developed to maximise the purchase of goods and services from within Tanzania and include, as appropriate, enterprise and capacity development.
8.11.4.3 Operation

Provision of Goods and Services

Benefit: Project procurement providing opportunities for national businesses.

The procurement and supply chain management plan, local content plan and the labour management plan will include measures that collectively contribute to the support of project opportunities for national businesses.

The procurement and supply chain management plan will be developed to maximise the purchase of goods and services from within Tanzania and include, as appropriate, enterprise and capacity development.
### Table 8.11-2  Economy – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment</td>
<td>The generation of national employment opportunities leading to an increase in household income and an improvement in living standards</td>
<td>C &amp; O</td>
<td>Y</td>
<td>B</td>
</tr>
<tr>
<td>Provision of Goods and Services</td>
<td>Project procurement providing opportunities for national businesses</td>
<td>C &amp; O</td>
<td>Y</td>
<td>B</td>
</tr>
<tr>
<td>Contribution to economy</td>
<td>Contribution to national economy from investment</td>
<td>C &amp; O</td>
<td>Y</td>
<td>B</td>
</tr>
<tr>
<td>Contribution to economy</td>
<td>Changes to the fiscal balance</td>
<td>C &amp; O</td>
<td>-</td>
<td>B</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
8.11.5 Transboundary Project Impacts

Construction activities in Mutukula town at the Tanzania–Uganda border will lead to an increase in both formal and informal trade across the border with Uganda and hence benefit the local and regional economy. The movements by local people across the border will have a transboundary effect.

It is also anticipated that during construction and operation, facilities closer to the Ugandan border may procure some goods and services from Uganda where it makes economic and logistical sense to do so, rather than sourcing them from distant locations (e.g., Dar es Salaam).

Section 8.12 describes local economic impacts from transboundary, mainly informal, trade.

8.11.6 Cumulative Impacts

Cumulative impacts are not considered for the economic VEC as it is not feasible to acquire residual economic impact information on the myriad of projects that are being developed in Tanzania much less predict their contribution to employment, provision of goods and services and contribution to the economy.

8.12 Local Economy (Nonland-Based Livelihoods)

This section describes potential impacts on the local economy (nonland-based livelihoods) during construction, commissioning and operation of the EACOP project and associated mitigation measures to be adopted.

8.12.1 Key Sensitivities and Considerations

The local economy (nonland-based livelihoods) baseline conditions are described in Section 6.4.3.7, as well as:

- local economy (nonland-based livelihoods) key valued environmental components (VECs) and their sensitivity ranking based on the relevant tables in Appendix D
- key considerations for the local economy (nonland-based livelihoods) impact assessment.

Sensitivity in the local economy (nonland-based livelihoods) AOI is ranked as potentially positive for VECs such as small business owners, who may benefit from an increase in business activities caused by a growing population, new developments and associated increase in construction activities. Employees in informal businesses are ranked as potentially positive VECs due to the potential increase in opportunities to start or expand a business. Transportation providers are ranked as potentially positive VECs, as road improvements associated with the implementation of EACOP may enhance their business activities.

Key considerations are:

- some small local companies will lack the skills and resources they need to meet external project standards. This may lead to many business and trade opportunities being taken by outsiders.
good road connections between rural communities and urban centres are crucial for business owners to source supplies and market their goods. Improved road conditions are therefore likely to enhance the capacity of local businesses and their ability to provide more services.

Section A11.4.5.3 in Appendix A11 identifies that the local economy (nonland-based livelihoods) does not provide ecosystem services. It does, however, rely on ecosystem services which are described in land-based livelihoods (see Section 8.13).

The key human rights considerations relevant to the local economy (nonland-based livelihoods) relate to a variety of workers’ rights, including the right to nondiscrimination, freedom from child labour, freedom from forced labour, freedom of association, right to just and favourable working conditions, and the right to work in a healthy and safe environment. Other human rights that are relevant to local economy (nonland-based livelihoods) are the right to an adequate standard of living and women’s rights. International standards for responsible business require that labour standards are respected by companies and that they use their leverage to ensure that contractors and suppliers also respect labour rights (see Section 4).

8.12.2 Potential Project Impacts

8.12.2.1 General

Appendices E2 and E3 include all pre-mitigation and post-mitigation generic and location-specific impacts. This includes two types of construction and operational impacts, those from construction facilities and those from the pipeline and AGIs. For impacts on the local economy (nonland-based livelihoods) the construction facility and pipeline and AGI impacts have been aggregated and are described as either construction or operation impacts. If a construction facility or pipeline and AGIs impact was greater than the other before the aggregation, the greater impact was applied. If a pre-mitigation or post-mitigation impact was determined to be significant, it is noted in the text when the other aggregated impact is not significant. All disaggregated impacts are included in Appendices E2 and E3.

8.12.2.2 Construction

Generic Benefits

Employment

Benefit: The generation of project local employment opportunities

During construction, approximately 2000 workers, including 200 unskilled workers, will be required per spread (refer to Section 2). The pipeline will be constructed near population centres (listed in Table 2.4-3, Section 2) where the inhabitants will have the opportunity to obtain project employment. PACs near the MCPYs will be particularly well placed to benefit from employment.

Increased income may enhance a household’s standard of living, their capacity to pay school and healthcare fees and invest in existing or future livelihood activities
(i.e., small-scale trade and agro-processing). This may improve the long-term prospects of children, household food security and nutrition.

**Benefit:** The provision of training and skill development opportunities within employment

A key constraint to growth in Tanzania is the availability of requisite industrial skills. The project will recruit unskilled labour from PACs where possible. Training will equip local workers with transferable skills that are currently in demand by the Tanzanian economy (see Section A11.4.4 in Appendix 11), thereby enhancing their future employment prospects and ultimately leading to a larger skilled workforce. Equipping local workers with construction skills such as site clearance and operating plant machinery will be particularly beneficial given national labour shortages in this sector.

** Provision of Goods and Services

**Benefit:** Project procurement providing opportunities for local businesses

A variety of materials will be sourced locally during pipeline construction including gravel, sand, cement, murram and fencing. In addition, the main camps and pipe yards (MCPYs), designed to accommodate up to 1000 people, will require supplies (e.g., food, fuel, medication). Providing goods and services to the project would enable local businesses to boost their income earnings and profit margins during the construction period, causing multiplier effects and overall benefits to the local economy. Increased incomes of local workers may also lead to increased spending in the PACs, benefiting local enterprises.

The informal, unregulated and small-scale nature of local businesses, lack of business expertise, market access and power supply may, however, hamper local businesses in meeting project standards and requirements.

In addition, women and young people seem to have fewer paid work opportunities and so the lack of start-up capital for the small business entrepreneur may be more keenly felt by these groups.

It should be noted that these increased incomes may not necessarily be used for the benefit of workers’ households. Increased access to cash by men in the PACs could lead to an increase in the incidence of social ills such as substance abuse and a rise in GBV with regards to spouses and children (see Section 8.19).

There may be an impact on human rights if the project does not exercise due diligence as it provides these opportunities for local businesses to minimise the risks of adverse impacts on workers’ rights (through contractual requirements about minimum working conditions, screening, auditing of local businesses and so forth) and to use its leverage to train and encourage local businesses to respect the appropriate working conditions.

There may be another impact on workers’ rights, for instance due to excessive working hours because of time pressures, or due to late payment of workers because of long payment terms for contractors.

The impacts are considered beneficial, while acknowledging the importance of mitigation measures to be put in place to protect workers’ rights.
Benefit: Improvements in road conditions for business owners and public transport

The pipeline has been routed, as much as possible, near existing infrastructure, thereby minimising the need for the development of new roads. To accommodate increased volumes of traffic generated by the project, access roads will be upgraded and widened to ensure two-way traffic can pass. It is expected that PACs will benefit from road upgrades and widening. The creation of a smaller number of new access roads may benefit some PACs by improving their access to markets, social services and neighbouring communities.

Poor road conditions are a significant challenge for business owners and public transport providers in the PACs; they increase travel time and costs considerably (see Section 8.17). Improvements in road conditions would allow business owners and public transport providers to travel faster and transport passengers and goods at lower costs.

The impacts are considered beneficial. The assessment of this impact assumes that the government will maintain the roads.

Generic Impacts

Employment

Potentially affected communities (PACs) are characterised by poverty, high unemployment and limited formal employment opportunities. Education levels and technical skills in particular sectors (i.e., formal training in construction) are low. Households have limited income streams and financial security and are therefore, sensitive to external shocks. Business owners and civil servants (i.e., teachers) reported fluctuating incomes and low salaries. PACs have high expectations from the project in terms of job and training opportunities.

The baseline context with respect to specific human rights context related to just and favourable working conditions includes:

- lack of awareness of labour rights. There is a low level of awareness of worker rights in PACs. Furthermore, there are low levels of understanding of a nondiscriminatory work culture, such as with a mixed gender workforce.
- no contracts. A national labour survey completed in 2012 identified that 80% of workers did not have written contracts and, where workers did hold an employment contract, 95% of the documents reviewed did not contain all the labour rights provided to workers under national legislation.
- general working conditions. Workers highlighted that they frequently work long hours or that often there are no set working hours. Baseline studies point out that many workers in the project area do not receive paid holidays. They do not receive sick leave from their employment when they fall ill. If they are injured on the job, little to no support is provided to them. In such cases and in cases of other employment-related grievances, such as nonpayment of wages, workers report that they do not have access to remedy. Concerns were raised about low wages received by workers, well-below a living wage.
- use of middlemen. In particular, middlemen are used to find workers for projects and those middlemen withhold entire salaries from workers for months of work.
- unionisation and collective bargaining. Workers in PACs stated that they have limited power to negotiate with their employers, which prevents them from
working in fair conditions. There is no culture of unionisation or collective bargaining. Trade union density is estimated to be around 3% of the total workforce. Many workers are illiterate and the laws governing the labour sectors are difficult for them to understand or manage, which makes them vulnerable. There are concerns in PACs that the work for the project will be difficult and poorly paid. Based on previous negative work experiences, workers fear they will not have any negotiating power.

- child labour. The incidence of child labour across the country was estimated to be 29% in 2014 (ILO and NBS 2016). Child labour has been linked to high school dropout rates, particularly in the context of artisanal and small-scale mining. Children who may be particularly vulnerable to child labour include those who come from low-income families, live in mining areas or areas where there are tobacco plantations or come from orphanages.

Impact: Loss of employment after project construction phase

This may lead to direct and indirect impacts.

Employment with the project may cause lack of attention to, or possible abandonment of, existing subsistence livelihood activities during the period of employment of household members, in particular crop growing and livestock rearing. Achieving the level of agricultural productivity established before project employment may require time, during which, household food security and nutrition may be compromised if replacement income sources are not available.

This may cause an economic shock at household level and a drop in the standard of living, which could potentially increase social ills such as alcohol abuse and gender-based violence (GBV). This could also affect the right to health of women.

There may also be an impact on the following human rights: the human right to work if the notice process for retrenchment is inadequate; the human right to an adequate standard of living due to loss of income and benefits; and the right to social security if employers have not provided the necessary social security benefits or contributed to private unemployment insurance schemes.

Generally low levels of financial literacy may prevent construction workers in the PACs from preparing financially for the termination of their employment contracts. The income generated by project employment may be used for immediate gratification or to pay items on credit, rather than saving for or investing in the future, or to bridge the post-project unemployment period, during which replacement livelihoods will need to be developed. Retrenched employees may also be faced with a lack of funds to honour credit repayments. However, not all retrenched workers will necessarily experience the impacts described above.

The impacts will be short-term and will affect some households within the PACs. Due to their short-term nature and localised extent, before mitigation the impacts are considered not significant.

Impact: Dissatisfaction arising from unmet expectations over the scale and duration of project local employment opportunities

This may lead to direct and indirect impacts.

The stakeholder engagement processes identified that, across all stakeholder categories, there are unrealistically high expectations of the project’s capacity to
provide employment opportunities. This was particularly accentuated at PAC level where there are few or no formal employment opportunities. Unmet expectations at PAC level could be further compounded by the potential project induced inmigration (PIIM) of workers and other opportunistic job seekers, who will increase competition for employment opportunities (described below).

There may be an impact on the human right to nondiscrimination because of real or perceived unfairness in how employment opportunities are allocated. While the rights of migrant workers and their families should be considered in the allocation of employment opportunities, this must be balanced by commitments to local hiring and national immigration and employment requirements.

Experience with large-scale projects globally indicates that unmet expectations could cause tensions at the local level, which, if not addressed satisfactorily, could potentially lead to some blockages or protests. If disregarded, relations could deteriorate further over time and culminate into clashes between PACs and migrants seeking access to work or other project benefits, or, in an extreme case, between PACs and project security personnel or local security forces. Dissatisfied communities may voice their grievances on local radio or social media platforms. Sites such as YouTube and Twitter are growing in popularity in Tanzania (see Section A11.4.10 in Appendix A11) and could be used by disgruntled PAC members to express grievances and garner support, spreading the dissatisfaction to a wider audience. As such, a localised upset could quickly escalate and reverberate over the AOI.

The impacts will be short-term and will affect districts. Due to their short-term nature, before mitigation the impacts are considered not significant.

Impact: Competition over employment opportunities

This may lead to direct and indirect impacts.

High unemployment rates may lead to competition over project employment opportunities in the PACs. Tanzania has a young and mobile population with people moving between districts and regions as well as people entering from neighbouring countries in search of employment (see Section A11.4.2 in Appendix A11). Migration to PACs by nonresidents and non-nationals seeking project employment may heighten the competition for job opportunities and raise tensions between the groups. It is quite possible that migrant job seekers could have gained skills in other large-scale projects, which will be an advantage in seeking project positions. As such, they could potentially out-compete local job seekers. The recruitment of foreign nationals may also lead to jealousy among locals who perceive that foreign workers are taking ‘their’ jobs. This may also cause conflicts between different groups.

The impacts will be short-term and will affect entire PACs. Due to their short-term nature and small extent, before mitigation the impacts are considered not significant.
Impact: Diversion of workers gaining employment from the project away from existing local businesses or public-sector jobs

This may lead to direct and indirect impacts. The risk that children will be diverted from schooling to backfill in subsistence agriculture is discussed in Section 8.13, or to find employment in the supply chain is described below as the next impact.

Low salaries and fluctuating income earnings may motivate public sector workers and business owners in PACs to seek project employment, particularly if the wages offered are more favourable. Pupil to teacher ratios in schools in the PACs are already high (see Section A11.4.3 in Appendix A11) and as such, there may be negative outcomes for the quality of education received by children if teachers find employment with the project and are not replaced. There may therefore be an impact on children’s human right to education. Considering that local health facilities are already understaffed (see Section A11.4.11 in Appendix A11), project employment of local health personnel may negatively impact local health services. There may therefore be an impact on the right to health.

The impacts will be short-term and will affect entire PACs. Due to their short-term nature and small extent, before mitigation the impacts are considered not significant.

Impact: School drop outs seeking employment in the project supply chain

This may lead to direct and indirect impacts.

Baseline data shows that low school attendance rates are common among both boys and girls. Boys are generally attracted by potential income earning activities, while girls are engaged in household chores. The project may entice children, particularly boys, to loiter near project works. In areas where artisanal and small-scale mining (ASM) activities have been identified, the risk of child labour may be higher given the presence of an already existing labour pool of children who have left school and have entered the workforce.

There may be an impact on the human right that prevents child labour as well as the right to education.

The impacts will be long-term and will affect PACs. Due to their localised extent, before mitigation the impacts are considered not significant.

Provision of Goods and Services

Commercial activity in the PACs consists predominantly of informal, small-scale enterprises that trade in agricultural produce, daily necessity goods and basic services.

Impact: Inflation and effects on supply owing to project procurement

This may lead to direct and indirect impacts.

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25 Artisanal and small-scale mining (ASM) refers to mining practised by individuals, groups or communities often informally (illegally). Extractive activities are often undertaken without mechanisation but when affordable simple technologies are used. Health and safety provisions are often overlooked in informal ASM and environmental degradation is consequential to the activities. Child labour is commonly engaged in informal ASM activities.
Project procurement of goods locally to worksites may cause price inflation and lead to a shortage in supplies.

Households dependent on the procurement of food as opposed to subsistence agricultural activities (e.g., landless), the elderly and female headed households are considered sensitive VECs.

The impacts will be short-term and will affect districts. Due to their short-term nature, before mitigation the impacts are considered not significant.

Impact: Restriction of access to small businesses, street vendors and local markets during construction

This may lead to direct and indirect impacts.

Markets and enterprises are on roadsides and at intersections in PACs. During construction, customer access may be temporarily obstructed by construction activities, causing loss of income to vendors.

The impacts will be transient and will affect entire PACs. Due to their transient nature and small extent, before mitigation the impacts are considered not significant.

From a human rights perspective there may be an impact, on a very temporary basis, on the right to work and on the right to an adequate standard of living of the small business owners and street vendors.

Temporary Road Closure

Business owners rely on the road network between PACs and urban centres to source supplies and market goods.

Impact: Increased transportation costs and travel time with economic consequences

This may lead to direct and indirect impacts.

The pipeline has been routed as much as possible near the existing road network, thereby minimising the need for the development of new roads. This means some existing roads which serve local communities will be upgraded.

Upgrading of the existing roads may temporarily interfere with business owners who purchase supplies in urban centres, farmers selling their produce at district markets and public transport providers, particularly motorbike taxis. Alternative routes (if available) to urban centres may increase the cost and time needed to source supplies. This may have negative outcomes for business operating hours and product prices, potentially reducing business competitiveness and customer bases.

From a human rights perspective, there may be an impact on the right to health and education through temporary reduced access to healthcare and education facilities.

The impacts will be transient and will affect entire PACs. Due to their transient nature and small extent, before mitigation the impacts are considered not significant.
Location-Specific Benefits

Pressure Reduction Station 1 (Kiteto District, KP1172) and Pressure Reduction Station 2 (Handeni District, KP1330)

The potential generic benefits are also applicable to the three PACs near the two pressure reduction stations. However, the benefit of improvements in road conditions for business owners and public transport (related to provision of goods and services), may be more pronounced in the following PAC:

- Kimana (KP1169).

This PAC is in Kiteto district, Manyara region. During construction, the project will instate a permanent new access road to PRS1, which will also link previously unconnected Kimana to the Kiberashi–Kibaya road. The improvement in access to and from Kimana will lead to potentially beneficial impacts for the PAC. It may be particularly valuable for farmers transporting perishable produce and livestock to markets.

The impacts are considered beneficial.

Location-Specific Impacts

Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147) Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)

The potential generic impacts are also applicable to the 38 PACs near the 12 MCPYs and one coating facility (CF). However, the impact of competition over employment opportunities may be more pronounced in the following PAC:

- Tanganyika (KP1405, the nearest urban centre to MCPY16, approximately 1 km away).

This PAC is densely populated and growing in size (see Appendix A11, Attachment A11.1) and demand for jobs is high. Many local businesses are already present. This PAC is more likely to experience PIIM than neighbouring PACs near the project, which are considerably smaller and offer fewer goods and services.

The impacts will be short-term and will affect the entire PAC. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

The impact of increased transportation costs and travel time with economic consequences (related to temporary road closure) may be more pronounced in the following PACs:
• Nkomero, Muleba district (KP418.5, the nearest PAC to MCPY6, approximately 1 km away), where the project will upgrade the road linking Nkomero to the Mutukula–Nzega trunk road.

• Serya, Kondoa district (KP1038.5, the nearest PAC to MCPY12, approximately 2.5 km away), where the project will upgrade to the road linking Serya to an existing murram road.

• Ndaleta, Kiteto district (KP1139.5, the nearest PAC to MCPY13, approximately 5.5 km away), where the project will upgrade the road linking Ndaleta to the Mlima Wa Simu–Kondoa road.

Upgrades to these roads before construction may temporarily disrupt traffic flows and obstruct existing routes used by business owners and other PAC members. The impacts will be short-term and will affect entire PACs. Due to their short-term nature and small extent, before mitigation the impacts are considered not significant.

RoW – PACs Close to Pipeline Crossings of Major Roads

The potential generic impacts are also applicable to PACs close to pipeline crossings of major roads. However, the impact of increased transportation costs and travel time with economic consequences (related to temporary road closure) may be more pronounced in the following PAC:

• Mkungo (KP513, on regional road R165-4375, approximately 1.5 km from major pipeline road crossing).

This PAC is on a main road and close to a point where the pipeline will intersect it. The pipeline crossing of this road during construction may disrupt traffic flows and obstruct existing routes used by business owners, public transport providers and other PAC members.

The impacts will be short-term and will affect the entire PAC. Due to their short-term nature and small extent, before mitigation the impacts are considered not significant.

Pumping Station 3 (Muleba District, KP405.4), Pumping Station 4 (Mbogwe District, KP610), Pumping Station 5 (Igunga District, KP824.8), Pumping Station 6 (Singida District, KP931)

The potential generic impacts are also applicable to the eight PACs near the four pumping stations.

Pressure Reduction Station 1 (Kiteto District, KP1172) and Pressure Reduction Station 2 (Handeni District, KP1330)

The potential generic impacts are also applicable to the three PACs near the two pressure reduction stations.

Marine Storage Terminal and Load-Out Facility (Tanga District)

The marine storage terminal (MST) is on the Chongoleani peninsula in Tanga district, Tanga region. The nearest PACs to the MST are Putini mtaa (KP1441.5, approximately 1.5 km away) and Chongoleani mtaa (KP1442.5, approximately 0.3 km away). Consultation undertaken for the project in these PACs indicated that
local residents have particularly high expectations in terms of business opportunities and the broader socio-economic development associated with the implementation of the project. Residents in these mtaas have had more exposure to the EACOP project than other villages or wards over the past 18 months; land acquisition by the Tanzania Ports Authority (TPA) has already taken place in support of several projects being planned in the area and stakeholder engagement activities to date have been intensive. The area also boasts other businesses (two cement factories and Tanzania International Petroleum Reserves Limited), which has increased the PACs’ exposure to potential enterprise benefits.

Unemployment is a key challenge in Putini and Chongoleani; consultations with leaders in both communities revealed that an increase in employment opportunities, particularly for women, is the main aspiration of the communities in both mtaas. Project-affected people (PAPs) in Putini and Chongoleani have expressed concern about any future in-migration of economic migrants to the area and the increased competition for jobs this may cause. While there is potential for PIIM in other PACs around the MST, this was not raised as a concern by those PACs. Residents in Putini and Chongoleani believe that they should be given priority for all employment opportunities associated with the project; the employment of nonlocals is considered unfair and unfavourable and would likely lead to an increase in tensions and conflicts.

The potential generic impacts are also applicable to Putini mtaa and Chongoleani mtaa. However, the following impacts may be more pronounced in these PACs:

**Employment**

Impact: Dissatisfaction arising from unmet expectations

and

Impact: Competition over employment opportunities

The impacts will be short-term and will affect the entire PACs. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

### 8.12.2.3 Operation

Personnel during operations will be employed in accordance with national and project requirements. In addition, a set of management measures will apply (described in Section 8.12.3).

**Generic Benefits**

The following potential generic benefit, described for construction, is also applicable during pipeline, AGI, MST and LOF operation:

**Provision of Goods and Services**

Benefit: Improvements in road conditions for business owners and public transport

It is expected that road upgrades and the establishment of new access roads during the construction period will continue to benefit the PACs during pipeline operation.
The impacts are considered beneficial. The assessment of this impact assumes that the government will maintain the roads.

**Generic Impacts**

The following potential generic impact, described for construction, is also applicable during pipeline, AGI, MST and LOF operation:

**Employment**

Impact: School drop outs seeking employment in the project supply chain

This may lead to direct and indirect impacts.

The project may continue to entice children, particularly boys, for maintenance of the RoW. In areas where ASM activities have been identified, the risk of child labour may be higher given the presence of an already existing labour pool of children who have left school and engaged in such activities.

There may be an impact on the human right that prevents child labour as well as the right to education.

The impacts will be long-term and will affect some individuals in the PACs. Due to their localised extent, before mitigation the impacts are considered not significant.

**Location-Specific Benefits**

**Marine Storage Terminal and Load-Out Facility (Tanga District)**

The potential generic benefits are also applicable to PACs near the MST. However, the following benefits may be more pronounced in Putini mtaa (KP1141.5) and Chongoleani mtaa (KP1442.5):

**Employment**

Benefit: The generation of project local employment opportunities

Personnel will be required to ensure pipeline safety, integrity and reliability during operations. Employment opportunities may also arise with local companies contracted to provide services during pipeline operation. During pipeline and AGI operation, approximately 300 personnel will be required, with an estimated 200 nationals. This number is lower than the number of personnel required during construction.

The impacts are considered beneficial.

Benefit: The provision of training and skill development opportunities within employment

Production, maintenance and inspection personnel will be locally recruited and trained during construction to ensure a trained resource pool that can be used during pipeline operations.

The impacts are considered beneficial.
Provision of Goods and Services
Benefit: Project procurement providing opportunities for local businesses
During operation, businesses in PACs around the MST will be able to provide
goods and services such as food, medical supplies and recreational materials to
workers. This will enable local businesses to boost their earnings and increase their
profit margins during the operation period, causing local economic growth.
The impacts are considered beneficial.

8.12.3 Enhancement and Mitigation Measures
This section describes the avoidance and mitigation measures that will be applied
to the aspects and activities that could affect the local economy (nonland-based
livelihoods).
Typically, it is not a single mitigation that reduces an impact but the application of
several mitigations that all contribute to the management of an impact. The key
mitigation measures presented in this section, and the associated management
plan and other measures that are included Appendix E4, have been collectively
used to assess residual impacts, and to determine their significance.

8.12.3.1 Design
Generic Mitigation Measures
As described in Section 3, Alternatives, route identification for the pipeline has
considered social aspects relating to the local economy (nonland-based livelihoods)
such as minimising impacts on local businesses and infrastructure. The selected
pipeline route was chosen partly because it had the lowest number of social
constraints of the routing options available.

Location-Specific Mitigation Measures
There are no location-specific design mitigation measures for the construction
facilities, pipeline, AGIs, MST and LOF.

8.12.3.2 Construction
Generic Enhancement Measures
Employment
Benefit: The generation of project local employment opportunities
The procurement and supply chain management plan, labour management plan and
the stakeholder engagement plan will include measures that collectively support
local employment opportunities.
As part of the tendering process (sub) contractors will be required to include
initiatives in their proposal aimed at increasing local employment. There will be a
recruitment procedure approved by the project that is open to all, transparent,
nondiscriminatory and promotes local content by preferentially employing local
people.
Benefit: The provision of training and skill development opportunities within employment

The procurement and supply chain management plan and the labour management plan will include measures that collectively support skills development within the workforce through compliance with project human resources policies and procedures. On-the-job training will be provided to enable local workers to gain new or improved skills while working on the project. Risk-based worksite training and daily toolbox meetings addressing health and safety concerns will provide additional on-the-job training.

Provision of Goods and Services

Benefit: Project procurement providing opportunities for local businesses

The procurement and supply chain management plan and the labour management plan will include measures that collectively contribute to the support of project opportunities for national businesses.

The procurement and supply chain management plan will be developed to maximise the purchase of goods and services from within Tanzania and include, as appropriate, enterprise and capacity development.

**Generic Mitigation Measures**

**Employment**

Impact: Loss of employment after project construction phase

The procurement and supply chain management plan, labour management plan and the stakeholder engagement plan will include measures that will contribute to the management of loss of employment after project construction phase.

A campaign focused on providing realistic community expectations with regard to livelihood options and employment opportunities, financial management workshops for workers to raise levels of financial literacy will be implemented. During the recruitment process and throughout their contract, workers will be advised regularly that the duration of their employment is temporary and that they should try to maintain their existing livelihoods and prepare for the termination of their employment.

A retrenchment plan will be prepared, using the principles in the International Finance Corporation’s Good Practice Note No. 4: Managing Retrenchment, 2005.

Although the pre-mitigation impact is considered not significant, the application of the above measures will further reduce impact; the residual impact will still have a site-based extent and long duration, although the magnitude is reduced to negligible.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the residual impact will be not significant.
Impact: Dissatisfaction arising from unmet expectations over the scale and duration of project local employment opportunities

and

Impact: Competition over employment opportunities

The labour management plan and stakeholder engagement plan will include measures that will contribute to the management of these impacts.

The project will set targets for local recruitment and establish employment offices in the districts traversed by the project.

A public awareness programme communicating employment and training opportunities and a PIIM management plan aiming to reduce the number of people that arrive into PACs will be developed.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the residual impacts will be not significant.

Impact: Diversion of workers gaining employment from the project away from existing local businesses or public-sector jobs

The procurement and supply chain management plan, labour management plan and stakeholder engagement plan will include measures that will contribute to the management of diversion of workers gaining employment from the project away from existing local businesses or public-sector jobs.

Before construction, a benchmarking exercise gathering data on average incomes in the private and public sector will be undertaken. This data will be used to identify salary levels for the construction workforce that avoid disparities with local businesses/public sector salaries.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the residual impacts will be not significant.

Impact: School drop outs seeking employment in the project supply chain

The procurement and supply chain management plan, monitoring and reporting plan, labour management plan and stakeholder engagement plan will include measures that contribute to the management of this impact.

The stakeholder engagement plan will include provisions to address school drop outs seeking employment in the project supply chain through an awareness campaign targeting schools in PACs, particularly in areas where ASM activities have been identified.

The following management measures will be included in the procurement and supply chain management plan, labour management plan and the stakeholder engagement plan:

• a transparent recruitment procedure
• regular meetings with supply chain workers to address human and labour rights
• no employees will be hired, directly or indirectly, under the age of 18 years
• stakeholders concerned about child labour will be encouraged to use the grievance mechanism
• evaluations of (sub) contractors’ human rights record related to labour and working conditions will be conducted.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the residual impacts will be not significant.

Provision of Goods and Services

Impact: Inflation and effects on supply owing to project procurement

The procurement and supply chain management plan will include measures that contribute to the management of this impact.

Before construction, a benchmarking exercise of local prices for goods will be undertaken and used to identify and monitor appropriate prices so that large price disparities between project-procured and local goods prices are avoided. Application of these mitigation measures will reduce the magnitude of impact from medium to small and the residual impacts will be not significant.

Impact: Restriction of access to small businesses, street vendors and local markets during construction

The resettlement action plan, monitoring and reporting plan and stakeholder engagement plan will include measures that contribute to the management of this impact.

A resettlement policy framework outlining procedures related to loss of assets and livelihood restoration has been developed. Based on the resettlement policy framework, the resettlement action plan or livelihood restoration plan will identify PAPs and the procedures related to compensation for loss of assets as well as livelihood restoration.

The stakeholder engagement plan keeps stakeholders informed about project activities and evaluates and responds to concerns.

Application of these mitigation measures will reduce the magnitude of impact from medium to negligible and the residual impact will be not significant.

Temporary Road Closure

Impact: Increased transportation costs and travel time with economic consequences

The infrastructure and utilities management plan and the stakeholder engagement plan will include measures that contribute to the management of this impact.

All construction activities that can interfere with local transportation will be communicated to local authorities and affected communities at least 72 hours beforehand.

Application of these mitigation measures will reduce the magnitude of impact from medium to small and the residual impact will be not significant.
Location-Specific Impacts

Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147), Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318), and Main Camp and Pipe Yard 16 (Muheza District, KP1404)

The generic enhancement and mitigation measures are also applicable to the 38 PACs near the 12 MCPYs and one CF. The additional specific mitigation measure is recommended for Tanganyika (KP1405):

Employment

Impact: Competition over employment opportunities

The stakeholder engagement plan and the PIIM management plan will contribute to the management of competition over employment opportunities for Tanganyika (KP1405).

The project will conduct ongoing monitoring of Tanganyika (Muheza district, Tanga region, Tanzania) and liaise with authorities to review social changes in the town, enhance existing interventions or develop additional interventions if required.

RoW – PACs Close to Pipeline Crossings of Major Roads

The generic enhancement and mitigation measures are also applicable to PACs close to pipeline crossings of major roads.

Pumping Station 3 (Muleba District, KP405.4), Pumping Station 4 (Mbogwe District, KP610), Pumping Station 5 (Igunga District, KP824.8), Pumping Station 6 (Singida District, KP931)

The generic enhancement and mitigation measures are also applicable to the eight PACs near the four pumping stations.

Pressure Reduction Station 1 (Kiteto District, KP1172) and Pressure Reduction Station 2 (Handeni District, KP1330)

The generic enhancement and mitigation measures are also applicable to the three PACs near the two pressure reduction stations.

Marine Storage Terminal and Load-Out Facility (Tanga District)

The generic enhancement and mitigation measures are also applicable to PACs near the MST. The additional specific mitigation measures required for Putini mtaa and Chongoleani mtaa are:
Employment

Impact: Dissatisfaction arising from unmet expectations

and

Impact: Competition over employment opportunities

The following location-specific mitigation will be included in the stakeholder engagement plan and the PIIM management plan to contribute to the management of competition over employment opportunities and dissatisfaction arising from unmet expectations for Putini mtaa and Chongoleani mtaa.

Ongoing monitoring and liaising with authorities to review social changes in Putini and Chongoleani (Muheza district, Tanga region) where additional interventions aimed at competition over employment and dissatisfaction from unmet expectations will be developed to support existing interventions.

Application of these mitigation measures will reduce the magnitude of impact from very large to medium and the residual impact will be not significant.

8.12.3.3 Operation

Generic Mitigation Measures

Employment

Impact: School drop outs seeking employment in the project supply chain

The procurement and supply chain management plan, monitoring and reporting plan, labour management plan and stakeholder engagement plan will include measures that contribute to the management of this impact.

The stakeholder engagement plan will include provisions to address school drop outs seeking employment in the project supply chain through an awareness campaign targeting schools in PACs, particularly in areas where ASM activities have been identified.

The following management measures will be included in the procurement and supply chain management plan, labour management plan and the stakeholder engagement plan:

- a transparent recruitment procedure
- regular meetings with supply chain workers to address human and labour rights
- no employees will be hired, directly or indirectly, under the age of 18 years
- stakeholders concerned about child labour will be encouraged to use the grievance mechanism
- evaluations of (sub) contractors’ human rights record related to labour and working conditions will be conducted.

Location-Specific Enhancement Measures

Marine Storage Terminal and Load-Out Facility (Tanga District)

The following enhancement measures, described for construction, are specifically applicable to Putini mtaa and Chongoleani mtaa:
Employment
Benefit: The generation of project local employment opportunities
The procurement and supply chain management plan, labour management plan, and stakeholder engagement plan will include measures that collectively support local employment opportunities.
As part of the tendering process, (sub)contractors will be required to include initiatives in their proposal aimed at increasing local employment as well as improving skills of local personnel. This requirement will be enforced through an approved recruitment procedure that is open to all, transparent, nondiscriminatory and promoting local content by preferentially employing local people.
Benefit: The provision of training and skill development opportunities within employment
The procurement and supply chain management plan and the labour management plan will include measures that collectively support skills development within the workforce through the compliance with project human resources policies and procedures. On-the-job training will be provided to enable local workers to gain new or improved skills while working on the project. Risk-based worksite training and daily toolbox meetings addressing health and safety concerns will provide additional on-the-job training.

Provision of Goods and Services
Benefit: Project procurement providing opportunities for local businesses
The procurement and supply chain management plan and the labour management plan will include measures that contribute to the management of this benefit.
The procurement and supply chain management plan will ensure the purchase of goods and services from within Tanzania and include, as appropriate, enterprise and capacity development.

8.12.4 Residual Impacts and Significance Summary
This section summarises the residual impacts on the local economy (nonland-based livelihoods) after mitigation has been implemented.
Table 8.12-1 summarises the potential generic local economy (nonland-based livelihoods) impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation. Table 8.12-2 summarises the location-specific impacts.
After mitigation has been implemented, the potential residual impacts on the local economy (nonland-based livelihoods) will be not significant.

8.12.4.1 Ecosystem Services
Section A11.4.5.4 in Appendix A11 identifies that the local economy (nonland-based livelihoods) does not provide ecosystem services. No ecosystem services have therefore been considered. The ecosystem services that the local economy
(nonland-based livelihoods) relies upon are described in land-based livelihoods (Section 8.13).
### Table 8.12-1  Local Economy (Nonland-Based Livelihoods) – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment</td>
<td>The generation of project local employment opportunities</td>
<td>C</td>
<td>Y</td>
<td>Procurement and supply chain management plan</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Labour management plan</td>
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<td></td>
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<td></td>
<td>Stakeholder engagement plan</td>
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<tr>
<td>Provision of Goods and Services</td>
<td>Project procurement providing opportunities for local businesses</td>
<td>C</td>
<td>Y</td>
<td>Procurement and supply chain management plan</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Labour management plan</td>
<td></td>
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<tr>
<td>Provision of Goods and Services</td>
<td>Improvements in road conditions for business owners and public transport</td>
<td>C &amp; O</td>
<td>Y</td>
<td></td>
<td>B</td>
</tr>
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</table>
### Table 8.12-1  Local Economy (Nonland-Based Livelihoods) – Generic Impacts

<table>
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<tr>
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<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
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<tbody>
<tr>
<td>Employment</td>
<td>Loss of employment after project construction phase</td>
<td>C</td>
<td>N</td>
<td>Procurement and supply chain management plan, Labour management plan, Stakeholder engagement plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>Employment</td>
<td>Dissatisfaction arising from unmet expectations over the scale and duration of project local employment opportunities</td>
<td>C</td>
<td>Y</td>
<td>Project-induced in-migration management plan, Labour management plan, Stakeholder engagement plan</td>
<td>4 2 3 5 14</td>
</tr>
<tr>
<td>Employment</td>
<td>Competition over employment opportunities</td>
<td>C</td>
<td>Y</td>
<td>Project-induced in-migration management plan, Labour management plan, Stakeholder engagement plan</td>
<td>4 2 2 5 13</td>
</tr>
<tr>
<td>Employment</td>
<td>Diversion of workers gaining employment from the project away from existing local businesses or public-sector jobs</td>
<td>C</td>
<td>N</td>
<td>Procurement and supply chain management plan, Labour management plan, Stakeholder engagement plan</td>
<td>4 2 2 4 12</td>
</tr>
</tbody>
</table>

**NOTES:** C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.12-1  Local Economy (Nonland-Based Livelihoods) – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
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<td></td>
<td>Procurement and supply chain management plan</td>
<td>M</td>
</tr>
<tr>
<td>Employment</td>
<td>School drop outs seeking employment in the project supply chain</td>
<td>C &amp; O</td>
<td>Y</td>
<td>Procurement and supply chain management plan</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Monitoring and reporting plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Labour management plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stakeholder engagement plan</td>
<td></td>
</tr>
<tr>
<td>Provision of Goods and Services</td>
<td>Inflation and effects on supply owing to project procurement</td>
<td>C</td>
<td>-</td>
<td>Procurement and supply chain management plan</td>
<td>4</td>
</tr>
<tr>
<td>Provision of Goods and Services</td>
<td>Restriction of access to small businesses, street vendors and local markets during construction</td>
<td>C</td>
<td>-</td>
<td>Resettlement action plan</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Monitoring and reporting plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stakeholder engagement plan</td>
<td></td>
</tr>
<tr>
<td>Temporary Road Closure</td>
<td>Increased transportation costs and travel time with economic consequences</td>
<td>C</td>
<td>-</td>
<td>Infrastructure and utilities management plan</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stakeholder engagement plan</td>
<td></td>
</tr>
</tbody>
</table>

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### Table 8.12-2  Local Economy (Nonland-Based Livelihoods) – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kimana (KP1169)</td>
<td>Provision of Goods and Services</td>
<td>Improvements in road conditions for business owners and public transport</td>
<td>C</td>
<td>Y</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Tanganyika (KP1405)</td>
<td>Employment</td>
<td>Competition over employment opportunities</td>
<td>C</td>
<td>Y</td>
<td>Project-induced in-migration management plan Stakeholder engagement plan</td>
<td>6 2 2 5 15</td>
</tr>
<tr>
<td>Nkomero (KP418.5)</td>
<td>Temporary Road Closure</td>
<td>Increased transportation costs and travel time with economic consequences</td>
<td>C</td>
<td>-</td>
<td>Infrastructure and utilities management plan Stakeholder engagement plan</td>
<td>6 2 2 5 15</td>
</tr>
<tr>
<td>Serya (KP1038.5)</td>
<td>Temporary Road Closure</td>
<td>Increased transportation costs and travel time with economic consequences</td>
<td>C</td>
<td>-</td>
<td>Infrastructure and utilities management plan Stakeholder engagement plan</td>
<td>6 2 2 5 15</td>
</tr>
<tr>
<td>Ndaleta (KP1139.5)</td>
<td>Temporary Road Closure</td>
<td>Increased transportation costs and travel time with economic consequences</td>
<td>C</td>
<td>-</td>
<td>Infrastructure and utilities management plan Stakeholder engagement plan</td>
<td>6 2 2 5 15</td>
</tr>
<tr>
<td>Mkungo (KP513)</td>
<td>Temporary Road Closure</td>
<td>Increased transportation costs and travel time with economic consequences</td>
<td>C</td>
<td>-</td>
<td>Infrastructure and utilities management plan Stakeholder engagement plan</td>
<td>6 2 2 5 15</td>
</tr>
</tbody>
</table>

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### Table 8.12-2  Local Economy (Nonland-Based Livelihoods) – Location-Specific Impacts

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<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Putini and Chongoleani (KP1141 to 1442.5)</td>
<td>Employment</td>
<td>Dissatisfaction arising from unmet expectations over the scale and duration of project local employment opportunities</td>
<td>C</td>
<td>Y</td>
<td>Stakeholder engagement plan, Project-induced in-migration management plan</td>
<td>M 6  D 2  E 2  S 5  SS 15</td>
</tr>
<tr>
<td>Putini and Chongoleani (KP1141 to 1442.5)</td>
<td>Employment</td>
<td>Competition over employment opportunities</td>
<td>C</td>
<td>Y</td>
<td>Stakeholder engagement plan, Project-induced in-migration management plan</td>
<td>M 6  D 2  E 2  S 5  SS 15</td>
</tr>
<tr>
<td>Putini and Chongoleani (KP1141 to 1442.5)</td>
<td>Employment</td>
<td>The generation of project local employment opportunities</td>
<td>O</td>
<td>Y</td>
<td>Procurement and supply chain management plan, Labour management plan, Stakeholder engagement plan</td>
<td>B</td>
</tr>
<tr>
<td>Putini and Chongoleani (KP1141 to 1442.5)</td>
<td>Employment</td>
<td>The provision of training and skill development opportunities within employment</td>
<td>O</td>
<td>Y</td>
<td>Procurement and supply chain management plan, Labour management plan</td>
<td>B</td>
</tr>
<tr>
<td>Putini and Chongoleani (KP1141 to 1442.5)</td>
<td>Provision of Goods and Services</td>
<td>Project procurement providing opportunities for local businesses</td>
<td>O</td>
<td>Y</td>
<td>Procurement and supply chain management plan, Labour management plan</td>
<td>B</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
8.12.5 Transboundary Project Impacts

8.12.5.1 Generic Transboundary Project Impacts

No generic transboundary project impacts have been identified in relation to the local economy (nonland-based livelihoods).

8.12.5.2 Location-Specific Transboundary Project Impacts

RoW – Mutukula Town, Kyotera District, Uganda (KP295.5)/Mutukula Town, Missenyi District, Tanzania (KP296)

The following location-specific transboundary project impacts have been identified in Mutukula town (Tanzania and Uganda) during construction:

Employment

Benefit: The generation of project local employment opportunities

The international border between Uganda and Tanzania at Mutukula is extremely porous; people migrate daily and weekly between the two countries to trade in basic goods and services. These movements are largely unregulated with customs being predominantly concerned with monitoring truck movements. The migration of agricultural labour to and from the areas surrounding Mutukula on a seasonal basis is also known to occur.

Ugandan nationals living close to the border with Tanzania may benefit from the generation of local employment opportunities by the project. Nationals from other neighbouring countries (i.e., Rwanda, Burundi) may also benefit as they have been known to migrate to the area for economic reasons. The history of cross border migration in Mutukula and the surrounding area has led to the development of social ties and family connections; these may facilitate the movement of people from Uganda and other countries to work on the project in Tanzania.

Impact: The provision of training and skill development opportunities within employment.

Nationals from Uganda (and other neighbouring countries), who successfully gain employment on the project in Tanzania, may also benefit from the training and skill development opportunities it will bring.

Provision of Goods and Services

Impact: Project procurement providing opportunities for local businesses

Traders in Mutukula, which straddles the Tanzania – Uganda border, may also benefit from opportunities to provide goods and services to the project or additional spending by the construction workforce in the town; this may enhance their business activities and income earnings as a result.

The potential for generation of project local employment opportunities, provision of training and skill development opportunities within employment and project procurement providing opportunities will be enhanced through the measures described in Section 8.11.4.
8.12.6 Cumulative Impacts

8.12.6.1 Context

Section 6.4.3.7 describes the baseline condition of the local economy (nonland-based livelihoods), the trends and sensitivity to change. Table 8.12-1 and Table 8.12-2 summarise project residual impacts.

Although agriculture remains the most important livelihood activity for most of the population in Tanzania, trade in retail merchandise and agricultural produce and the provision of local services also play an important role in the economy of the districts in the AOI. There are presently few formal employment opportunities in the PACs and most PACs lack semiskilled and skilled workers.

The project impacts that may cause cumulative impacts are:

- provision of employment opportunities (mainly unskilled)
- skills development
- opportunities for businesses development from project procurement
- diversion of local people from existing local businesses or public-sector jobs
- retrenchment after the completion of construction
- children dropping out of school to seek employment in the project supply chain
- inflation due to project procurement of goods and services.

The cumulative impacts may be experienced in the districts, wards and PACs within the shared AOI of the EACOP project and the third-party developments. The third-party developments are shown in the cumulative impacts matrix, described and mapped in Appendix H. The third-party developments are:

- Ngono project (TZ04)
- Geita airport (TZ05)
- extension water supply project from Lake Victoria to Tabora, Nzega and Igunga (TZ16)
- road upgrade (TZ27)
- waste facility (TZ28)
- mining concessions (TZ34).

No cumulative impacts with the associated facilities were identified.

No threshold is required for the beneficial impact of employment, training and local purchasing.

The preferred condition for the other potential impacts is that PACs maintain an adequate standard of living by returning to their pre-employment livelihoods or through alternative employment opportunities following retrenchment; children stay in school; and project-induced inflation is curbed.

The predicted cumulative impacts should be interpreted with caution, as data on construction schedules, labour and purchasing needs for third-party developments were not available at the time of writing.
8.12.6.2 Cumulative Impacts

Potential cumulative impacts on the local economy may occur near the MCPYs, MST and third-party developments that also require substantial labour forces, construction materials and supplies, and which have concurrent or successive construction phases. The third-party developments, MCPYs, MST and wards and districts that may be impacted are shown in Table 8.12-3.

Table 8.12-3   Cumulative Impacts: Local Economy (Nonland-Based Livelihoods)

<table>
<thead>
<tr>
<th>ID</th>
<th>Project</th>
<th>Nearest KP</th>
<th>MCPY/MST</th>
<th>Ward or District Potentially Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ04</td>
<td>Ngono dam</td>
<td>333.5</td>
<td>MCPY5 (approximately 6 km from TZ04)</td>
<td>Kayaka, Kilimilili and Mushaha wards, Missenyi district</td>
</tr>
<tr>
<td>TZ05</td>
<td>Geita airport</td>
<td>498.5</td>
<td>MCPY7 (approximately 13 km from TZ05)</td>
<td>Katende and Bukombe wards, Chato district</td>
</tr>
<tr>
<td>TZ14</td>
<td>Transmission line construction</td>
<td>955.5–956</td>
<td>955.5–956</td>
<td>Singida urban district and Singida district</td>
</tr>
<tr>
<td>TZ16</td>
<td>Extension water supply project from Lake Victoria to Tabora, Nzega and Igunga</td>
<td>730–819.5</td>
<td>MCPY10 (approximately 2 km from TZ16). Pipeline runs parallel to EACOP and crosses the pipeline</td>
<td>Nanga ward, Igunga district</td>
</tr>
<tr>
<td>TZ27</td>
<td>Handeni to Singida road upgrade</td>
<td>1061 and 1080</td>
<td>MCPY13 (approximately 12 km from TZ27) and crosses the pipeline</td>
<td>Serya, Suruke, Kingale, Chemchem, Kilimani, Kondoa and Mjini wards, Kondoa district</td>
</tr>
<tr>
<td>TZ27</td>
<td></td>
<td>1230–1240</td>
<td>MPCY 14 (approximately 15 km from TZ 27)</td>
<td>Kibirashi ward, Kilindi district, Loolera ward, Kiteto district</td>
</tr>
<tr>
<td>TZ28</td>
<td>Mpirani waste facility</td>
<td>1437.5</td>
<td>MST (approximately 5 km from TZ28)</td>
<td>Chongoleani and Mabokweni wards (and wards of Tanga city), Tanga district</td>
</tr>
<tr>
<td>TZ34</td>
<td>Mining concessions</td>
<td></td>
<td></td>
<td>Kasharunga and Karambi ward, Muleba district, Bukome ward with Chato district, Bukombe ward in Bukombe district, Igusule ward in Nzega district, Nanga ward in Igunga district, Serya ward in Kondoa district, Loolera ward and Njoro wards in Kiteto district, Mabanda in Handeni Township Authority, Kibirashi in Kilindi district</td>
</tr>
</tbody>
</table>
Local Economic Boost

Table 8.12-3 shows the districts and wards that may benefit from a boost in general economic development due to the cumulative impacts from local employment, training and purchasing associated with the EACOP project and third-party developments. If the projects were implemented consecutively, the economic boost may be less intense but would occur over a longer duration.

The PACs that may experience a substantial economic boost (including development of new commerce and services, and an increase in material standard of living of many households) because of the cumulative impact of employment, training and purchasing are:

- Missenyi, Bulifani and Kashaba, because of cumulative impacts from the Ngono water project and EACOP project. The Ngono project will have a peak construction workforce of 1400 people. The EACOP project will include 2000 workers for the spread that affects these PACs including 200 unskilled workers.
- Chato and Mkungo, because of cumulative impacts from Geita airport and the EACOP project. While no workforce figures are available for construction of Geita airport, it is estimated that the workforce will be smaller than for the EACOP spread.
- Singida, because of cumulative impacts from the transmission line project and the EACOP project. While no workforce figures are available for construction of the transmission line project, it is estimated that the workforce will be smaller than for the EACOP spread.
- Bulyang’ombe, because of cumulative impacts from the water pipeline project and the EACOP project. It is estimated that the workforce for the water pipeline may be of similar size to the EACOP spread.
- Kondoa, Seye and Gitu, because of cumulative impacts from the Handeni to Singida road upgrade and the EACOP project. The construction workforce for the road upgrade is estimated to be smaller than for the EACOP project.
- Mabokweni, Putini, Ndaoya, Bagamoyo and Tanga city because of cumulative impacts from the Miprani waste facility and the EACOP project. A construction workforce similar to the EACOP spread and MST is estimated for the waste facility.

The wards harbouring mining concessions, MCPYs and/or MST (see Table 8.12-3) may be cumulatively impacted, although the potential occurrence is estimated to be low. Data available on planned activities in mining concessions were insufficient at the time of writing to identify potential cumulative impacts.

The economic boost in the above-mentioned PACs and wards may lead to an overestimation of financial opportunity among school-going youth, causing them to leave school in search of employment or informal business opportunities. The potentially increased pool of jobs may also entice public sector employees away from their employment in search of higher salaries with the EACOP project and other third-party developments. The presence of third-party projects would cause an impact greater than the impact caused by the EACOP project alone.

The project will engage proponents of the third-party developments and appropriate government agencies to consider options for management measures to address significant cumulative impacts. This may include development and implementation
of awareness campaigns in schools and in the community to ensure that the short-term nature of employment opportunities is communicated effectively.

With the mitigation measures implemented, the preferred condition will be achieved and the residual cumulative impact is considered not significant.

Inflation

Purchasing by the EACOP project and third-party developments combined may cause inflation of a larger magnitude than inflation caused by the EACOP project alone in the wards and districts within the shared AOI of EACOP and the third-party developments (see Table 8.12-3 for wards and districts). This impact would be felt during the construction period but could continue into operations for manned AGIs.

The project will undertake a benchmarking assessment on the inflation of goods within PACs if construction phases with other third parties with large workforces coincide. The results of benchmarking will be shared with the proponents of the third-party developments as required.

With the mitigation measures implemented, the preferred condition will be achieved and the residual cumulative impact is considered not significant.

Economic Decline After Construction

PACs that may have experienced an economic boom because of cumulative impacts of employment, purchasing and training, as well as PIIM generally linked to a boom, may experience a 'bust' after completion of the construction period of the EACOP project and third-party developments. This will be more pronounced and involve a larger number of households in the PACs if the construction schedules of both the EACOP project and the third-party developments are concurrent. If the projects were implemented consecutively, the economic ‘bust’ would be less intense, as the downturn would be spread over a longer period.

The project will engage proponents of the third-party developments and appropriate government agencies to consider options for management measures to address significant cumulative impacts. This may include collaboration in terms of local economic programmes.

With the mitigation measure implemented, the preferred condition will be achieved and the residual cumulative impact is considered not significant.

Retrenchment and Re-employment

At the time of writing, construction schedules are not known. However, where the construction schedules of the EACOP project and third-party developments partially overlap or are consecutive, work experience and potentially enhanced skills may provide retrenched EACOP project employees with enhanced opportunities for employment with third-party developments. EACOP may also provide opportunities for retrenched workers from third-party developments if their construction period ends before or during the EACOP construction phase.

The project will engage proponents of the third-party developments and appropriate government agencies to consider options for management measures to address
significant cumulative impacts. This may include collaboration to optimise opportunities for re-employment of retrenched employees.

Insufficient information was available for the identified third-party developments and associated sequence of construction phases to conduct a more detailed analysis of this impact in terms of the number of people affected.

However, with the mitigation measures implemented, the preferred condition will be achieved and the residual cumulative impact is considered not significant.

8.13 Land-Based Livelihoods

This section describes the potential impacts on land-based livelihoods during construction, commissioning and operation of the EACOP project and associated mitigation measures to be adopted.

8.13.1 Key Sensitivities and Considerations

The land-based livelihoods baseline conditions are described in Section 6.4.3.8, as well as:

- land-based livelihoods key VECs and their sensitivity ranking based on the relevant tables in Appendix D
- key considerations for the land-based livelihoods impact assessment.

Sensitivity in the land-based livelihoods AOI is ranked as follows:

- Crop farming households, including men, women and children, engaged in subsistence and commercial crop farming are deemed very highly sensitive, owing to their limited access to alternative sources of income, caused by remote location, lack of education, skills and experience. Farmers have low resilience to external shocks such as crop failure. This can impact on food/nutritional status as well as cash for cost of education and health care. Female headed households are even more sensitive due to their more pronounced lack of access to alternative incomes sources.

- Children are considered very highly sensitive in terms of potential impact on their school attendance. Agricultural work may prevent them from attending school. Both boys and girls may be impacted.

- Landless farm labourers are ranked as very highly sensitive; without their wages, potential impacts will be directly felt on household food and nutritional status as well as cash for education and health care.

- Commercial farmers farming large-scale crops (e.g., coffee, tea) are deemed moderately sensitive as they generally have access to farming inputs, cash reserves and land.

- Crop buyers are ranked as moderately sensitive, as they are dependent on the supply of crops, vegetables and fruits to process and sell. Buyers are often dependent on one income stream, but they are likely to have access to credit facilities based on the business.

- Nomadic livestock owners and their families with large herds are ranked very highly sensitive because a reduction in free movements of large herds may cause reduced access to pasture and water sources.
- Children of nomadic livestock owners, both boys and girls are deemed very highly sensitive as, due to the nomadic lifestyle they often do not have access to schools and other social services.
- Livestock keepers and families who are not fully dependant on livestock or farming are considered moderately sensitive as they may be better protected against shocks.
- Children involved in ASM are very highly sensitive since they are exposed to safety risks and may lack education caused by working on mining activities.
- Miners who are engaged as casual labour and pursue ASM as a sole occupation are deemed very highly sensitive; they have no access to land for farming or livestock as an alternative livelihood and are highly vulnerable.
- Women involved in ASM are considered highly sensitive, as they have less access to productive capital than men and may be relying on ASM as a sole livelihood.
- Pit owners are considered moderately sensitive; they may be vulnerable to a loss of income but are likely to be more resilient if relocated because of a higher income level.
- Female firewood collectors are deemed highly sensitive VECs because of their dependency on natural resources; biomass reserves are already decreasing and with limited access to firewood, household food security is threatened.
- Wild food users are also highly sensitive VECs; plants supplement diets and are used in months when households may not have sufficient access to food.
- Medicinal plant users are moderately sensitive, as without access to plants, there may be limited means to treat certain illnesses in an affordable manner.
- Sensitivity for hunters is medium; they are generally not reliant on the animals they hunt for food or as a source of income, however some groups do rely on hunting for food and hunt as a rite of passage.
- Sensitivity for beekeepers is low as beekeeping is overwhelmingly an activity to supplement farming and not a sole livelihood strategy.
- Sensitivity for grass collectors is low; grass is widespread and availability will not be substantially affected.
- Sensitivity for fibre collectors is low as logging and timber production is not a prevalent economic activity at village level.

Key considerations are:
- crop farming:
  - In the sample PACs, crop farming is generally low input, low output and harvests are vulnerable to pests and diseases. It is not uncommon for entire crops to be spoilt, thus making households vulnerable in terms of food security and economic security.
  - Crop farming is mostly undertaken on household land holding. The impacts of failed crops of loss of land can last for several years, as seedlings and seeds are produced each season for the subsequent season.
  - Seasonal changes are becoming more apparent with late rains and extended droughts. Without irrigation, crop farmers are reliant on rains and thus they are vulnerable to seasonal changes.
  - Crop farmers in the sample PACs receive little to no external support.
Agricultural labour shortages may impact on household’s ability to increase production. Children may be required to contribute more to household tasks which may impact on school attendance.

Access to markets is a major challenge; farmers depend on selling goods locally or to middlemen.

Women involved in crop farming are significantly disadvantaged compared to men owing to limited access to land and capital to improve farming activities.

Human rights to food and an adequate standard of living are sustained.

**livestock rearing:**

Owners of large herds in the sample PACs often do not have diversified income streams.

Livestock-rearing activities are under pressure due to shortage of land and water resources.

Pastoralists migrate through the pipeline route, especially during the dry season.

There are ongoing conflicts between pastoralists and crop farmers.

Livestock diseases are common and can spread fast from one region and district to another. Increased movements of vehicles and people could increase their spread.

Human rights to food and an adequate standard of living are maintained.

**ASM and large-scale mining:**

ASM activities are informal, transient and often operate without a licence.

ASM provides an alternative livelihood to agricultural subsistence farming and offers employment where there are few other livelihood alternatives.

ASM activities are often linked to in-migration, increase in social ills and crime.

The construction industry in Tanzania is growing and therefore there is an increasing demand for construction materials such as aggregate sand and bricks.

PACs’ human rights to an adequate standard of living, safe and healthy working conditions and security of the person are maintained.

**natural resource use:**

Communities, especially poorer households, are dependent on natural resources for the provision of wild food, natural medicine and fuel-wood for cooking.

Growing populations and increasing demand for firewood and charcoal has reduced their availability in the AOI.

There is a decline in bee populations due to habitat destruction in favour of crop farming and annual grazing. Additional removal of land cover may affect the bee population further.

PACs’ human rights to food and an adequate standard of living are maintained.

Sections A11.4.6.1, A11.4.6.2, A11.4.6.3 and A11.4.6.4 in Appendix A11 identify ecosystem services associated with land-based livelihoods in the AOI. The following ecosystem services have been considered:
Crop farming provisioning services:
- food for basic survival of the local population
- income from selling surplus crops to pay for education, clothes and health-related items as well as other basic needs
- jobs for farm labourers
- products for agro-processing activities.

Crop farming is undertaken throughout the AOI in PACs, sometimes being their only source of food.

In the sample PACs, most of the farming is subsistence and the agricultural produce is consumed within the family with a small portion being sold at the local market.

Livestock rearing provisioning services:
- rural income from selling livestock
- food security for families and future generations (if managed in a sustainable manner)
- financial security (livestock rearing is part of a diversification strategy to ensure some cash will be available when other means of income fail).

Livestock rearing cultural services:
- preservation of cultural heritage and traditional knowledge where livestock-rearing is intergenerational.

Key points to note are that within the districts traversed by the AOI, livestock and livestock products are used for both subsistence and sale.

Land provides a provisioning service as a resource for livestock keeping. It provides grazing resources, water sources, ground for movement and habitation of livestock herds and trees for shelter and medicinal herbs.

ASM and large-scale mining provisioning services:
- income from sale of materials for construction (e.g., sand, clay, gravel).
- materials for dwellings and shelter
- salt for livestock and domestic consumption.

ASM is an abiotic provisioning service conducted throughout the AOI by sample PACs primarily in the dry season.

Natural resources use provisioning services:
- energy for cooking and food security
- construction materials for shelter
- income from selling natural resources
- traditional medicine.

Natural resources are obtained from a variety of ecosystems within or near the PACs including forests, wetlands and pasture rangelands. As such, these natural resources play a vital role in subsistence of rural communities. With an increasing
population and a high demand and reliance on natural resources, continued protection of and access to these resources is essential.

The main human rights that are relevant to land-based livelihoods are the right to an adequate standard of living, women’s rights and children’s rights as vulnerable groups. International standards for responsible business also provide that individuals should receive adequate compensation when deprived of their means of livelihood. Adequate compensation requires that displaced persons are provided with compensation for loss of assets at full replacement cost and other assistance to help them improve or at least restore their standards of living or livelihoods (see Section 4).

In addition, in Tanzania, there are several groups who engage in pastoralist and hunter-gatherer activities that may be considered indigenous peoples according to international standards. The international standards for indigenous peoples include requirements to seek the free, prior and informed consent of these groups when project activities may have impacts on their traditional use of lands and natural resources.

Through the human rights impact assessment and other studies and engagement activities, the project is proactively seeking to identify where the project may have potential impacts on indigenous peoples’ rights. In the case of land-based livelihoods, this will be determined by where the pipeline route intersects with traditional lands and natural resources used by indigenous peoples.

As part of the human rights impact assessment HRIA, there was engagement with groups who self-identify as indigenous peoples. In addition, engagement was undertaken with organisations specialising in support for pastoralist and indigenous communities as well as local government representatives on this topic.

Engagement has been conducted with local government and communities and specific groups in areas where these pastoralists and indigenous groups are present to better understand their use of the land within the AOI. Targeted inclusive engagement is being undertaken to reach these groups in particular and ensure their information needs about project impacts are met and to consult with them on potential impacts and appropriate mitigation measures.

The project’s current understanding is that the impact on land will be short term and given the large grazing areas used by pastoralists groups, impact will be temporary and reversible as grazing will continue once the pipeline has been constructed. At this stage, no cultural heritage sites of these groups have been specifically identified within the AOI. The project is focusing on engagement with these groups to the extent possible in order to ensure that they are informed about the project and are engaged in discussion on mitigation measures and other project planning.

Survey work of land and assets including cultural heritage within the AOI will be undertaken and the project will then be able to understand if Performance Standard 7 is triggered. Until that point the objective of the project is to reinforce engagement with such groups to ensure their understanding of the project and for the project to understand their concerns.
8.13.2 Potential Project Impacts

8.13.2.1 Construction

Generic Benefits

Use of Road Network

Within PACs, surplus agricultural produce and livestock is marketed either at farm gates (to bulk buyers) or at weekly or daily local and district markets. Temporary disruption of access to markets are discussed in Section 8.12. Farm gate sales are particularly advantageous to livestock owners as they can avoid the administrative legalities enforced at livestock markets. Baseline data indicates that marketing of produce and livestock is a major challenge, especially in rural areas, due to inadequate road infrastructure. Roads often become impassable during the two rainy seasons. Consequently, produce spoils because it cannot reach markets in time and costs of transportation are inflated, reducing farmers' profits.

Benefit: Improved ability to sell agricultural produce to nearby markets for farmers and traders

The project will improve the conditions of some existing murram roads and construct some new roads for project access to the pipeline RoW and AGI facilities, which will be advantageous to rural communities. With improved road conditions, marketing of agricultural produce may increase and may lead to increased revenue of producers in the AOI.

Generic Impacts

Impeded Movement of Animals

Livestock are intrinsic to the livelihoods of rural PAC households. Cattle and goat rearing in the PACs is both sedentary and nomadic. Pasture lands used are either in fenced areas on privately owned land or, more commonly, on communal village land. Nomadic pastoralists move their livestock to follow the seasonal variation in grazing areas and sources of water.

Impact: Due to access restrictions, livestock cause damage to crops

This may lead to direct and indirect impacts.

Trenching and the creation of new access roads could temporarily limit or restrict access routes to grazing areas and watering points. This will force livestock herders to seek alternative routes or sites, potentially entering farming areas when doing so. This may cause crop damage, increase the number of conflicts or exacerbate existing conflicts between livestock owners and crop farmers. Access restrictions may also force livestock herders to enter areas protected for their biodiversity values when seeking alternative routes or sites.

The impacts will be short-term and will affect some individuals within the PACs. Due to their short-term nature and localised extent, before mitigation the impacts are considered not significant.
Accidents Due to Open Excavations
Livestock in PACs often roam free.
Impact: Livestock falling into excavations
This may lead to direct and indirect impacts.
Livestock could fall into excavations such as the pipeline trench, causing injury or death. PACs do not have easy access to veterinary services for injured livestock. Loss of livestock may impact a household’s food security, collateral for loans and cash income.
The impacts will be medium-term and will affect some households within the PACs. Due to their localised extent, before mitigation the impacts are considered not significant.

Loss/Severance of Land and Disruption to Land-Based Livelihoods
PAC households are reliant on agricultural land for crop farming, forests and scrubland for natural resources, grassland for livestock rearing and areas suitable for ASM.
Impact: Permanent loss of land used for crop farming
This may lead to direct and indirect impacts.
A permanent land acquisition of approximately 4000 ha will cause loss or severance of agricultural land. Baseline data indicates that there is substantial dependency on land used for commercial and subsistence crop farming, the latter of which is undertaken in nearly every PAC. Mixed farming activities consist of growing variations of perennial and annual cash crops, trees (fruit and tree plantations) and subsistence crops. Women are particularly engaged in crop farming and use the income generated to reinforce household food security and pay for their children’s education and health care. Without access to land, a household’s livelihood, food security and well-being could be severely affected.
From a human rights perspective there may be an impact on the rights related to land, including for indigenous peoples.
Baseline data further indicates that there is increasing scarcity of land and replacement land for economically displaced individuals may not be as productive as previous land holdings.
The impacts will be very long-term and will affect some households within the PACs. Due to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.
Impact: Temporary loss of grazing land
This may lead to direct and indirect impacts.
Livestock rearing in the PACs is nomadic and sedentary with grazing on owned, rented or communal land. There are few alternative areas available to graze cattle without entering protected areas or causing disruptions to other land holders or users. Livestock farming is reliant on grazing land to feed animals, with few or no supplements provided.
Acquisition of land used for grazing within the RoW will result in reduced access to grazing land for livestock during construction. After the completion of construction, no farming will be allowed in the RoW and areas outside protected areas kept clear of shrubs and trees. As a result, most of the RoW will become suitable for grazing which will be allowed.

From a human rights perspective there may be an impact on the rights related to land, including for indigenous peoples.

The impacts will be short-term and will affect some households within the PACs who depend on livestock rearing. Due to their short-term nature and localised extent, before mitigation the impacts are considered not significant.

Impact: Increased traffic leading to spread of animal diseases

This may lead to direct and indirect impacts.

Livestock diseases are prevalent in the districts traversed by the AOI, partially due to a lack of veterinary services and some livestock owners lacking the means to afford veterinary services. Project vehicles and people will be moving across districts, potentially spreading disease (such as foot and mouth disease) on car tyres and shoes. An increase in livestock disease may negatively impact the food security and cash income of households depending on livestock rearing for a major proportion of their livelihoods.

The impacts will be medium-term, will affect districts and may have transboundary implications (described in Section 8.13.5). Due to their medium-term nature and medium extent, before mitigation the impacts are considered not significant.

Impact: Permanent loss of access to artisanal mining sites

This may lead to direct and indirect impacts.

ASM within the project AOI is undertaken in two types of areas:

- where ASM occurs without the permission of Zonal and Resident Mines Offices. It is expected that the pipeline corridor will traverse several areas where unpermitted ASM activities take place.
- with mining activities that have been permitted by the government. The Government of Tanzania has allocated large areas of land for ASM activities. The corridor traverses two of these demarcated ASM areas in Shinyanga district.

Owing to the costs associated with a primary mining licence, ASM is undertaken without a licence. Operations are usually nonmechanised, though simple technologies may be applied with minimal economic outlay. ASM engages many people to undertake manual labour, predominantly landless and male youths. Uncontrolled ASM takes place where there are known lucrative deposits, such as on the peripheries of large-scale mining sites or in areas where large scale mining operations previously took place.

With few alternative employment opportunities, ASM, particularly for gold in the Biharamulo, Chato, Mbogwe, Bukombe, Kahama, Nzega, Igunga, Singida and Geita districts, is poverty-driven and provides an important livelihood strategy for several households in the PACs. With permanent loss of access to ASM sites
through permanent land acquisition for the project, households may experience a decrease in cash income and food security.

Furthermore, as it may be difficult to keep individuals involved in ASM away from known mineral deposits (particularly gold), there could be impacts related to interactions between PACs and project security personnel (see Section 8.19).

The impacts will be long-term and will affect some individuals within the PACs who depend on ASM. Young artisanal miners, who often turn to mining activities because they do not have access to land for farming or livestock rearing and lack alternative livelihood opportunities, are deemed very highly sensitive VECs. Due to their very large magnitude and high sensitivity, before mitigation the impacts are considered significant.

Impact: Permanent loss of natural resources

This may lead to direct and indirect impacts.

All households in PACs rely on natural resources including biomass fuel such as firewood or charcoal (for cooking), wood (for house construction), grasses (for thatched roofing and fodder for livestock), wild plants (to supplement food and human and animal medicine), nonwood fibres such as papyrus (for mats and screens), and insects and animals (for food and honey).

Baseline studies found varying degrees of reliance on natural resources for food security, medicine, shelter and income generation. However, the poorest members of PACs are most reliant on natural resources, often due to a lack of access to land to grow crops. There is a pronounced reliance on biomass fuels (firewood and charcoal) for cooking as there are no affordable alternatives. Medicinal plants are particularly relied on in remote rural areas where access to health care is limited.

From a human rights perspective there may be an impact on indigenous peoples rights to access to natural resources. In this context, potential human rights impacts include the right to an adequate standard of living and cultural rights.

Population growth and overexploitation is leading to a decrease in available natural resources, particularly biomass fuel.

Permanent loss of access to natural resources, caused by project land acquisition, could affect those relying on natural resources.

The impacts will be long-term and will affect entire PACs. Poorer households (e.g., landless, widowed, single female and elderly headed households) who are particularly dependent on natural resources may be more vulnerable. Owing to their small extent, before mitigation the impacts are considered not significant.

Impact: Reduction in honey production due to loss of habitat

This may lead to direct and indirect impacts.

Most PACs have at least one household involved in apiculture, which is undertaken alongside crop farming and livestock rearing activities. Apiculture is widespread in the project AOI but is particularly prevalent in Missenyi, Muleba, Chato, Singida, Kondoa and Kilindi districts and Handeni township where the habitat is particularly
conducive to this activity. However, baseline studies indicate a decline in the bee population, which is partially due to loss of habitat.

From a human rights perspective there may be an impact on the right to an adequate standard of living, as well as indigenous people’s rights (particularly for hunters and gatherers).

Further habitat degradation could be compounded by dust created along the RoW, access roads or rural roads used by construction vehicles, particularly during the two dry seasons when traffic is more likely to create dust. Vibrations, generated by construction activities, may also affect bee populations (described in Section 8.13). A decline in honey production will result in loss of income for households involved in apiculture.

The impacts will be medium-term and will affect some individuals within the PACs. Due to their localised extent, before mitigation the impacts are considered not significant.

Disruption to Surface Water Catchments

Crop cultivation in the PACs is mainly rain fed as few farmers have irrigation infrastructure. However, crop farmers are also reliant on other water sources such as rivers, dams and wells, which are drainage fed. During dry periods, water is collected from these sources and (mostly) manually transported to agricultural plots with containers to drip irrigate seedlings.

Livestock owners are reliant on catchment areas for their animals. These sources of water are not always reliable throughout the year and alternative sources often have to be accessed with permission from land holders.

These water sources are also used in some PACs by household members for washing clothes and, to a lesser extent, for drinking water.

Impact: Temporary disruption to surface water

This may lead to direct and indirect impacts.

Disruption of surface water catchment areas could affect irrigation, livestock water points and sources of water used by households. Disruptions could lead to both lack of water and flooding, resulting in direct impacts on crop cultivation and livestock rearing and indirect impacts on food security and income generation. Loss of access to water sources for livestock owners was a major concern for representatives of pastoralist groups as this can affect their seasonal migration patterns and increase the risk of conflicts over lands as they seek alternative water sources for their livestock.

The impact will be short-term and will affect entire PACs. Due to their short-term nature and small extent, before mitigation the impacts are considered not significant.

From a human rights perspective there may be an impact on the right to water and an adequate standard of living in relation to farmers and irrigation. There may be an adverse impact on indigenous peoples’ rights to the extent that pastoralist groups meet the relevant criteria for indigenous peoples.
Location-Specific Impacts

Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147) Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)

The potential generic impacts are also applicable to the 38 PACs near the 12 MCPYs and one CF, except for impacts related to temporary loss of grazing land. The land acquired for the MCPYs and CF will be acquired permanently by the government and leased to the project. It has been assumed that the land will not be returned to agricultural use when the lease ends. Therefore, the following specific impact is applicable to the 38 PACs near the MCPYs and CF:

Loss/Severance of Land and Disruption to Land-Based Livelihoods
Impact: Permanent loss of grazing land
This may lead to direct and indirect impacts.

Permanent land acquisition of approximately 260 ha for the MCPYs and CF will cause permanent loss or severance of grazing land.

Livestock farming in the PACs is reliant on grazing land to feed animals, with few or no supplements provided to the animals. Permanent acquisition of grazing land for the MCPYs and CF could result in insufficient grazing land for livestock and could affect the livelihoods, food security and wellbeing of PAC households engaged in livestock rearing.

The impacts will be very long-term and will affect some households within the PACs. Owing to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

The following generic impacts may be more pronounced in the 38 PACs near the 12 MCPYs and one CF:

Loss/Severance of Land and Disruption to Land-Based Livelihoods
Impact: Permanent loss of land used for crop farming

Owing to the land acquisition of approximately 260 ha for the MCPYs and one CF, permanent loss of crop farming land will be greater at these locations than in PACs near to the RoW. The potential PIIM of economic migrants to the area due to employment opportunities may increase existing pressure on remaining cropland during the construction period. Impacts from loss of cropland may be particularly pronounced in PACs near MCPY16 because these are within the Agro-Tanga sisal plantation, which supports landless community members who work on the plantation. The acquisition of land for MCPY16 may lead to a loss of labour.
Crop farming households engaged in subsistence farming and crop farming female headed households will be particularly vulnerable due to their lack of access to alternative income sources.

The impacts will be very long-term and will affect some households within the PACs. Owing to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Impact: Permanent loss of natural resources

This may lead to direct and indirect impacts.

Land acquisition of approximately 260 ha for the MCPYs and one CF will cause greater permanent loss of natural resources at these locations than in PACs near to the RoW. The potential PIIM of economic migrants to the area due to employment opportunities will increase pressure on natural resources.

The impacts will be long-term and will affect entire PACs. Owing to their moderate sensitivity and small extent, before mitigation the impacts are considered not significant.

The following specific impact is also applicable to the 38 PACs near the 12 MCPYs and one CF:

Employment

Owing to the dearth of formal employment opportunities in PACs, households in rural areas are reliant on crop farming and livestock rearing for food security and cash income. These activities rely primarily on household members for labour.

Impact: Household members seeking employment with the project will no longer be available for land-based livelihood activities

This may lead to indirect impacts.

Household members, who may gain employment from the project, will not be available for household land-based livelihood activities (e.g., crop farming, mining). This may increase the contribution of the remaining spouse (usually the wife) and children to land-based livelihoods. Increased child labour requirements may jeopardise school attendance. Girls are more likely to be withdrawn from school than boys due to cultural norms. If the woman is employed by the project, girls will more likely be withdrawn from school to fulfil household tasks.

Furthermore, it is possible that households may not return to their previous livelihood activities following the termination of their employment contracts. With new skills and experience on the project, households may pursue alternative work in more urbanised areas instead. Households who can secure work in such areas may benefit from increased income earning opportunities. However, households who are unable to find alternative employment may experience greater insecurity and impoverishment owing to the abandonment of existing subsistence livelihoods during the period of their employment with the project.

Households may leave land untended or under-utilised, causing agricultural production to decline. Any decline in land quality and productivity may necessitate considerable effort and financial investment to recover its previous potential.
The impacts will be medium-term and will affect some households within the PACs. Owing to their localised extent, before mitigation the impacts are considered not significant.

**RoW – Artisanal and Small-Scale Mining Concentrations**

The potential generic impacts are also applicable to PACs where there is a concentration of ASM activities. However, the following impact may be more likely in Iparamasa village (KP552), Lubeho village (KP608), Zongomera village (KP665) and Kimana village (KP1169):

Loss/Severance of Land and Disruption to Land-Based Livelihoods

Impact:Permanent loss of access to artisanal mining sites

This may lead to direct and indirect impacts.

ASM is prevalent in these PACs and particularly attracts the poorer members of the community (i.e., the landless, those with little formal education and youths, with no prospects of formal employment). Zongomera is in Kahama Township Authority. This district is in Acacia Mining’s relinquished prospecting licence area and contains around 8000 small-scale gold miners.

The impacts will be long-term and will affect some individuals within the PACs. Those potentially most affected include women involved in mining activities having less access to capital than men, and casual ASM labourers without access to crop land. Owing to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

**RoW – Licensed Mining Concessions**

The potential generic impacts are also applicable to districts where there are licensed mining concessions. However, the following specific impact is applicable to districts where there are licensed mining concessions:

Loss/Severance of Land and Disruption to Land-Based Livelihoods

Impact:Permanent loss of access to licensed mining concessions

This may lead to direct and indirect impacts.

The construction corridor crosses areas where prospecting, primary mining and mining licence holders are active. These are held predominantly in Mbugwe, Kahama and Geita districts (see Section A11.4.6.3 in Appendix A11).

Extraction is undertaken in a formal manner with necessary permits and oversight by authorities. Considerable investment is required for all permit holders in terms of purchasing necessary licences as well as equipment.

Revocation of concession rights around the pipeline corridor that traverses licensed mining areas will have an impact on the licence holder potentially leading to reduction on operations, at a cost (capital investment in licences equipment and lost revenue) to licence holders. Mining workers hired by mining bosses are deemed very highly vulnerable and sensitive receptors; they are often landless and lack alternative livelihood means. These people will be directly impacted by loss of livelihood, which may impoverish their households.
The impacts will be long-term and will affect some individuals at the national level. Owing to their large magnitude and high sensitivity, before mitigation the impacts are considered significant.

**Pumping Station 3 (Muleba District, KP405.4), Pumping Station 4 (Mbogwe District, KP610), Pumping Station 5 (Igunga District, KP824.8) and Pumping Station 6 (Singida District, KP931)**

The potential generic impacts are also applicable to the eight PACs near the four pumping stations except for impacts related to permanent loss of access to artisanal mining sites. No evidence of ASM was found near the pumping stations during the baseline studies.

**Pressure Reduction Station 1 (Kiteto District, KP1172) and Pressure Reduction Station 2 (Handeni District, KP1330)**

The potential generic impacts are also applicable to the three PACs near the two pressure reduction stations.

**Marine Storage Terminal and Load-Out Facility (Tanga District)**

The potential generic impacts are also applicable to the two PACs near the MST and LOF – Putini mtaa (KP1441.5, approximately 1.5 km away) and Chongoleani mtaa (KP1442.5, approximately 0.3 km away) – except for impacts related to temporary loss of grazing land. The land acquired by TPA in the Chongoleani Peninsula has been acquired permanently and will not be returned to PACs. Therefore, the following specific impacts are applicable to PACs near the MST:

- **Loss/Severance of Land and Disruption to Land-Based Livelihoods**
  - Impact: Permanent loss of grazing land
  - This may lead to direct and indirect impacts.
  - The MST requires 72 ha of land. A government land acquisition process undertaken by TPA has acquired 200 ha of land near where the MST will be located. The land acquired was previously partly used for grazing. In addition, these PACs will likely experience PIIM of employment seekers, increasing pressure on land used for agriculture.
  - The impacts will be very long-term and will affect some households within the PACs. Owing to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.
  - The following generic impacts may be more pronounced in Putini mtaa and Chongoleani mtaa:
    - **Loss/Severance of Land and Disruption to Land-Based Livelihoods**
      - Impact: Permanent loss of land used for crop farming
      - This may lead to direct and indirect impacts.
      - The MST requires 72 ha of land, which has already been acquired by the government. This land was partly used for crop farming. In addition, these PACs will likely experience PIIM of employment seekers, increasing pressure on land used for...
crop farming. The impacts will be very long-term and will affect some households within the PACs. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Impact: Permanent loss of natural resources

This may lead to direct and indirect impacts.

The MST requires 72 ha of land, which has already been acquired by the government. This land was partly used for collecting natural resources. These PACs will likely experience PIIM of employment seekers, increasing pressure on natural resources.

The impacts will be very long-term and will affect entire PACs. Due to their moderate sensitivity and small extent, before mitigation the impacts are considered not significant.

8.13.2.2 Operation

The land acquired for the MCPYs and CF will be acquired permanently by the government and leased to the project. When construction has been completed, land leased to the project for these construction facilities will be returned to the government. The government will determine how this land will be used in the future. No additional land will be required during the operation phase.

Generic Impacts

There are no generic impacts during pipeline, AGI, MST and LOF operation.

Location-Specific Impacts

Pumping Station 3 (Muleba District, KP405.4), Pumping Station 4 (Mbogwe District, KP610), Pumping Station 5 (Igunga District, KP824.8) and Pumping Station 6 (Singida District, KP931)

The following specific impact is applicable to the eight PACs near the four pumping stations during operation:

Loss/Severance of Land and Disruption to Land-Based Livelihoods

Impact: Accidental damage to crops during maintenance activities

This may lead to direct and indirect impacts.

During project maintenance activities, accidental damage to crops could occur. The impacts will be transient and will affect some individuals within the PACs. Due to their transient nature and localised extent, before mitigation the impacts are considered not significant.

8.13.3 Mitigation Measures

This section describes the impact avoidance and mitigation measures that will be applied to the aspects and activities that could affect land-based livelihoods.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key
mitigation measures presented in this section, and the associated management plan and other measures that are included Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.

8.13.3.1 Design

Generic Mitigation Measures

As described in Section 3, Alternatives, route identification for the pipeline has considered social aspects such as land use. The selected pipeline route was chosen partly because it had the lowest number of social constraints of the routing options available. However, it may therefore have had potentially a greater impact on land-based livelihoods.

Location-Specific Mitigation Measures

There are no location-specific mitigation measures related to the design of the construction facilities, pipeline, AGIs, MST and LOF.

8.13.3.2 Construction

Generic Mitigation Measures

Impeded Movement of Animals

Impact: Due to access restrictions, livestock cause damage to crops

The community health, safety and security plan, stakeholder engagement plan and the monitoring and reporting plan include measures that will manage impeded movement of animals.

Crossing points will be provided across trenches at locations identified to be most appropriate by local people who will be informed of access restrictions. Incidents in conflicts between crop farmers and herders will be monitored, support will be provided to local authorities where required and all stakeholders will have access to the grievance procedure.

Meetings will be held with PAC representatives, when construction is active in their area, to provides updates on construction progress and to receive comments or queries. Leaflets and posters with additional information will be produced consistent with project stakeholder engagement plan guidelines.

Where access restrictions affect land-based livelihoods because of interruption to agricultural production, appropriate compensation will be provided.

Application of these mitigation measures will reduce the magnitude from very large to medium and the residual impact is not significant.

Accidents Due to Open Excavations

Impact: Livestock falling into excavations

The community health, safety and security plan, stakeholder engagement plan and monitoring and reporting plan will include measures that will manage accidents related to open excavations.
A risk assessment will be conducted for excavations and the maximum length of open trench will be defined based on community safety and livestock management patterns. Community awareness programmes will be implemented to ensure community and livestock safety during construction. Inspections of construction activity will include checks for compliance with measures to protect livestock.

Application of these mitigation measures will reduce the magnitude from medium to negligible and the duration from medium-term to short-term. There will be no significant residual impacts.

Loss/Severance of Land and Disruption to Land-Based Livelihoods
Impact: Permanent loss of land used for crop farming
Impact: Temporary loss of grazing land
Impact: Permanent loss of access to artisanal mining sites
Impact: Permanent loss of natural resources
Impact: Reduction in honey production due to loss of habitat

The pollution prevention plan, resettlement action plan and monitoring and reporting plan will include measures that contribute to manage land and livelihood related impacts.

A resettlement action plan will describe the procedures related to compensation for loss of assets and livelihood restoration strategies to ensure livelihoods are restored to pre-project levels as a minimum.

Where construction generated dust may affect honey production, dust suppression, adherence to RoW speed limits and sheeting of fine materials being transported or stored on-site will be considered.

For the impact permanent loss of land used for crop farming, application of these mitigation measures will reduce the magnitude of impact from large to small and the duration of impact from very long-term to short-term. The residual impact is not significant.

For the impact temporary loss of grazing land, application of these mitigation measures will reduce the magnitude of impact from large to small and the residual impact will be not significant.

For the impact permanent loss of access to artisanal mining sites, application of these mitigation measures will reduce the magnitude of impact from very large to small and the duration of impact from long-term to short-term. The residual impact will be not significant.

For the impact permanent loss of natural resources, application of these mitigation measures will reduce the magnitude of impact from large to small and the residual impact will be not significant.

For the impact reduction in honey production due to loss of habitat, application of these mitigation measures will reduce the magnitude of impact from small to negligible and the duration from medium-term to short-term.

The residual impact will be not significant.
Impact: Increased traffic leading to spread of animal diseases.

The transport and road safety management plan; community health, safety and security management plan and the biodiversity management plan will include measures to manage spread of animal diseases.

Measures will include inspections, cleaning and the restriction of movement to defined access roads and demarcated working areas (unless in the event of an emergency).

Application of these mitigation measures will reduce the magnitude from large to small and the residual impact will be not significant.

Disruption to Surface Water Catchments

Impact: Temporary disruption to surface water

The infrastructure and utilities management plan and resettlement action plan will include measures that will contribute to the management of this impact.

Potentially affected landowners, land users and communities will be consulted if there is likely to be any disruption to the existing infrastructure and utility services and their feedback will inform planning of the works. If project activities affect land-based livelihoods because of interruption to irrigation or drainage required for agricultural production, compensation will be provided.

A pre-construction entry survey will be undertaken to document the condition of immovable assets and crops to provide baseline evidence in the event of a claim for damage and agree on temporary measures to be installed (e.g., during disruption to drainage or irrigation, temporary fencing).

Application of these mitigation measures will reduce the magnitude from medium to small and the residual impact will not be significant.

Indigenous Peoples’ Rights

If it is determined that the pipeline route intersects with traditional land and territories of people who self-identify as Indigenous Peoples; the resettlement action that will contribute to the control of impacts on people who self-identify as Indigenous Peoples. The main mitigation measures will be:

- a commitment to human rights for all stakeholders includes those that self-identify as Indigenous Peoples and the cultural characteristics that form their identity
- consultations with appropriate institutions and groups to identify desirable and feasible land use agreements required for the project, in compliance with national legislation and IFC Performance Standard 7.
Location-Specific Mitigation Measures

Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147) Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)

The generic mitigation measures are also applicable to the 38 PACs near the 12 MCPYs and one CF. The additional specific mitigation measures recommended for these PACs are as follows.

Employment

Impact: Household members seeking employment with the project will no longer be available for land-based livelihood activities

The stakeholder engagement plan and labour management plan will include measures that will contribute to managing employment impacts.

This will include a campaign focused on providing realistic community expectations about livelihood options and employment opportunities. Financial management workshops for workers to raise levels of financial literacy. During the recruitment process and throughout their contract, workers will be advised regularly that the duration of their employment is temporary and that they should try to maintain their existing livelihoods and prepare for the termination of their employment.

Application of these mitigation measures will reduce the magnitude from large to small and the residual impact will be not significant.

Children’s Rights

An awareness campaign targeting schools at sensitive locations within the project AOI will be developed. This will focus on topics specifically important to children:

- importance of staying in school
- risks of relationships with transient workers, transactional and commercial sex

Right to an Adequate Standard of Living

The project will develop a campaign focused on providing realistic community expectations about livelihood options and employment opportunities.

All stakeholders will be informed on their rights and the project grievance mechanism and their right to use it.

RoW – Artisanal and Small-Scale Mining Concentrations

The generic mitigation measures are also applicable to PACs where there is a concentration of ASM activities.
RoW – Licensed Mining Concessions
The generic mitigation measures are also applicable to districts where there are licensed mining concessions.

Pumping Station 3 (Muleba District, KP405.4), Pumping Station 4 (Mbogwe District, KP610), Pumping Station 5 (Igunga District, KP824.8) and Pumping Station 6 (Singida District, KP931)
The generic mitigation measures are also applicable to the eight PACs near the four pumping stations, except for measures related to permanent loss of access to artisanal mining sites. No evidence of ASM was found near the pumping stations during the baseline studies.

Pressure Reduction Station 1 (Kiteto District, KP1172) and Pressure Reduction Station 2 (Handeni District, KP1330)
The generic mitigation measures are also applicable to the three PACs near the two pressure reduction stations.

Marine Storage Terminal and Load-Out Facility (Tanga District)
The generic mitigation measures are also applicable to the three PACs near the MST and LOF.

8.13.3.3 Operation

Generic Mitigation Measures
As there are no predicted generic impacts for pipeline, AGI, MST and LOF operation, no mitigation measures are required.

Location-Specific Mitigation Measures

Pumping Station 3 (Muleba District, KP405.4), Pumping Station 4 (Mbogwe District, KP610), Pumping Station 5 (Igunga District, KP824.8) and Pumping Station 6 (Singida District, KP931)
Loss/Severance of Land and Disruption to Land-Based Livelihoods
Impact: Accidental damage to crops during maintenance activities
The stakeholder engagement plan and the resettlement action plan will include measures that address grievances arising from maintenance activities at the pumping stations.
The compensation framework from the RAP will provide compensation rates for damaged crops.
Application of these mitigation measures will reduce the magnitude of impact from medium to small and the residual impact will be not significant.

8.13.4 Residual Impacts and Significance Summary
This section summarises the residual impacts on land-based livelihoods after mitigation has been implemented.
Table 8.13-1 summarises the potential generic land-based livelihoods impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation. Table 8.13-2 summarises location-specific impacts.

After mitigation has been implemented, the potential residual impacts on land-based livelihoods are considered not significant.

8.13.4.1 Ecosystem Services

Sections A11.4.6.1, A11.4.6.2, A11.4.6.3 and A11.4.6.4 in Appendix A11 identify ecosystem services associated with land-based livelihoods in the AOI. The following ecosystem services have been assessed in Sections 8.13.2 and 8.13.3:

Crop farming provisioning services:
- food for basic survival of the local population
- income from selling surplus crops to pay for education, clothes and health-related items as well as other basic needs
- jobs for farm labourers
- products for agro processing activities.

Crop farming is undertaken throughout the AOI in PACs, sometimes being their only source of food.

In the sample PACs, most of the farming is subsistence and the agricultural produce is consumed within the family with a small portion being sold at the local market.

Livestock rearing provisioning services:
- rural income from selling livestock
- food security for families and future generations (if managed in a sustainable manner)
- financial security (livestock rearing is part of a diversification strategy to ensure some cash will be available when other means of income fail).

Livestock rearing cultural services:
- preservation of cultural heritage and traditional knowledge where livestock-rearing is inter-generational.

Key points to note are that within the districts traversed by the AOI, livestock and livestock products are used for both subsistence and sale.

Land provides a provisioning service as a resource for livestock keeping. It provides grazing resources, water sources, ground for movement and habitation of livestock herds and trees for shelter and medicinal herbs.

ASM and large-scale mining provisioning services:
- income from sale of materials for construction (e.g., sand, clay, gravel).
- materials for dwellings and shelter
- salt for livestock and domestic consumption.

ASM is an abiotic provisioning service conducted throughout the AOI by sample PACs primarily in the dry season.
Natural resources use provisioning services:
- energy for cooking and food security
- construction materials for shelter
- income from selling natural resources
- traditional medicine.

Natural resources are obtained from a variety of ecosystems within or near the PACs including forests, wetlands and pasture rangelands. As such, these natural resources play a vital role in subsistence of rural communities. With an increasing population and a high demand and reliance on natural resources, continued protection of and access to these resources is essential.

With the implementation of the planned mitigation measures, the residual impact on the above services will be not significant.
### Table 8.13-1  Land-Based Livelihoods – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of Road Network</td>
<td>Improved ability to sell agricultural produce nearby markets for farmers and traders</td>
<td>C</td>
<td>Y</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Impeded Movement of Animals</td>
<td>Due to access restrictions, livestock cause damage to crops</td>
<td>C</td>
<td>-</td>
<td>Community health, safety and security plan, Stakeholder engagement plan, Monitoring and reporting plan</td>
<td>6 2 1 5 14</td>
</tr>
<tr>
<td>Accidents Due to Open Excavations</td>
<td>Livestock falling into excavations</td>
<td>C</td>
<td>Y</td>
<td>Community health, safety and security plan, Stakeholder engagement plan, Monitoring and reporting plan</td>
<td>2 3 1 5 11</td>
</tr>
<tr>
<td>Loss/Severance of Land and Disruption to Land-Based Livelihoods</td>
<td>Permanent loss of land used for crop farming</td>
<td>C</td>
<td>Y</td>
<td>Pollution prevention plan, Resettlement action plan, Monitoring and reporting plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>Loss/Severance of Land and Disruption to Land-Based Livelihoods</td>
<td>Temporary loss of grazing land</td>
<td>C</td>
<td>Y</td>
<td>Pollution prevention plan, Resettlement action plan, Monitoring and reporting plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>Loss/Severance of Land and Disruption to Land-Based Livelihoods</td>
<td>Increased traffic leading to spread of animal diseases</td>
<td>C</td>
<td>-</td>
<td>Transport and road safety management plan, Community health, safety and security plan, Biodiversity management plan</td>
<td>4 3 3 4 14</td>
</tr>
</tbody>
</table>

NOTES: C = construction; O = operation; C&O = construction and operation; B = beneficial impact; M = magnitude of impact; D = duration of impact; E = extent of impact; S = sensitivity; SS = significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
## Table 8.13-1  Land-Based Livelihoods – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss/ Severance of Land and Disruption to Land-Based Livelihoods</td>
<td>Permanent loss of access to artisanal mining sites</td>
<td>C</td>
<td>Y</td>
<td>Pollution prevention plan; Resettlement action plan</td>
<td>4 2 1 4 11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Monitoring and reporting plan</td>
<td></td>
</tr>
<tr>
<td>Loss/Severance of Land and Disruption to Land-Based Livelihoods</td>
<td>Permanent loss of natural resources</td>
<td>C</td>
<td>Y</td>
<td>Pollution prevention plan; Resettlement action plan</td>
<td>2 2 2 2 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Monitoring and reporting plan</td>
<td></td>
</tr>
<tr>
<td>Loss/Severance of Land and Disruption to Land-Based Livelihoods</td>
<td>Reduction in honey production due to loss of habitat</td>
<td>C</td>
<td>Y</td>
<td>Pollution prevention plan; Resettlement action plan</td>
<td>2 2 1 3 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Monitoring and reporting plan</td>
<td></td>
</tr>
<tr>
<td>Disruption to Surface Water Catchments</td>
<td>Temporary disruption to surface water</td>
<td>C</td>
<td>Y</td>
<td>Infrastructure and utilities management plan; Resettlement action plan</td>
<td>4 2 2 5 13</td>
</tr>
</tbody>
</table>

**NOTES:** C = construction; O = operation; C&O = construction and operation; B = beneficial impact; M = magnitude of impact; D = duration of impact; E = extent of impact; S = sensitivity; SS = significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.13-2 Land-Based Livelihoods – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACs near the 12 MCPYs and one CF</td>
<td>Loss/Severance of Land and Disruption to Land-Based Livelihoods</td>
<td>Permanent loss of grazing land</td>
<td>C</td>
<td>Y</td>
<td>Pollution prevention plan Resettlement action plan Monitoring and reporting plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>PACs near the 12 MCPYs and one CF</td>
<td>Employment</td>
<td>Household members seeking employment with the project will no longer be available for land-based livelihood activities</td>
<td>C</td>
<td>-</td>
<td>Stakeholder engagement plan Labour management plan</td>
<td>4 3 1 4 12</td>
</tr>
<tr>
<td>Districts where there are licensed mining concessions</td>
<td>Loss/Severance of Land and Disruption to Land-Based Livelihoods</td>
<td>Permanent loss of access to licensed mining concessions</td>
<td>C</td>
<td>Y</td>
<td>Pollution prevention plan Resettlement action plan Monitoring and reporting plan</td>
<td>4 4 1 4 13</td>
</tr>
<tr>
<td>Putini mtaa and Chongoleani mtaa (KP1441.5 to KP1442.5)</td>
<td>Loss/Severance of Land and Disruption to Land-Based Livelihoods</td>
<td>Permanent loss of grazing land</td>
<td>C</td>
<td>Y</td>
<td>Pollution prevention plan Resettlement action plan Monitoring and reporting plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>PACs near the four pumping stations</td>
<td>Loss/Severance of Land and Disruption to Land-Based Livelihoods</td>
<td>Accidental damage to crops during maintenance activities</td>
<td>O</td>
<td>-</td>
<td>Stakeholder engagement plan Resettlement action plan</td>
<td>4 1 1 5 11</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score: Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
8.13.5 Transboundary Project Impacts

8.13.5.1 Generic Transboundary Project Impacts

Loss/Severance of Land and Disruption to Land-Based Livelihoods

Impact: Increased traffic leading to spread of animal diseases

Livestock diseases are prevalent in PACs, most notably, during baseline studies, foot and mouth disease. During construction, project-related traffic will move across districts and between countries. Because of these movements, animal diseases could be inadvertently spread on vehicle tyres, directly impacting livestock populations and indirectly impacting households whose livelihoods depend on them (particularly those with large herds).

The potential for increased traffic leading to the spread of animal diseases across national borders will be managed through the mitigation measures described in Section 8.13.3. After mitigation has been implemented, the potential residual impact is considered not significant.

8.13.6 Cumulative Impacts

8.13.6.1 Context

Section 6.4.3.8 describes the baseline condition of land-based livelihoods, the trends and sensitivity to change. Table 8.13-1 and Table 8.13-2 summarises project residual impacts.

Most PAC households are rural and dependent on land-based livelihoods, mainly crop farming and livestock rearing for food security and cash income. Population increase, including in-migration, and overexploitation, is decreasing natural resource availability.

Sensitivity in the land-based livelihoods AOI is ranked as very high for households in PACs engaged in subsistence and commercial crop farming. Landless farm labourers and female-headed households are also ranked as very highly sensitive.

The EACOP project impacts which may have cumulative effects include:

• temporary and permanent loss/severance of land and consequent disruption to land-based livelihoods
• damage to crop land
• disruption of surface water catchments
• increased spread of animal disease.

The cumulative impacts may be experienced in the districts, wards and PACs within the shared AOI of the EACOP project and the third-party developments. The third-party developments are shown in the cumulative impacts matrix, described and mapped in Appendix H. The third-party developments are:

• extension water supply project from Lake Victoria to Tabora, Nzega and Igunga (TZ16)
• mining concessions (TZ34).
No cumulative impacts with the associated facilities were identified.

The preferred condition is for the standards of living of the impacted individuals and households of the affected PACs to be equal to, or better than, before construction.

### 8.13.6.2 Cumulative Impacts

Potential cumulative impacts linked to land-based livelihoods are predicted where:

- the EACOP project and third-party developments require a high proportion of land used by a particular PAC or household
- traffic from outside the local area is prevalent.

Table 8.13-3 shows the third-party developments, EACOP infrastructure and the wards and districts that may be impacted.

#### Table 8.13-3  Cumulative Impacts: Land-Based Livelihoods

<table>
<thead>
<tr>
<th>ID</th>
<th>Project</th>
<th>Nearest KP</th>
<th>MCPY / AGI</th>
<th>Ward or District Potentially Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ16</td>
<td>Extension water supply project from Lake Victoria to Tabora, Nzega and Igunga</td>
<td>730–819.5</td>
<td>MCPY10 (approximately 2 km from TZ16). Pipeline runs parallel to EACOP and crosses the pipeline</td>
<td>Nanga ward Igunga district</td>
</tr>
<tr>
<td>TZ34</td>
<td>Mining concessions</td>
<td></td>
<td>Feature along the pipeline route including:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kasharunga, Karambi and Burungura wards in Muleba district</td>
<td></td>
<td>Nyamigogo ward in Biharamulo district</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bukome, Makurugusi, Butengoruma, Ipamasa and Bwanga wards in Chato district</td>
<td></td>
<td>Kaseme ward in Geita district</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lulembela, Ikunguigazi, Nyakaful, Bukandwe and Ng’homolwai wards in Mbogwe district</td>
<td></td>
<td>Lyambamongo and Bukombe wards in Bukombe district</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ngogwa, Isagehe, Mondo, Mwendakulima, Zongomera and Busoka wards in Kahama Township Authority</td>
<td></td>
<td>Mbogwe, Miguwa, Ngengandogo, Mwango, Mwamala, Igusule and Kasela wards in Nzega district</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Igunga, Bukoko, Nyandekwa, Nanga, Itunduru and Ziba wards in Igunga district</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mtoa, Mgongo, Kinampanda, Ulemo and Kyengege wards in Irinrama district</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Iguguno ward in Makalama district</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Serya and Suruke wards in Kondoa district</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mrijo and Chandama wards in Chemba district</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ndedo, Loolera, Njoro and Olboroti wards in Kiteto district</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mkindi, Kisangasa and Kibirashi wards in Kilindi district</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Malezi and Mabanda wards in Handeni Township Authority</td>
<td></td>
</tr>
</tbody>
</table>
Table 8.13-3 Cumulative Impacts: Land-Based Livelihoods

<table>
<thead>
<tr>
<th>ID</th>
<th>Project</th>
<th>Nearest KP</th>
<th>MCPY / AGI</th>
<th>Ward or District Potentially Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Sindeni, Misima and Kwamatuku wards in Handeni district</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Mnyuzi ward in Korogwe district</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Ngomeni and Mlingano wards in Muheza district</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Pongwe, Mzizima, Mabokweni, Kiomoni wards in Tanga district</td>
</tr>
</tbody>
</table>

**Impacts on Permanent and Temporary Loss of Land**

Cumulative impacts on land-based resources of PACs (and households within PACs) may lead to:

- insufficient remaining communal grazing land for the PAC to graze its livestock and receive nomadic livestock herds
- insufficient remaining communal land for the PAC to harvest natural resources
- insufficient remaining crop land for the PAC and for some households in particular for fallowing and crop rotation
- insufficient remaining land for land-based livelihood restoration (when required for physical and economic resettlement) within the PAC.
- insufficient access to water sources for the entire PAC. This could affect irrigation, livestock water points and sources of water used by households.

These cumulative impacts may apply to the following:

- the community of Bulyang’ombe, because of cumulative impacts from the construction of the Lake Victoria to Kahama, Shinyanga and Tabora water pipeline and the EACOP project MCPY10
- PACs in the wards shared by the EACOP project and mining concessions (see Table 8.13-3). Owing to a lack of information on the planned activities in the identified mining concessions, no detailed analysis of the potential cumulative impacts on land-based livelihoods from mining projects in PACs could be conducted at the time of writing.

With the mitigation measure implemented, the preferred condition will be achieved and the residual cumulative impact is considered not significant.

**Damage to Cropland**

The land take and construction activities in wards where both the EACOP project and third-party developments occur (see Table 8.13-3) could disrupt routes used by nomadic pastoralists and their herds, thereby potentially causing damage to crop land.

The cumulative impact would be of a greater magnitude than the potential damage caused by the EACOP project alone, and could exacerbate existing, or ignite new conflicts between crop farmers and livestock owners. This cumulative impact may be caused by the concurrent construction of the Lake Victoria to Kahama, Shinyanga and Tabora water pipeline and MCPY 10 as the area around KP730–
819.5 experiences intense cattle movement. Insufficient data were available at the time of writing to provide a more detailed analysis of PACs potentially affected by this cumulative impact.

To manage this cumulative impact, the project will advise appropriate regulators and lead agencies of the construction schedule to reduce disruption. With the additional mitigation measure implemented, the preferred condition will be achieved and the residual cumulative impact is considered not significant.

**Increased Traffic Spreading Animal Diseases**

Vehicles of the EACOP project and third-party developments travelling through the same districts, where cattle are present could potentially increase the spread of animal diseases.

Owing to a lack of sufficient data on routes used by third-party developments and nomadic pastoralists and their herds at the time of writing, a more detailed analysis of the affected PACs could not be provided.

The project will engage proponents of the third-party developments and relevant government agencies to consider options for management measures to address significant cumulative impacts. This may include sharing measures to reduce the spread of animal diseases.

### 8.14 River-, Lake- and Marine-Based Livelihoods

This section includes the potential impacts on river-, lake- and marine-based livelihoods during the construction, commissioning and operation of the EACOP project and associated mitigation measures to be adopted.

#### 8.14.1 Key Sensitivities and Considerations

The river, lake and marine-based livelihoods baseline conditions are described in Section 6.4.3.9, as well as:

- river, lake and marine-based livelihoods key VECs and their sensitivity ranking based on the relevant tables in Appendix D
- key considerations for the river, lake and marine-based livelihoods impact assessment.

Sensitivity is ranked as very high for:

- fisherfolk, who receive low wages and a small percentage of fish caught compared to boat owners and have limited resilience to cope with change.
- women engaged in the processing and selling of fish, who have limited access to alternative livelihoods and poor resilience against fluctuations in the supply of fish.

Sensitivity is ranked as high for:

- women engaged in intertidal gleaning activities, who have poor resilience against a loss of access to the intertidal zone due to lack of alternative livelihoods and access to land.
Sensitivity is ranked as moderate for:

- owners of vessels, gear and aquaculture units, who receive higher shares of catches than fisherfolk.

Key considerations are as follows:

- inland fisheries
  - artisanal inland fisheries are small scale and mostly subsistence activity.
  - there is increasing pressure on inland fish resources owing to increasing crop failures caused by drought or floods.
  - human right to access to food and an adequate standard of living for communities.

- marine fisheries
  - coastal PACs rely heavily on fishing and gleaning activities due to lack of alternative livelihood activities.
  - boats, fishing gear and equipment are of poor quality which compromises efficiency of fishing operations and poses risks to the safety of fisherfolk. This also forces vessels to stay close to the coast.
  - fish stocks are reducing to unsustainable levels caused by overfishing.
  - human rights to access to food and an adequate standard of living are sustained.

Section A11.4.7.3 in Appendix A11 identifies ecosystem services associated with river, lake and marine-based livelihoods in the AOI. The following ecosystem services have been considered:

Provisioning services:

- income from selling catch and fishing equipment
- food to supplement diets
- products for fish processing activities.

Cultural services:

- fishing has been an important activity for generations and is a major part of the PACs’ way of life.

The main human right that is relevant to river, lake and marine-based livelihoods is the right to an adequate standard of living, and the right to health where there may be an increase in boat collisions, boats capsizing due to marine project traffic and obstructions to reach fishing grounds. International standards for responsible business also provide that individuals should receive adequate compensation when deprived of their means of livelihood. Adequate compensation requires that displaced persons are provided with compensation for loss of assets at full replacement cost and other assistance to help them improve or at least restore their standards of living or livelihoods (see Section 4).
8.14.2 Potential Project Impacts

8.14.2.1 Construction

**Generic Impacts – Inland Fisheries**

Restriction of Access to Fisheries

Fishing in lakes, rivers and dams by PACs is mostly a small-scale subsistence activity. The baseline study indicated decreasing fish stock in lakes and rivers due to illegal, unreported and unregulated fishing, drying out of ponds and wetlands being converted to cropland. Fisherfolk often combine fishing with land-based livelihood activities such as crop farming and livestock rearing. However, fishing is also undertaken as a full-time primary livelihood activity by some households in PACs. Pond and dam aquaculture is undertaken part-time and on a small-scale, although it provides livelihoods for aquaculture business owners and their personnel, some of whom have no other sources of income.

The fisheries sector also provides a livelihood for those engaged in the supply chain such as fish processing, fish trading, boat-building and trading in fishing equipment.

Impact: Temporary loss of access to fishing grounds (rivers, lakes, dams and ponds) due to temporary road closures and access restrictions across the RoW

This may lead to direct and indirect impacts.

Temporary loss of access to fishing grounds, due to road closure and access restrictions, could impact the food security and cash income of fisherfolk and their households. Those who rely on fishing as a full-time occupation will be particularly vulnerable (usually the landless) as they have no other means of generating an income. Those who rely on aquaculture and the fisheries supply chain as their main livelihood will also be vulnerable (usually the landless) as they have no other income or means of obtaining food security.

The impacts will be short-term and will affect some households within the PACs. Due to their short-term nature and localised extent, before mitigation the impacts are considered not significant.

Resettlement

Land acquired permanently for the project may lead to the loss of an aquaculture pond or may require physical resettlement of some households, leading to a loss of access to their pond.

Impact: Permanent loss of access to ponds used for aquaculture due to project land acquisition

This may lead to direct and indirect impacts.

Permanent loss of access to ponds used for aquaculture may impact on the food security and cash incomes of those involved in aquaculture. It may also impact on their access to credit, as ponds may be used for collateral.

---

26 Inland fishing includes fishing in lakes, rivers, wetlands, reservoirs, streams and ponds.
Households engaged in aquaculture who lack alternative assets or sources of income will be most vulnerable. The impacts will be very long-term and will affect some households within the PACs. Owing to their localised extent, before mitigation the impacts are considered not significant.

**Location-Specific Impacts – Inland Fisheries**

**Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)**

The potential generic impacts on inland fisheries are also applicable to the 12 PACs near MCPY6, MCPY9 and CF, MCPY15 and MCPY16. The potential reduction in the availability of potable water in PACs due to PIIM is described in Section 8.18. The following specific impact is also applicable to these PACs:

**Project-induced In-Migration**

Impact: Reduction in local fish stocks due to PIIM

This may lead to direct and indirect impacts. The potential PIIM of economic migrants to PACs surrounding the MCPYs may lead to a reduction in local fish stocks due to increased fishing activities in local rivers and streams. This may lead to a reduction in food security among PAC households reliant on these watercourses for subsistence.

Women engaged in the processing and selling of fish are deemed very highly sensitive VECs due to their low resilience against fluctuations in the supply of fish. The impacts will be short-term and will affect some households within the PACs. Owing to their short-term nature and localised extent, before mitigation the impacts are considered not significant.

**RoW – PACs Close to Pipeline River Crossings**

During the construction period, the pipeline will cross the following rivers:

- Kigosi River (KP604.7)
- Nawa River (KP713.1)
- Kinkungu River (KP854.8)
- Bubu River (KP1044-KP1064)
- Mnyuzi River (KP1337.1)
- Pangani River (KP1370.4).

The potential generic impacts are applicable to PACs close to pipeline river crossings. The following specific impact is also applicable to these PACs:
Impeded Flow of River or Channel

Impact: Reduction in artisanal fish catches due to changes in water flows and increased levels of sediment during open-cut crossing construction

This may lead to direct and indirect impacts.

Open-cut crossing construction is typically completed over a short period. As a proportion of the total and average movement of sediment in these rivers, the amount of sediment mobilised by construction is likely to be small and short-term. Nevertheless, a temporary increase in levels of suspended sediment may lead to a temporary reduction in fish catch. This may reduce a household’s food security and cash income.

The impacts will be short-term and will affect some households within the PACs. The landless with no alternative means of income will be most vulnerable. Due to their short-term nature and localised extent, before mitigation the impacts are considered not significant.

**Pumping Station PS3 (Muleba District, KP405.3)**

The potential generic impacts on inland fisheries are also applicable to the one PAC near PS3.

**Location: Marine Storage Terminal and Load-Out Facility (Tanga District)**

The potential generic impacts on inland fisheries are also applicable to the three PACs near the MST and LOF site that fish in the Sigi River and Ziki Lake.

**Generic Impacts – Marine Fisheries**

There are no generic impacts on marine fisheries during MST and LOF construction.

**Location-Specific Impacts – Marine Fisheries**

**Location: Marine Storage Terminal and Load-Out Facility (Tanga District)**

Figure 8.14-1 shows the location of the 1900-m-long trestle component of the LOF and the fishing areas of the surrounding PACs. During the construction period, a 50-m construction zone and 500-m marine exclusion zone (MEZ) will be maintained. During operations, the 500-m MEZ will remain, with a 560-m turning radius off the loading platform component of the LOF, where no fishing access or activity will be permitted when a tanker is being berthed (see Figure 8.14-1). It is understood that the MEZ is also applicable onshore for the pipeline section between the LOF and the MST site.

PACs fish along the coastal area near the MST and LOF, both for subsistence and cash income (see Section 6.4.3.9 for fishing areas). Tanga Bay is an important fish nursery and the area around the MST is an important fishing ground, particularly for Putini mtaa (KP1441.5), Chongoleani mtaa (KP1442.5) and Helani hamlet (KP1437). The baseline data indicates that only the few fisherfolk who have access to motorised boats fish in open waters, while the vast majority use canoes to fish near the shore.
Baseline data showed that fishing, as a main source of income, is prevalent in:

- Putini mtaa (Tanga city, KP1441.5)
- Chongoleani mtaa (Tanga city, KP1442.5).

Fishing as a secondary livelihood strategy is common in:

- Mleni mtaa (Tanga city, KP1429)
- Mabokweni mtaa (Tanga city, KP1435)
- Helani hamlet (Tanga city, KP1437).

The baseline indicates that fishing is increasingly important for the PACs due to lack of alternative livelihoods in the area compounded by the government’s auction of land in the Chongoleani Peninsula. At the same time, crop failures are being caused by droughts and floods, while fish stocks are diminishing due to overfishing. The loss of land has further increased dependency on fishing as a main source of income and subsistence.

Gleaning is undertaken in the intertidal zone and in mangroves (including the area crossed by the LOF) by women and the elderly, who have no access to the assets or skills required for fishing.

Depending on the size of the catch, fisherfolk and gleaners from PACs sell their catch in three different locations:

- Deep Sea landing site
- Sahale fish market
- neighbouring villages.

In addition to gleaning and fishing, PACs around the MST and LOF derive income from fish processing and marketing (primarily undertaken by women), and production and repair of fishing gear and boats. The main market for the fisherfolk is Deep Sea landing site (see Section 6.4.3.9). Deep Sea is the main place of business for the majority of the Tanga region’s fisherfolk and fish traders; here, fisherfolk get a higher price for their catch than at Sahale Market or neighbouring villages.
Figure 8.14-1 Fishing and Gleaning Locations
The following specific impacts are applicable to PACs near the MST and LOF (specifically Putini mtaa, Chongoleani mtaa, Mabokwendi mtaa and Helani hamlet):

Restriction of Access to Fisheries

Impact: Loss of, or restriction of access to, existing fishing grounds, transit routes, fish landing sites and market sites due to the MEZ

This may lead to direct and indirect impacts.

The MEZ covers a large area of productive fishing grounds and an access route, most convenient to their villages, to the open sea for the PACs. The majority of the fisherfolk in the PACs use nonmotorised canoes and are therefore predominantly confined to the bay and surrounding areas for fishing. Lack of outboard engines limit their access to distant fishing and most of the canoes remain close to the shore, approximately 500 m.

The motorised fishing boats which travel beyond 1 km from the shore will need to take a long detour to reach their fishing grounds, landing sites and markets.

Overfishing and competition over fishing grounds has already affected the sustainability of fishing in and around the MEZ area. Loss of the MEZ area to the local fisherfolk may further reduce catches, impacting fisherfolk food security and a primary source of income (particularly in Putini mtaa, Chongoleani mtaa and Helani hamlet). Decreases in fish supply may in turn affect fish processors and traders, leading to loss of income. Casual labour engaged in fishing activities are usually landless and are thus highly vulnerable to even a partial loss of access to fishing grounds. This is due to a lack of alternative incomes or food sources.

The impacts will be very long-term and will affect some households within the PACs. Owing to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Impact: Loss of, or restriction of access to, intertidal gleaning sites due to the MEZ

This may lead to direct and indirect impacts.

Gleaners along Tanga Bay harvest clams, oysters, mussels and octopus in the intertidal zone (including the intertidal area falling within the MEZ). This activity is conducted at low tide by women, elderly men and children. For most women, gleaning is their only source of cash income. Competition for gleaning is high and the existing gleaning grounds, particularly the intertidal area in the MEZ, are considered productive.

Construction of the LOF will cause the loss of, and/or restricted access to, parts of the intertidal gleaning areas; which may impact the food security and income of the gleaners.

The impacts will be very long-term and will affect some households within the PACs. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Impact: Damage to, or displacement of, fishing gear by project construction vessels

This may lead to direct and indirect impacts.
The baseline survey indicated that gillnets and hand lines are the main types of fishing gear used by fisherfolk in the PACs. Other types of fishing gear include longlines, dema traps, baskets, shark nets, spears, ring nets, seine nets, beach seines, lift nets and scoop nets. Increased traffic in the LOF and trestle construction area (as well as to and from the construction area), may lead to the disturbance of fishing activities and damage to gear, causing a loss of income and food security. Fisherfolk without alternative assets or other sources of income are particularly vulnerable.

The impacts will be short-term and will affect some households within the PACs. Owing to their short-term nature and localised extent, before mitigation the impacts are considered not significant.

Impact: Displacement of fishing effort (from the loss of, or restriction of access to, grounds) into adjacent grounds

This may lead to indirect impacts.

Owing to the nearshore small-scale nature of the fisheries and loss of the area occupied by the MEZ, the intensity of fishing efforts will highly increase in surrounding areas, as fisher folk are displaced from the grounds within the MEZ footprint into adjacent areas. This may lead to conflicts between fisher folk competing for grounds. Fisherfolk without alternative assets or other sources of income within the PACs are particularly vulnerable.

The impacts will be long-term and will affect some households within the PACs. Owing to their long-term nature and high sensitivity, before mitigation the impacts are considered significant.

Noise

Installation of piles and usage of vessels and equipment is required during LOF construction, which will create noise (see Section 5.3.3 of Volume 2).

Impact: Loss of or displacement of fish due to construction activities affecting fishing livelihoods

This may lead to indirect impacts.

The noise from pile installation and vessel and equipment use during construction could cause a range of physical, physiological and behavioural effects in nearby fish. The base case for pile installation is drilling, giving a modelled area of effect of less than 1 m from each pile location, and it is estimated that the area affected by each vessel that is operational during the construction phase is also within 1 m of the vessel (see Underwater Noise in Appendix D3 and D5 of Volume 2). Impacts may include but are not limited to:

- potential loss and displacement of targeted species
- potential loss and displacement of fish caught for bait
- potential recruitment concerns due to spawning or nursery grounds being affected; the physical, physiological and behavioural impacts on fish are described in Section 5.5.2 of Volume 2.

Fisherfolk without alternative assets or other sources of income within the PACs are particularly vulnerable.
The impacts will be long-term and will affect some households within the PACs. Due to their localised extent, before mitigation the impacts are considered not significant.

Impact: Noise impacts on fisherfolk

This may lead to direct and indirect impacts.

Baseline findings indicate that some local fisherfolk work in groups of 10–15 people to manually deploy fishing nets in the waters in and around Tanga Bay. This activity routinely takes place with the use of snorkels, enabling the divers to dive below the surface. Therefore, the potential exists for fisherfolk to be underwater while pile installation is taking place.

High underwater noise levels have the potential to impact fisherfolk during the deployment of nets. The effects can include dizziness, hearing loss or injuries to other sensitive organs, depending on the frequency and intensity of the sound.

The impacts will be medium-term and will affect some households within the PACs. Due to their localised extent, before mitigation the impacts are considered not significant.

Community Safety

Impact: Increased risks of accidents due to increased boat traffic outside the restricted areas

This may lead to direct and indirect impacts.

Owing to the nearshore small-scale nature of the fisheries and loss of the area occupied by the MEZ, the intensity of boat and canoe traffic will highly increase in the area around the MEZ. This, in turn, may increase the risk of collisions.

The impacts will be long-term and will affect some households within the PACs. Due to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Project-Induced In-Migration

Impact: Reduction in local fish stocks due to PIIM

This may lead to direct and indirect impacts.

The potential PIIM of economic migrants to PACs near the MST may lead to a reduction in local fish stocks. Fishing by in-migrants in coastal areas may increase pressure on local fish stocks and reduce the fish catch available for local fisherfolk. This may lead to a reduction in household food security and cash income. Households who are solely reliant on fishing for livelihood and subsistence purposes may be more vulnerable.

The impacts will be long-term and will affect some households within the PACs. Owing to their localised extent, before mitigation the impacts are considered not significant.
8.14.2.2 Operation

Generic Impacts – Inland Fisheries

There are no generic impacts on inland fisheries during pipeline, AGI, MST and LOF operation.

Location-Specific Impacts – Inland Fisheries

There are no specific impacts on inland fisheries during pipeline, AGI, MST and LOF operation.

Generic Impacts – Marine Fisheries

There are no generic impacts on marine fisheries during MST and LOF operation.

Location-Specific Impacts – Marine Fisheries

MST and LOF (Tanga District)

The following specific impacts, described for construction, are also applicable to PACs near the MST and LOF during MST and LOF operations. The ratings do not change.

Restriction of Access to Fisheries

- Impact: Loss of, or restriction of access to, existing fishing grounds, transit routes, fish landing sites and market sites due to the MEZ
- Impact: Loss of, or restriction of access to, intertidal gleaning sites due to the MEZ
- Impact: Damage to, or displacement of, fishing gear by project construction vessels
- Impact: Displacement of fishing effort (from loss of, or restriction of access to, grounds) into adjacent grounds

Community Safety

- Impact: Increased risks of accidents due to increased boat traffic outside the restricted areas

8.14.3 Mitigation Measures

This section describes the impact avoidance and mitigation measures that will be applied to the aspects and activities that could affect river-, lake- and marine-based livelihoods.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management plan and other measures that are included in Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.
8.14.3.1 Design

**Generic Mitigation Measures**

As described in Section 3, Alternatives, route identification for the pipeline has considered social aspects relating to river-, lake- and marine-based livelihoods such as minimising impacts on water bodies and water points/sources. The selected pipeline route was chosen partly because it had the lowest number of constraints of the routing options available.

**Location-Specific Mitigation Measures**

There are no location-specific mitigation measures relating to the design of the construction facilities, pipeline, AGIs, MST and LOF.

8.14.3.2 Construction

**Generic Mitigation Measures – Inland Fisheries**

Restriction of Access to Fisheries

Impact: Temporary loss of access to fishing grounds (rivers, lakes, dams and ponds) due to temporary road closures and access restrictions across the RoW

The resettlement action plan and stakeholder engagement plan will include measures to manage access to fisheries.

A resettlement policy framework has been developed to outline procedures related to loss of assets and livelihood restoration. A resettlement action plan or livelihood restoration plan will describe the procedures related to compensation for loss of assets as well as livelihood restoration strategies.

The project will engage and consult with internal and external stakeholders to keep them informed about progress with the project, understand and respond to their concerns and report to them on the project's environmental and social performance.

The project will implement a grievance procedure to provide opportunities for PACs to express grievances and a campaign focused on providing realistic community expectations about livelihood options and employment opportunities to avoid livelihood decisions based on incorrect information.

Application of these mitigation measures will reduce the magnitude of impact from medium to small and the residual impact is not significant.

**Resettlement**

Impact: Permanent loss of access to ponds used for aquaculture due to project land acquisition

The resettlement action plan, the stakeholder engagement plan and the monitoring and reporting plan will include measures that will manage this impact.

Resettlement action plan procedures will guide compensation for loss of assets and livelihood restoration strategies, and additional measures will be developed where necessary to ensure livelihoods are restored as a minimum to pre-project levels.
The stakeholder engagement plan will identify how to engage and consult with stakeholders to keep them informed on project activities and understand and respond to their concerns. A grievance procedure will provide opportunity to stakeholders to express grievances about project activities.

Application of these mitigation measures will reduce the magnitude of impact from medium to small and duration from very long-term to short-term. The residual impact is not significant.

**Location-Specific Mitigation Measures – Inland Fisheries**

**Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)**

The generic mitigation measures for inland fisheries are applicable to the 12 PACs near the MCPY6, MCPY9 and CF, MCPY15 and MCPY16. The following additional specific mitigation measure is recommended for these PACs:

**Project-Induced In-Migration**

Impact: Reduction in local fish stocks due to PIIM

A PIIM management plan will be developed and implemented with the aim of reducing the number of, and impacts associated with people attracted by job opportunities arriving into PACs.

Application of this mitigation measure will reduce the magnitude of impact from medium to small and the residual impact is not significant.

**RoW – PACs Close to Pipeline River Crossings**

The generic mitigation measures are applicable to PACs close to pipeline river crossings. The additional mitigation measures recommended for these PACs are as follows:

**Impeded Flow of River or Channel**

Impact: Reduction in artisanal fish catches due to changes in water flows and increased levels of sediment during open-cut crossing construction.

The pollution prevention plan and reinstatement plan will include mitigations that will manage impacts to PACs close to pipeline river crossings.

Location-specific method statements will be produced for watercourse crossing construction that will incorporate erosion control; sediment control, maintaining environmental base flows downstream of crossings, reinstatement, spill response and the notification of fisherfolk.

Application of these measures will reduce the magnitude of impact from large to small and the residual impact is not significant.

**Pumping Station 3 (Muleba District, KP405.3)**

The generic mitigation measures for inland fisheries are also applicable to the one PAC near PS3.
Marine Storage Terminal and Load-Out Facility (Tanga District)

The generic mitigation measures for inland fisheries are also applicable to the three PACs near the MST and LOF site that fish in the Sigi River and Ziki Lake.

Generic Impacts – Marine Fisheries

As there are no predicted generic impacts on marine fisheries during MST and LOF construction, no mitigation measures are required.

Location-Specific Impacts – Marine Fisheries

MST and LOF (Tanga District)

Restriction of Access to Fisheries

Impact: Loss of, or restriction of access to, existing fishing grounds, transit routes, fish landing sites and market sites due to the MEZ

The resettlement action plan will include measures that will manage restriction of access to fisheries.

A marine livelihoods study will be conducted in the AOI and a marine livelihoods restoration plan will be developed.

Post-resettlement monitoring of livelihood restoration measures will be implemented to ensure livelihoods are restored to pre-project levels as a minimum.

The project will implement and communicate a grievance procedure to provide opportunities for PACs to express grievances about the project activities.

Application of these mitigation measures will reduce the magnitude of impact from very large to small and the duration of impact from very long-term to short-term. The residual impact is not significant.

Security and Human Rights

Strategies for implementing the Voluntary Principles on Security and Human Rights will be developed, including for the MEZ. The strategies will be based on a risk assessment conducted in consultation with stakeholders and development of agreements and protocols to govern the interactions between public and private security forces. Strategies can include:

- joint training between public and private security forces that cover the Voluntary Principles.
- ongoing communication and consultation about security arrangements governing the MEZ with fisherfolk and PACs.
- ensuring that the project’s community grievance mechanism is promoted with fisherfolk and PACs affected by the MEZ.

Impact: Loss of, or restriction of access to, intertidal gleaning sites due to the MEZ

The resettlement action plan will include measures that will manage this impact.

A marine livelihoods study will be conducted in the AOI and a marine livelihoods restoration plan will be developed.
Post-resettlement monitoring of livelihood restoration measures will be implemented to ensure livelihoods are restored to pre-project levels as a minimum.

The project will implement and communicate a grievance procedure to provide opportunities for PACs to express grievances about the project activities.

Application of these mitigation measures will reduce the magnitude of impact from very large to small and the duration of impact from very long-term to short-term. The residual impact is not significant.

Impact: Damage to, or displacement of, fishing gear by project construction vessels

The community health, safety and security plan, marine vessel management plan and the stakeholder engagement plan will include measures to manage project damage to or displacement of fishing gear.

The project developed will liaise with the Tanzania Ports Authority to agree on a vessel transit route to the marine construction site.

CLOs will resolve gear damage from construction activities through the project grievance mechanism and monitor compliance with agreed actions arising from the grievance management process.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the residual impact is not significant.

Impact: Displacement of fishing effort (from loss of, or restriction of access to, grounds) into adjacent grounds

The resettlement action plan, stakeholder engagement plan and monitoring and reporting plan will include measures to manage displacement of fishing activities.

A marine livelihoods study will be conducted in the AOI and a marine livelihoods restoration plan (LRP) will be developed.

Application of these mitigation measures will reduce the magnitude of impact from very large to medium and the duration of impact from long-term to short-term. The residual impact is not significant.

Noise

Impact: Loss of or displacement of fish due to construction activities affecting fishing livelihoods.

The resettlement action plan, stakeholder engagement plan and monitoring and reporting plan will include measures that will manage construction induced loss or displacement of fish.

A marine livelihoods study will be conducted in the AOI and a marine livelihoods restoration plan (LRP) will be developed.

Application of these mitigation measures will reduce the magnitude of impact from very large to medium and the duration of impact from long-term to short-term. The residual impact is not significant.
Impact: Noise impacts on fisherfolk

The community health, safety and security plan, resettlement action plan, stakeholder engagement plan and associated grievance procedure, the marine vessel management plan and the monitoring and reporting plan will include measures that will contribute to manage risk of accidents.

The project will liaise with fishermen and marine users to provide information on the construction exclusion zone and activities with the potential to cause disruption (e.g., construction activities that cause noise) will be notified at a minimum of 24 hours in advance.

Application of this mitigation measure will reduce the magnitude of impact from large to small and the duration of impact from medium-term to short-term. The residual impact is not significant.

Community Safety
Impact: Increased risks of accidents due to increased boat traffic outside the restricted areas

The community health, safety and security plan, resettlement action plan, stakeholder engagement plan and associated grievance procedure, the marine vessel management plan and the monitoring and reporting plan will include measures that will contribute to manage risk of accidents.

Risks associated with increased boat traffic will be addressed by the marine vessel management plan that will cover anchoring, navigation, lighting and vessel movements, and be designed to minimise impacts to marine and onshore VECs.

The grievance procedure will provide opportunities for PACs to express grievances; and it will be clearly communicated to PACs that complaints related to interactions with public or private security forces will also be addressed.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the residual impact is not significant.

Project-Induced In-Migration
Impact: Reduction in local fish stocks due to PIIM

The PIIM management plan will include measures to manage PIIM induced effects on fish stocks.

A marine livelihoods study will be conducted in the AOI against which PIIM can be monitored.

A PIIM management plan will be developed and implemented for the project with the aim of reducing the number of people that arrive into PACs and mitigating the impacts of PIIM that does occur.

The grievance procedure will provide opportunities for PACs to express grievances.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the duration of impact from long-term to short-term. The residual impact is not significant.
8.14.3.3 Operation

**Generic Impacts – Inland Fisheries**

As there are no predicted generic impacts on inland fisheries during pipeline, AGI, MST and LOF operation, no mitigation measures are required.

**Location-Specific Mitigation Measures – Inland Fisheries**

As there are no predicted specific impacts on inland fisheries during pipeline, AGI, MST and LOF operation, no mitigation measures are required.

**Generic Mitigation Measures – Marine Fisheries**

As there are no predicted generic impacts on marine fisheries during MST and LOF operation, no mitigation measures are required.

**Location-Specific Mitigation Measures – Marine Fisheries**

**Location: Marine Storage Terminal and Load-Out Facility (Tanga District)**

The following location-specific mitigation measures, described for construction, will all contribute to the management of operational phase impacts associated with marine fisheries at the MST and LOF (no additional mitigation measures are necessary):

- **Restriction of Access to Fisheries**
  - Impact: Loss of, or restriction of access to, existing fishing grounds, transit routes, fish landing sites and market sites
  - Impact: Loss of, or restriction of access to, intertidal gleaning sites

  The resettlement action plan will include a marine livelihoods study, which takes into account the implications of the MEZ. This will be conducted in the AOI and it will inform the marine livelihoods restoration plan. An RPF has also been developed and will outline procedures related to compensation for loss of assets and livelihood restoration. The project will implement a grievance procedure to provide opportunities for PACs to express grievances about project activities.

  Application of these mitigation measures will reduce the magnitude of these impacts from very large to small with no significant residual impact.

- **Impact: Damage to, or displacement of, fishing gear**
  - The community health, safety and security plan, marine vessel management plan and the stakeholder engagement plan will include measures that will control this impact.

  The stakeholder engagement plan will identify how the project will engage and consult with internal and external stakeholders to keep them informed about project activities, understand and respond to their concerns and report to them on the project’s environmental and social performance.

  The CHSSP and marine vessel management plan will ensure that construction marine exclusion zones and associated access routes are designated and implemented in consultation with the Ports Authority.
Application of these mitigation measures will reduce the magnitude of impact from large to small with no significant residual impact.

Impact: Displacement of fishing effort

The resettlement action plan will include a marine livelihoods study, which takes into account the implications of the MEZ. This will be conducted in the AOI and it will inform the marine livelihoods restoration plan.

Application of this mitigation will reduce the magnitude of impact from very large to medium with no significant residual impact.

Community Safety

Impact: Increased risks of accidents due to increased boat traffic

A marine vessel management plan and stakeholder engagement plan will include measures to manage increased risk of accidents.

The marine vessel management plan will cover anchoring, navigation, refuelling, lighting and vessel movements, and be designed to minimise impacts to marine and onshore VECs where possible.

The SEP will identify how the project will engage and consult with internal and external stakeholders to keep them informed about project activities, understand and respond to their concerns and report to them on the project's environmental and social performance.

Application of these mitigation measures will reduce the magnitude of impact from large to small with no significant residual impact.

8.14.4 Residual Impacts and Significance Determination Summary

This section summarises the residual impacts on the river-, lake- and marine-based livelihoods after mitigation has been implemented.

Table 8.14-1 summarises the potential generic river, lake and marine-based livelihoods impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation. Table 8.14-2 summarises location-specific impacts.

8.14.4.1 Inland Fisheries

After mitigation has been implemented, the potential residual impacts on inland fisheries are considered not significant.

8.14.4.2 Marine Fisheries

The ESIA surveys identified the PACs for the MST/LOF area that require an independent in-depth fishing livelihood assessment to be executed by fisheries specialists. The livelihood study would focus on degree of reliance on fisheries in PACs and in individual households, dependence on particular fishing grounds and availability of alternative grounds, marketing and processing of fish and improvement of processing techniques, use of particular fishing gear and boats and
affordability, potential for adaptation of fishing techniques and strategies and potential for replacement livelihood activities.

8.14.4.3 Ecosystem Services

Section A11.4.7.3 in Appendix A11 identifies ecosystem services associated with river lake and marine-based livelihoods in the AOI. The following ecosystem services have been assessed in Sections 8.13.2 and 8.13.3:

Provisioning services:
- income from selling catch and fishing equipment
- food to supplement diets
- products for fish processing activities

Cultural services:
- fishing has been an important activity for generations and is a major part of the PACs’ way of life.

With the implementation of the planned mitigation measures, the residual impact on the above services will be not be significant.
## Table 8.14-1  River, Lake and Marine-Based Livelihoods – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Resettlement action plan</td>
<td>M  D  E  S  SS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stakeholder engagement plan</td>
<td>2  2  1  4  9</td>
</tr>
<tr>
<td>Restriction of Access to Fisheries</td>
<td>Temporary loss of access to fishing grounds (rivers, lakes, dams and ponds) due to temporary road closures and access restrictions across the RoW</td>
<td>C</td>
<td>-</td>
<td>Resettlement action plan</td>
<td>2  2  1  4  9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stakeholder engagement plan</td>
<td>2  2  1  4  9</td>
</tr>
<tr>
<td></td>
<td>Resettlement Permanent loss of access to ponds used for aquaculture due to project land acquisition</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan</td>
<td>4  2  1  5  12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stakeholder engagement plan</td>
<td>4  2  1  5  12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Monitoring and reporting plan</td>
<td>4  2  1  5  12</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
Table 8.14-2  River, Lake and Marine-Based Livelihoods – Location Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACs near MCPY6, MCPY9 and CF, MCPY15 and MCPY16</td>
<td>PIIM</td>
<td>Reduction in local fish stocks due to PIIM</td>
<td>C</td>
<td>Y</td>
<td>Project-induced in-migration management plan</td>
<td>4 2 1 3 10</td>
</tr>
<tr>
<td>PACs close to pipeline river crossings</td>
<td>Impeded Flow of River or Channel</td>
<td>Reduction in artisanal fish catches due to changes in water flows and increased levels of sediment during open-cut crossing construction</td>
<td>C</td>
<td>-</td>
<td>Pollution prevention plan Reinstatement plan</td>
<td>4 2 1 2 9</td>
</tr>
<tr>
<td>Mleni mtaa, Mabokweni mtaa, Helani hamlet, Putini mtaa and Chongoleani mtaa (KP1429 to 1442.5)</td>
<td>Restriction of Access to Fisheries</td>
<td>Loss of, or restriction of access to, existing fishing grounds, transit routes, fish landing sites and market sites due to the MEZ</td>
<td>C &amp; O</td>
<td>Y</td>
<td>Resettlement action plan Marine livelihoods restoration plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>Mleni mtaa, Mabokweni mtaa, Helani hamlet, Putini mtaa and Chongoleani mtaa (KP1429 to 1442.5)</td>
<td>Restriction of Access to Fisheries</td>
<td>Loss of, or restriction of access to, intertidal gleaning sites due to the MEZ</td>
<td>C &amp; O</td>
<td>Y</td>
<td>Resettlement action plan Marine livelihoods restoration plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>Mleni mtaa, Mabokweni mtaa, Helani hamlet, Putini mtaa and Chongoleani mtaa (KP1429 to 1442.5)</td>
<td>Restriction of Access to Fisheries</td>
<td>Damage to, or displacement of, fishing gear by project construction vessels</td>
<td>C &amp; O</td>
<td>-</td>
<td>Community health, safety and security plan Stakeholder engagement plan Marine vessel management plan</td>
<td>4 2 1 5 12</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.

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Table 8.14-2  River, Lake and Marine-Based Livelihoods – Location Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mleni mtaa, Mabokwendi mtaa, Helani hamlet, Putini mtaa and Chongoleani mtaa (KP1429 to 1442.5)</td>
<td>Restriction of Access to Fisheries</td>
<td>Displacement of fishing effort (from loss of, or restriction of access to, grounds) into adjacent grounds</td>
<td>C &amp; O</td>
<td>Y</td>
<td>Resettlement action plan Stakeholder engagement plan Monitoring and reporting plan Marine livelihoods restoration plan</td>
<td>6 2 1 4 13</td>
</tr>
<tr>
<td>Mleni mtaa, Mabokwendi mtaa, Helani hamlet, Putini mtaa and Chongoleani mtaa (KP1429 to 1442.5)</td>
<td>Noise</td>
<td>Loss of or displacement of fish due to construction activities affecting fishing livelihoods</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan Stakeholder engagement plan Monitoring and reporting plan Marine livelihoods restoration plan</td>
<td>6 2 1 4 13</td>
</tr>
<tr>
<td>Mleni mtaa, Mabokwendi mtaa, Helani hamlet, Putini mtaa and Chongoleani mtaa (KP1429 to 1442.5)</td>
<td>Noise</td>
<td>Noise impacts on fisherfolk</td>
<td>C</td>
<td>-</td>
<td>Stakeholder engagement plan Community health, safety and security plan Resettlement action plan Marine vessel management plan Monitoring and reporting plan</td>
<td>4 2 1 4 11</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.14-2  River, Lake and Marine-Based Livelihoods – Location Specific Impacts

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<tr>
<th>Location</th>
<th>Aspect</th>
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<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
</table>
| Mleni mtaa, Mabokweni mtaa, Helani hamlet, Putini mtaa and Chongoleani mtaa (KP1429 to 1442.5) | Community Safety             | Increased risk of accidents due to increased boat traffic outside the restricted areas | C & O | Y                        | Community health, safety and security plan  
Resettlement action plan  
Marine vessel management plan  
Stakeholder engagement plan  
Monitoring and reporting plan                                                                                                                                                                                       | 4 4 1 5 14      |
| Mleni mtaa, Mabokweni mtaa, Helani hamlet, Putini mtaa and Chongoleani mtaa (KP1429 to 1442.5) | PIIM                          | Reduction in local fish stocks due to PIIM.                                     | C     |                          | Project-induced in-migration management plan                                                                                                                                                                     | 6 2 1 5 14      |

**NOTES:** C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
8.14.5 Transboundary Project Impacts

The following transboundary project impact has been identified:

8.14.5.1 Marine Fisheries

Dried dagaa\textsuperscript{27} in Tanga is distributed via a network of traders. The major importing countries are the Democratic Republic of the Congo (DRC), Burundi, Zambia, South Sudan, Kenya, Rwanda, Zimbabwe and Malawi. Much of the trade is informal and there are few reliable statistics regarding the quantities, but they are believed to be substantial. Dagaa is an important component of the local diet in the importing countries and is in high demand. Fisherfolk and fish traders may lose their regular customers due to reduced fish catch which can affect supply of the international buyers.

8.14.6 Cumulative Impacts

8.14.6.1 Context

No cumulative impacts have been identified for river-, lake- and marine-based livelihoods.

8.15 Land and Property

This section describes potential impacts on land and property during the construction, commissioning and operation of the EACOP project and associated mitigation measures to be adopted.

8.15.1 Key Sensitivities and Considerations

The land and property baseline conditions are described in Section 6.4.3.10, as well as:

- land and property key VECs and their sensitivity ranking based on the relevant tables in Appendix D
- key considerations for the land and property impact assessment.

Sensitivity in the land and property AOI is ranked as very high for female headed households, who are particularly vulnerable due to long-standing discrimination that excludes women from owning, inheriting and controlling land. Pastoralists, who depend on access to land and water sources to move livestock to, are considered highly sensitive VECs; movements are increasingly important with a climate change-related trend resulting in more unpredictable rains. Youths are potentially highly sensitive VECs as a result of having limited access to land outside their customary rights. Artisanal miners are considered highly sensitive to loss of areas

\textsuperscript{27} Sardines, known in Kiswahili as dagaa, are recognised by the Indian Ocean Commission as a species of primary importance to the national and regional economies and for regional trade development in Tanzania. Dried dagaa is produced by sun-drying which is often done by women. The dried fish is marketed in local markets and/or sent to major wholesale markets for dried dagaa in Mwanza and Geita regions. It is transported all over eastern and southern Africa from the markets. The final use of dried dagaa can either be human food or animal feed (Indian Ocean Commission 2011).
for mining because, without legal access to land, they may not qualify for compensation. Land users in protected areas and land owners without formal title deeds are potentially highly sensitive VECs as, without formal acknowledgement and formal title deeds, these groups may not be eligible for compensation. Key considerations are:

- decreasing availability of grazing land, impacting on pastoralist livelihoods, which may be exacerbated by the growing population and new developments
- increasing scarcity of land, which may impact on the ability to provide alternative land to PAPs requiring resettlement
- the vulnerability of most landowners due to lack of formal title deeds, potentially making them vulnerable in terms of rights to compensation for loss of land
- women being disadvantaged in terms of access to land. Compensation for loss of land will mostly be paid to the head of household (men) with spousal consent, leaving women vulnerable in terms of access to that compensation.
- the existence of numerous land conflicts
- the trend of village land being purchased by outsiders
- the lack of land management plans
- the existence of vulnerable groups in terms of potential land take, such as artisanal miners, illegal users of the land, hunters and natural resource collectors
- the negative experience of stakeholders with regards to fair and timely compensation for resettlement by government (see land-based livelihoods).

The ecosystem services associated with land have been considered in land-based livelihoods (see Section 8.13).

The key human rights relevant to land and property are the right to own property and the right to an adequate standard of living. Women’s rights and children’s rights should also be considered here as they are identified to be particularly vulnerable groups. International standards for responsible business also provide that individuals should receive adequate compensation when deprived of their land. Adequate compensation requires that displaced persons are provided with compensation for loss of assets at full replacement cost and other assistance to help them improve or at least restore their standards of living or livelihoods (see Section 4).

As noted above, there are several groups who engage in pastoralist and hunter-gatherer activities that may be considered indigenous peoples according to international standards.

Through the human rights impact assessment and other studies and engagement activities, the project is proactively seeking to identify where the project may have potential impacts on indigenous peoples’ rights. In the case of land-based livelihoods, this will be determined by where the pipeline route intersects with lands, natural resources and cultural heritage used by indigenous peoples.

### 8.15.1.1 Resettlement

This section describes the land acquisition and compensation process that will be implemented by the project.
The project will require permanent land acquisition of approximately 4000 ha and a resettlement policy framework (RPF) has been developed and presented to the Government (see Appendix L). The purpose of the RPF is to define the overarching principles for land access, compensation and resettlement planning, and is the foundation for the development of resettlement action plans (RAPs) or livelihood restoration plans (LRPs). The Tanzanian Petroleum Development Corporation, in coordination with the PPT, will acquire the permanent right of occupancy for project-required land, except for land acquired by the Tanzania Port Authority in the Chongoleani Peninsula. These entities will lease the land to the project.

Land access and resettlement planning for the project will be undertaken in compliance with Tanzanian legal and regulatory requirements and international good practice as reflected in the International Finance Corporation (IFC) Performance Standard (PS) 5 on Land Acquisition and Involuntary Resettlement. In instances where a given project comprises subprojects or multiple components that cannot be identified before project approval, or that may be implemented sequentially over an extended period. PS5 allows for the prior development of an RPF outlining the general principles for resettlement planning.

**Project Land**

Table 8.15-1 indicates the land required for each project component.

### Table 8.15-1  Summary of Project Land Requirements

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Estimated Affected Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction Facilities</strong></td>
<td></td>
</tr>
<tr>
<td>Coating facility/pipe yard (one in Tanzania)</td>
<td>40 ha</td>
</tr>
<tr>
<td>12 MCPYs</td>
<td>Approximately 210 ha</td>
</tr>
<tr>
<td><strong>Construction and Operation</strong></td>
<td></td>
</tr>
<tr>
<td>New access roads to construction facilities, pipeline</td>
<td>Approximately 74 ha</td>
</tr>
<tr>
<td>RoW and AGIs</td>
<td></td>
</tr>
<tr>
<td><strong>Operational Facilities</strong></td>
<td></td>
</tr>
<tr>
<td>Export Pipeline</td>
<td></td>
</tr>
<tr>
<td>30-m-wide RoW</td>
<td>30-m corridor: 3429 ha</td>
</tr>
<tr>
<td>Additional temporary construction workspace along RoW</td>
<td>163 ha</td>
</tr>
<tr>
<td>(estimate)</td>
<td></td>
</tr>
<tr>
<td>AGIs</td>
<td>72 ha</td>
</tr>
<tr>
<td>MST/tanks</td>
<td></td>
</tr>
<tr>
<td>Four PS (includes buffer and construction staging area)</td>
<td>4 x 14 ha outside 30-m RoW = 56 ha</td>
</tr>
<tr>
<td>(15 ha each with 1 ha in pipeline RoW)</td>
<td></td>
</tr>
<tr>
<td>Two PRS (estimated 3.3 ha each additional to pipeline</td>
<td>2 x 3.3 ha outside 30-m RoW = 6.6 ha</td>
</tr>
<tr>
<td>RoW)</td>
<td></td>
</tr>
</tbody>
</table>
Table 8.15-1  Summary of Project Land Requirements

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Estimated Affected Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total project land requirement (construction and operation)</td>
<td>Approximately 4000 ha</td>
</tr>
</tbody>
</table>

The following land will also be acquired and leased by the project:

- “orphaned land” where the pipeline corridor dissects a field, leaving small portions which are no longer viable to cultivate/use and classed as “uneconomic”.
- temporary land requirements by contractors (e.g., for construction access, storage of equipment and hydrotest water).

The project footprint is primarily rural land and analysis of satellite imagery allowed for the identification of three main land categories within the footprint:

- land used for cultivation (with no discernible dwellings)
- land in which dwellings are interspersed with cultivation and/or grazing
- vacant or grazing land with no dwellings and little or no cultivation.

The majority (approximately 55%) of land that will be affected by the project falls within the first category (cultivation with no discernible dwellings), while about 22% falls in the second category (dwellings interspersed with cultivation).

Legislative and Regulatory Requirements and International Standards

The primary project obligation is to meet national legislative requirements for land acquisition, compensation and resettlement. In addition, international financing standards enshrined in the Equator Principles (EPs) III and the IFC PSs will apply to meet lender requirements. Based on these requirements, the RPF has conducted a gap analysis to ensure both national and lender requirements are met. The RPF ensures that, where a discrepancy exists between lender requirements (EPs and IFC PSs) and national legislation, the more stringent of the two will be used and/or applied.

Eligibility and Entitlements/Compensation Framework

The RPF considers eligibility for compensation and resettlement entitlements. Eligibility is defined as entitlement to compensation and assistance granted to persons, groups of persons, families, or institutions due to displacement from land acquisition, the revocation of rights, and/or the compulsory acquisition of property as a direct result of the project.

Only persons occupying or using an area in the project footprint before the cut-off date (the first date of valuation in a given area) are eligible for compensation for loss of land rights and assets established before this cut-off date. Only these assets will be recorded during the valuation process. Should affected persons not be

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28 This excludes “orphaned land” where the pipeline corridor dissects a field, leaving small portions which are no longer viable to cultivate/use and classed as “uneconomic”.

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present during the valuation process, such persons will be requested to provide proof of their presence in the project area during the valuation period, and/or proof of ownership of assets in the project area during that period, to be eligible for compensation.

Assets affected by the project will be valued to determine the compensation due to their owners and/or users. The valuation methodology to be used is prescribed in various acts and regulations which explicitly provide guidance on valuation practices. Different valuation methods are proposed for the various eligibility categories identified, particularly in relation to land, structures, crops and trees and businesses. The selection of the specific valuation method has been guided by the requirement of compliance with Tanzanian legislation. Further to the valuation methodologies, options and packages are proposed by the project to ensure that IFC PS5 criteria are fully addressed, particularly to “improve, or restore, the livelihoods and standards of living of displaced persons”.

Entitlements associated with impacts and those impacted are set out in the RPF in an eligibility and entitlements framework.

Resettlement Action Plans

Based on the RPF, the project’s resettlement process will culminate in the development of a suite of RAPs and/or LRPs. The geographical area to be covered by each is determined partly by administrative boundaries, and partly by the timing of required land access for various project components. The RAPs/LRPs proposed thus comprise the following:

- one RAP/LRP for MCPYs that need to be prioritised in terms of early land access requirements; and
- eight RAPs/LRPs for the pipeline RoW and AGIs in each of the eight regions traversed by the AOI.

8.15.2 Potential Project Impacts

8.15.2.1 Construction

Generic Impacts

Resettlement

Pipeline route selection has been undertaken to minimise disruption to land and property. Nevertheless, on a project of this scale, some physical displacement (loss of shelter or relocation of households) and economic displacement (loss of, or interruption of access to, land or other livelihood resources) for communities is unavoidable.

The estimated project land requirements are summarised in Table 8.15-1 and the number of PAPs affected in Section 2.3.7.2.

Implementation of the RAP will need to consider the following conditions:

- Holding land deeds is rare in rural Tanzania and there is limited tenure security in rural villages. The lack of formal title deeds leaves local landowners vulnerable in terms of rights to compensation for loss of land. A
lack of formal written documentation also has the potential to exacerbate disputes and generate fraudulent activity.

- Population increase with accompanying purchase of right of occupancy of land by migrants is causing increasing scarcity of land (Section A11.4.8.1 in Appendix A11).

- Land value awareness has grown substantially and has impacted on increasing sales of land, rentals and compensation. This is particularly pertinent for Geita, Shinyanga and Tabora districts, which are mineral-rich areas (Section A11.4.8.1 in Appendix A11).

- Despite policy and legal safeguards women have inferior land rights, particularly regarding customary land rights, as traditions and customs protect men’s control over land as the value of land increases, male dominance over land-related decisions is likely to increase (Section A11.4.8.1 in Appendix A11).

From a human rights perspective, there is an additional potential impact if a woman cannot prove that she is married to her partner. Furthermore, numerous households include a complex family situation where multiple women can be partners to the same man. In these cases, women’s rights and children’s rights can be negatively affected if compensation is not granted to the persons who are entitled to receive it.

Impact: Permanent loss of private land due to project land acquisition

This will lead to direct and indirect impacts.

The project will require approximately 4000 ha of land (see Table 8.15-1). Those affected by project land acquisition will lose an important asset as it sustains land-based livelihoods such as grazing, crop growing, mining and natural resource use. The impacts associated with loss of land-based livelihoods are described in Section 8.13.

In addition to sustaining livelihoods, land ownership is important as collateral to access loans. One of the major constraints for agricultural development is limited access to credit for farmers. The purchase of agricultural inputs including seeds, fertilisers, pest control materials and mechanised equipment, depends generally on the availability of credit, which can only be obtained with collateral. Loss of land due to project land acquisition will increase constraints on accessing credit among PAPs.

Those most affected by permanent loss of rights of occupancy to land are households for which the majority, if not all, of their land is impacted by the project, and households without alternative assets or sources of income. The latter often include female-headed households, the disabled, infirm and elderly individuals.

The impacts will be very long-term and will affect some households within the PACs. Due to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

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29 PAPs are parties affected by loss of assets.
Impact: Land speculation by third parties

This may lead to direct and indirect impacts.

Speculation is a common consequence of public disclosure of the need for project driven land acquisition and is often initiated by resourceful individuals with access to privileged information. Acting on such information, speculators may extort land from ignorant or needy landowners (usually parcels held under customary tenure), often at below-market prices and often without consent from family or clan members. This may lead to forced eviction of current land owners by outside purchasers (direct or in-direct pressure), fraudulent purchase of land, inflation of land prices and commercialisation of land. Speculation may also drive a change in land tenure patterns, which may further reduce access to land for poorer members of PACs.

Those with low levels of education and awareness of their own rights will be most vulnerable as they may be more easily targeted and manipulated by speculators.

The impacts will be long-term and will affect some individuals within the PACs. However, due to their localised extent, before mitigation the impacts are considered not significant.

Impact: Land and property speculation by land owners

This may lead to direct and indirect impacts.

Expectations of benefits from the project are high. To enhance benefits, potentially affected land owners may participate in speculation through the construction of new structures and/or the division of their own land to allow relatives or new tenants to construct new structures on the land.

This type of speculation may require short-term loans to purchase tenancies and construction materials. A prolonged or delayed compensation process may place those with short-term loans in considerable long-term debt if short-term loans are not repaid on time. This situation is further compounded if interest rates are high.

Those with low levels of education and awareness of their own rights will be most vulnerable as they may be more easily targeted and manipulated by speculators.

The impacts will be short-term and will affect some individuals within the PACs. Owing to their short-term nature and localised extent, before mitigation the impacts are considered not significant.

Impact: New disputes and exacerbation of pre-existing disputes and conflict around land and property

This may lead to direct and indirect impacts.

Tensions exist in PACs regarding both private and communal land.

The baseline revealed a current prevalence of land disputes linked to private land, including conflicts over boundaries, multiple claims on land parcels and sales of family land without consent of all family members.

The acquisition of land and property for the project may cause new disputes and conflicts including:
• intra-family disputes and conflict linked to the sale of family owned land for project facilities (without consent of the entire family)
• disputes and conflict over land boundaries
• disputes and conflict over fraudulent land and property purchases related to land being acquired for the project.

The baseline indicates that communal land is less common than land held under customary rights of occupancy in the PACs. Lack of land use plans contributes to the decreasing availability of communal land as potential grazing land is use for other purposes. Communal land is important for grazing and natural resource collection, particularly for those without, or with limited access to, private land and those with large herds. The decreasing availability of communal land is leading to competition between those using it. Added to which, the PIIM of opportunistic job seekers may add to existing pressure on land, in particular natural resources. The acquisition of land and property for the project may exacerbate this competition for communal land use and lead to conflict. Widows, single females and elderly-headed households may be more vulnerable to disputes and conflict around land and property as their access to land is generally more restricted (see Section A11.4.8.1 in Appendix A11). Landowners without formal title deeds may also be more vulnerable; without proof of land ownership, they may not be able to defend their rights in the event of a dispute or conflict.

The impacts will be long-term and will affect some individuals within the PACs. Due to their localised extent, before mitigation the impacts are considered not significant.

Impact: Permanent loss of physical structures due to project land acquisition

This may lead to direct and indirect impacts.

The available pre-survey estimates indicate that the project will lead to the loss of around 100030 structures. Some PAPs will permanently lose their dwelling, which is an asset and provides shelter.

The impacts will be very long-term and will affect some households within the PACs. Due to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Impact: Permanent loss of local enterprises due to project land acquisition

This may lead to direct and indirect impacts.

Baseline data shows that PACs generally boast some shops that sell daily necessities. These are relied upon by the entire PACs, particularly in the remote areas, which are not well connected to urban centres.

Land acquisition by the project may lead to the loss of businesses, which are an asset and a source of income for business owners and their employees.

The impacts will be very long-term and will affect some individuals within the PACs. Due to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

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30 Visual inspection of LiDAR imagery of the pipeline corridor
Impact: Loss of community infrastructure (schools, clinics, community halls) due to project land acquisition

This may lead to direct and indirect impacts.

The baseline indicates that community infrastructure is generally poor, with a lack of sufficient schools and clinics to meet local needs. Land acquisition by the project may lead to the loss of community structures, which may have a further impact on education, health services and community life.

The impacts will be long-term and will affect entire PACs. Due to their small magnitude and small extent, before mitigation the impacts are considered not significant.

Impact: Loss of access to informal support networks and social services after physical displacement due to project land acquisition

This may lead to indirect impacts.

Due to a dearth of formal safety networks and services, PAPs are dependent on local social networks and community support. Women in particular rely on savings societies and other support groups.

The resettlement of PAPs may impact upon their informal social networks, which may negatively impact on their quality of life and ability to deal with problems. The most vulnerable PAPs are female headed households, children, the elderly and the disabled. Resettlement may also lead to loss of access to social services for these individuals.

The impacts will be medium-term and will affect some individuals within the PACs. Owing to their small magnitude and localised extent, before mitigation the impacts are considered not significant.

Vibration

There are two main types of house structures observed in the PACs:

- traditional structures made from wooden or wattle frames with mud filling and roofing of corrugated iron sheets or thatched leaves
- houses, locally called ‘improved houses’, built with burnt brick or cement blocks, cement flooring, plastered or painted walls and corrugated iron roofing.

Construction phase activities that may cause vibration include:

- access road construction and upgrades
- vehicles transporting construction materials and the labour workforce along access roads
- site clearance, levelling and infrastructure construction and installation
- RoW clearing, grading, trenching and backfilling
- river crossing horizontal directional drilling (HDD)
- pile installation for AGI construction.

Impact: The generation of vibrations during construction works

This may lead to direct and indirect impacts.
The generation of vibrations during construction may cause physical damage to houses and other structures. Households lacking the means to repair their structures are most vulnerable to this impact. Vulnerable groups for this impact include females, the elderly and widows.

The impacts will be medium-term and will affect some individuals within the PACs. Owing to their localised extent, before mitigation the impacts are considered not significant.

Location-Specific Impacts

Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147), Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)

The potential generic impacts are also applicable to the 38 PACs near the 12 MCPYs and one CF. However, the following impacts may be more pronounced in these PACs because a larger area of land will be acquired, and potential PIIM into the area from job seekers may place additional pressure on the land.

Resettlement

Impact: Permanent loss of private land due to project land acquisition

This may lead to direct and indirect impacts.

Those most affected by permanent loss of rights of occupancy to land are households for which the majority, if not all, of their land is impacted by the project, and households without alternative assets or sources of income. The latter often include female-headed households, the disabled, infirm and elderly individuals.

The impacts will be very long-term and will affect entire PACs. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Impact: Land speculation by third parties

This may lead to direct and indirect impacts.

The impacts will be long-term and will affect some individuals within the PACs. However, due to their localised extent, before mitigation the impacts are considered not significant.

Impact: Land and property speculation by landowners

This may lead to direct and indirect impacts.

The impacts will be short-term and will affect some individuals within the PACs. Owing to their short-term nature and localised extent, before mitigation the impacts are considered not significant.
Impact: New disputes and exacerbation of pre-existing disputes and conflict
This may lead to direct and indirect impacts.
The impacts will be long-term and will affect some individuals within the PACs. Owing to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Impact: Permanent loss of physical structures due to project land acquisition
This may lead to direct and indirect impacts.
The impacts will be very long-term and will affect some individuals within the PACs. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Impact: Permanent loss of local enterprises due to project land acquisition
This may lead to direct and indirect impacts.
The impacts will be very long-term and will affect some individuals within the PACs. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Impact: Loss of access to informal support networks and social services after physical displacement due to project land acquisition
This may lead to indirect impacts.
The impacts will be medium-term and will affect some individuals within the PACs. Due to their localised extent, before mitigation the impacts are considered not significant.

RoW – Masusu (KP1006)
The potential generic impacts are applicable to Masusu (KP1006). However, the following impact may be more pronounced in this PAC:

Resettlement
Impact: New disputes and exacerbation of pre-existing disputes and conflict
This may lead to indirect impacts.
Masusu is an isolated rural PAC in Hanang district, Manyara region. Since the early 2000s, Masusu has experienced tribal conflict between the Barabaig and the Waasi people and several land clashes between pastoralists and farmers have taken place in the past. Land acquisition associated with the project could further exacerbate these tensions.
The impacts will be long-term and will affect some households in the PAC. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

RoW – KP1082 to KP1106
The potential generic impacts are applicable to the two PACs between KP1082 and KP1106. However, the following impact may be more pronounced in these PACs:
Vibration
Impact: The generation of vibrations during construction works
This may lead to direct and indirect impacts.

Much of the rock in Chemba district (Dodoma region) is of low workability and hard to excavate, meaning that blasting may be required in this area during pipeline construction. There are several identified structures in Chemba district between KP1082 and KP1106 where blasting may occur. Potential blasting impacts are much higher than for conventional rock breaking methods and there is the added generation of air overpressure. Blast-induced vibration could cause cosmetic or structural damage to traditional structures, housings or other buildings in PACs between KP1082 and KP1106.

The impacts will be medium-term and will affect entire PACs. Owing to their short-term nature and small extent, before mitigation the impacts are considered not significant.

RoW – KP1380 to KP1410
The potential generic impacts are applicable to the nine PACs between KP1380 and KP1410. However, the following impacts may be more pronounced in these PACs:

Resettlement
Impact: Permanent loss of private land
and
Impact: Permanent loss of physical structures
These may lead to direct and indirect impacts.

In the 30-km stretch between KP1380 and KP1410, there are a large number of identified structures in concentrated settlements with high population densities. The permanent loss of private land and physical structures may thus be more pronounced in this area.

The impacts will be very long-term and will affect some individuals within the PACs. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Impact: New disputes and exacerbation of pre-existing disputes and conflict
This may lead to direct and indirect impacts.

Muheza district has fertile lands that attract farmers from both within and outside the district causing incidences of land disputes in Muheza to be much higher than in the neighbouring districts.

The impacts will be long-term and will affect some individuals within the PACs. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.
Pumping Station 3 (Muleba District, KP405.4), Pumping Station 4 (Mbogwe District, KP610), Pumping Station 5 (Igunga District, KP824.8) and Pumping Station 6 (Singida District, KP931)

The potential generic impacts are also applicable to the eight PACs near the four pumping stations.

Pressure Reduction Station 1 (Kiteto District, KP1172) and Pressure Reduction Station 2 (Handeni District, KP1330)

The potential generic impacts are also applicable to the three PACs near the two pressure reduction stations.

Marine Storage Terminal and Load-Out Facility (Tanga District)

The nearest PACs to the MST are Putini mtaa (KP1441.5, approximately 1.5 km away) and Chongoleani mtaa (KP1442.5, approximately 0.3 km away). The MST will require 72 ha of land on a long-term basis, which is much higher than is required for the AGIs.

The area where the MST will be will be within or close to a 200-ha area of land, which has been acquired by the Tanzania Ports Authority (TPA) and where TPA continues to acquire land for other industrial projects. However, several concerns have been raised by those who were resettled caused by this land acquisition undertaken by TPA. These include:

- not all PAPs received cash compensation before resettlement
- compensation rates were considered inadequate.

Chongoleani mtaa experienced episodes of public disorder during the land acquisition and compensation payments process (late 2017). Information collected during baseline surveys indicated that residents are still resentful.

The MST will provide employment opportunities and may cause PIIM into the area; this may exacerbate the impacts related to loss of land and property and add additional pressure on available land and social services.

The potential generic impacts are also applicable to Putini mtaa and Chongoleani mtaa. However, the following impact may be more pronounced in these PACs:

Resettlement

Impact: New disputes and exacerbation of pre-existing disputes and conflict

The impacts will be long-term and will affect some individuals within the PACs. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

8.15.2.2 Operation

Generic Impacts

There are no generic impacts during pipeline, AGI, MST and LOF operation. During the operations phase, no additional land will be required.
Location-Specific Impacts
There are no location-specific impacts during pipeline, AGI, MST and LOF operation. Land leased for the MCPYs will be returned to the Tanzanian government.

8.15.3 Mitigation Measures
This section describes the impact avoidance and mitigation measures that will be applied to the aspects and activities that could affect land and property.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management plan and other measures that are included in Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.

8.15.3.1 Design

Generic Mitigation Measures
As described in Section 3, Alternatives, route identification for the pipeline has considered social aspects relating to land and property such as minimising impacts on social and community infrastructure and structures within 50 m of the corridor centreline. The selected pipeline route was chosen partly because it had the lowest number of social constraints of the routing options available.

Location-Specific Mitigation Measures
There are no location-specific mitigation measures relating to the design of the construction facilities, pipeline, AGIs, MST and LOF.

8.15.3.2 Construction

Generic Mitigation Measures
Resettlement
Impact: Permanent loss of private land due to project land acquisition
Impact: Land speculation by third parties
Impact: Land and property speculation by land owners
Impact: New disputes and exacerbation of pre-existing disputes and conflict around land and property
Impact: Permanent loss of physical structures due to project land acquisition
Impact: Permanent loss of local enterprises due to project land acquisition
Impact: Loss of community infrastructure (schools, clinics, community halls) due to project land acquisition
Impact: Loss of access to informal support networks and social services after physical displacement due to project land acquisition
The resettlement action plan, stakeholder engagement plan, community health, safety security plan, and the monitoring and reporting plan will contain measures to manage land and property related impacts.

A resettlement action plan will include the procedures related to compensation for loss of assets and livelihood restoration strategies and is backed-up by the grievance procedure that will be communicated to all PACs allowing for the resolution of potential grievances. The RAP process is described in Section 2.3.7.2.

The resettlement action plan will ensure PACs will be sensitised to recent land speculation and instances of associated violence and informed of actions that can be taken. Spouses will be consulted and present during the land surveys, entitlement briefings and compensation agreements and both spouses will sign the compensation agreements.

Post-resettlement monitoring of livelihood restoration measures will be implemented, and the project will engage with authorities (security providers in particular) to ensure that in cases where compulsory acquisition is unavoidable no use of force is used to remove people.

The stakeholder engagement plan will identify how the project will engage and consult with stakeholders to keep them informed about project activities, understand and respond to their concerns and report to them.

For the impact permanent loss of private land due to project land acquisition, application of these mitigation measures will reduce the magnitude of impact from large to small and the duration of impact from very long-term to short-term. The residual impact is not significant.

For the impact land speculation from third parties, application of these mitigation measures will reduce the magnitude of impact from large to medium and the residual impact is not significant.

For the impact land and property speculation by land owners, application of these mitigation measures will reduce the magnitude of impact from medium to small and the residual impact is not significant.

For the impact new disputes and exacerbation of pre-existing disputes and conflict around land and property, application of these mitigation measures will reduce the magnitude from large to medium and the residual impact is not significant.

For the impact permanent loss of physical structures due to project land acquisition, application of these mitigation measures will reduce the magnitude of impact from large to small and the duration of impact from very long-term to short-term. The residual impact is not significant.

For the impact loss of community infrastructure (schools, clinics, community halls) due to project land acquisition, application of these mitigation measures will reduce the magnitude from small to negligible and the duration from long-term to short-term. The residual impact is not significant.

For the impact loss of access to informal support networks and social services after physical displacement due to project land acquisition, application of these mitigation
measures will reduce the magnitude from small to negligible and the residual impact is not significant.

Vibration
Impact: The generation of vibrations during construction works
The infrastructure and utilities management plan will include measures that manage impacts from construction-related vibration.
A pre-construction entry survey area will be conducted for infrastructure that may be exposed to construction-related vibration. A post-construction exit survey will be conducted to assess the condition of infrastructure and any actions, such as repairs, arising from the exit survey will be closed out on a timely basis to allow a prompt return to the relevant authority, PAC or landowner.

Indigenous Peoples’ Rights
If it is determined that the pipeline route intersects with traditional land and territories of people who self-identify as indigenous peoples; the resettlement action plan will address management of indigenous peoples’ considerations. The main mitigation measures will include:
- a commitment to human rights for all stakeholders includes those that self-identify as indigenous peoples and the cultural characteristics that form their identity
- consultations with appropriate institutions and groups to identify desirable and feasible land use agreements, in compliance with national legislation and IFC Performance Standard 7.

Application of these mitigation measures will reduce the magnitude from large to small and the residual impact is not significant.

Location-Specific Mitigation Measures

Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147) Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)

The generic mitigation measures are also applicable to the 38 PACs near the 12 MCPYs and one CF.

RoW – Masusu (KP1006)
The generic mitigation measures are also applicable to Masusu (KP1006).
RoW – KP1082 to KP1106
The generic mitigation measures are also applicable to the two PACs between KP1082 and KP1106. The additional mitigation measures recommended for these PACs are as follows.

Vibrations
Impact: The generation of vibrations during construction works
The following mitigation will be included in the infrastructure and utilities management plan to contribute to the management of impacts from the generation of vibrations during blasting near the two PACs between KP1082 and KP1106.
Blasting will only be used where other excavation methods are considered technically impracticable or uneconomic and where undertaken. A rock blasting management plan will be developed to consider the effects of air overpressure and vibration on dwellings, structures and wildlife and the identification of appropriate mitigation where required.
Application of these mitigation measures will reduce the magnitude from large to small and the residual impact is not significant.

RoW – KP1380 to KP1410
The generic mitigation measures are also applicable to the nine PACs between KP1380 and KP1410.

Pumping Station 3 (Muleba District, KP405.4), Pumping Station 4 (Mbogwe District, KP610), Pumping Station 5 (Igunga District, KP824.8) and Pumping Station 6 (Singida District, KP931)
The generic mitigation measures are also applicable to the eight PACs near the four pumping stations.

Pressure Reduction Station 1 (Kiteto District, KP1172) and Pressure Reduction Station 2 (Handeni District, KP1330)
The generic mitigation measures are also applicable to the three PACs near the two pressure reduction stations.

Location: Marine Storage Terminal and Load-Out Facility (Tanga District)
The generic mitigation measures are also applicable to Putini mtaa (KP1441.5) and Chongoleani mtaa (KP1442.5).
The TPA has already acquired land in the Chongoleani Peninsula at or close to the MST site. The potential problems that were experienced with regards to land acquisition will be addressed as follows:

Resettlement
Impact: Permanent loss of private land due to project land acquisition
Impact: Permanent loss of physical structures due to project land acquisition
Impact: Permanent loss of local enterprises due to project land acquisition
Impact: Loss of community infrastructure (schools, clinics, community halls) due to project land acquisition

The land acquisition process as outlined in the resettlement policy framework (see Section 8.15.1.1) will be implemented through the resettlement action plan. Where required, additional entitlements including livelihood restoration measures will be implemented.

For the impact permanent loss of private land due to project land acquisition, application of these mitigation measures will reduce the magnitude of impact from very large to small and the duration from very long-term to short-term. There will be no significant residual impact.

For the impact permanent loss of physical structures due to project land acquisition, application of these mitigation measures will reduce the magnitude from very large to small and the residual impact is not significant.

8.15.3.3 Operation

Generic Mitigation Measures

As there are no predicted generic impacts during pipeline, AGI, MST and LOF operation, no mitigation measures are required.

Location-Specific Mitigation Measures

As there are no predicted location-specific impacts during pipeline, AGI, MST and LOF operation, no mitigation measures are required.

8.15.4 Residual Impacts and Significance Summary

This section summarises the residual impacts on land and property after mitigation measures have been implemented.

Table 8.15-2 summarises the potential generic land and property, proposed mitigation measures and the determination of significance of the residual impacts after mitigation. Table 8.15-3 summarises location-specific impacts.

After mitigation has been implemented, the potential residual impacts on land and property are considered not significant.

8.15.4.1 Ecosystem Services

Section A11.4.8 in Appendix A11 identifies that land and property does not provide ecosystem services. It does, however, rely on ecosystem services which are described in land-based livelihoods (see Section 8.13).
Table 8.15-2  Land and Property – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resettlement</td>
<td>Permanent loss of private land due to project land acquisition</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan&lt;br&gt;Stakeholder engagement plan&lt;br&gt;Community health, safety and security plan&lt;br&gt;Monitoring and reporting plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>Resettlement</td>
<td>Land speculation by third parties</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan&lt;br&gt;Stakeholder engagement plan&lt;br&gt;Community health, safety and security plan&lt;br&gt;Monitoring and reporting plan</td>
<td>6 2 1 5 14</td>
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<tr>
<td>Resettlement</td>
<td>Land and property speculation by land owners</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan&lt;br&gt;Stakeholder engagement plan&lt;br&gt;Community health, safety and security plan&lt;br&gt;Monitoring and reporting plan</td>
<td>4 2 1 4 11</td>
</tr>
<tr>
<td>Resettlement</td>
<td>New disputes and exacerbation of pre-existing disputes and conflict around land and property</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan&lt;br&gt;Stakeholder engagement plan&lt;br&gt;Community health, safety and security plan&lt;br&gt;Monitoring and reporting plan</td>
<td>6 4 1 5 16</td>
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</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.15-2  Land and Property – Generic Impacts

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<td>Resettlement action plan</td>
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<td>Resettlement</td>
<td>Permanent loss of physical structures due to project land acquisition</td>
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<td>Permanent loss of local enterprises due to project land acquisition</td>
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<td>Loss of community infrastructure (schools, clinics, community halls) due to project land acquisition</td>
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<td>Y</td>
<td>Resettlement action plan</td>
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<td>Loss of access to informal support networks and social services after physical displacement due to project land acquisition</td>
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<tr>
<td>Vibration</td>
<td>The generation of vibrations during construction works</td>
<td>C</td>
<td>Y</td>
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## Table 8.15-3  Land and Property – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
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<th>Phase</th>
<th>High Stakeholder Concern</th>
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<td>PACs near the 12 MCPYs and one CF</td>
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Table 8.15-3  Land and Property – Location-Specific Impacts

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<td>PACs near the 12 MCPYs and one CF</td>
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<td>Permanent loss of physical structures due to project land acquisition</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan, Stakeholder engagement plan, Community health, safety and security plan, Monitoring and reporting plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>PACs near the 12 MCPYs and one CF</td>
<td>Resettlement</td>
<td>Permanent loss of local enterprises due to project land acquisition</td>
<td>C</td>
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<td>Resettlement action plan, Stakeholder engagement plan, Community health, safety and security plan, Monitoring and reporting plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>PACs near the 12 MCPYs and one CF</td>
<td>Resettlement</td>
<td>Loss of access to informal support networks and social services after physical displacement due to project land acquisition</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan, Stakeholder engagement plan, Community health, safety and security plan, Monitoring and reporting plan</td>
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<td>Masusu (KP1006)</td>
<td>Resettlement</td>
<td>New disputes and exacerbation of pre-existing disputes and conflict around land and property</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan, Stakeholder engagement plan, Community health, safety and security plan, Monitoring and reporting plan</td>
<td>4 4 1 5 14</td>
</tr>
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<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
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</thead>
<tbody>
<tr>
<td>PACs between KP1082 and KP1106</td>
<td>Vibration</td>
<td>The generation of vibration during construction works</td>
<td>C</td>
<td>Y</td>
<td>Infrastructure and utilities management plan&lt;br&gt;Rock blasting management plan</td>
<td>4 2 2 5 13</td>
</tr>
<tr>
<td>PACs between KP1380 and KP1410</td>
<td>Resettlement</td>
<td>Permanent loss of private land due to project land acquisition</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan&lt;br&gt;Stakeholder engagement plan&lt;br&gt;Community health, safety and security plan&lt;br&gt;Monitoring and reporting plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>PACs between KP1380 and KP1410</td>
<td>Resettlement</td>
<td>Permanent loss of physical structures due to project land acquisition</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan&lt;br&gt;Stakeholder engagement plan&lt;br&gt;Community health, safety and security plan&lt;br&gt;Monitoring and reporting plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>PACs between KP1380 and KP1410</td>
<td>Resettlement</td>
<td>New disputes and exacerbation of pre-existing disputes and conflict around land and property</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan&lt;br&gt;Stakeholder engagement plan&lt;br&gt;Community health, safety and security plan&lt;br&gt;Monitoring and reporting plan</td>
<td>4 4 1 5 14</td>
</tr>
</tbody>
</table>

**NOTES:** C = construction; O = operation; C&O = construction and operation; B = beneficial impact; M = magnitude of impact; D = duration of impact; E = extent of impact; S = sensitivity; SS = significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.

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### Table 8.15-3 Land and Property – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Putini mtaa and Chongoleani mtaa (KP1441.5 to KP1442.5)</td>
<td>Resettlement</td>
<td>New disputes and exacerbation of pre-existing disputes and conflict around land and property</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan Stakeholder engagement plan Community health, safety and security plan Monitoring and reporting plan</td>
<td>4 4 1 5 14</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
8.15.5 Transboundary Project Impacts

No transboundary project impacts have been identified.

8.15.6 Cumulative Impacts

8.15.6.1 Context

Section 6.4.3.10 describes the baseline condition of land and property, the trends and sensitivity to change. Table 8.15-2 and Table 8.15-3 summarise project residual impacts.

In Tanzania, access to both private and communal land is becoming increasingly challenging due to population growth (natural increase and in-migration) and changing land use patterns. An added layer of complexity surrounding land and property rights is the absence of formal title deeds and the prevalence of land conflicts. These factors are rendering landholders and users vulnerable in terms of available land and, should their land be impacted, access to replacement land of suitable quality.

Project impacts that may contribute to cumulative impacts include:

- permanent loss of private land due to project land acquisition
- land speculation
- exacerbation of existing land disputes and conflicts
- loss of access to informal support networks and social services after physical displacement due to project land acquisition.

Third-party developments that are in the AOI of the EACOP project and third-party developments are shown in the cumulative impacts matrix, described and mapped in Appendix H. The developments are:

- rural electrification (TZ03)
- Ngono dam (TZ04)
- Geita airport (TZ05)
- housing development in Kahama (TZ13)
- transmission line (TZ14)
- Extension water supply project from Lake Victoria to Tabora, Nzega and Igunga (TZ16)
- road upgrade (TZ27)
- Mpirani waste facility (TZ28)
- mining concessions (TZ34).

No cumulative impacts with the associated facilities were identified.

The preferred condition is for the status of impacted individual or household livelihoods and general standards of living in PACs and for individual households to be equal to, or better than, before construction.
8.15.6.2 Cumulative Impacts

**Land and Property**

Potential cumulative impacts are predicted where the EACOP project and third-party developments require land acquisition and have parallel or consecutive construction schedules. Table 8.15-4 shows the third-party developments, EACOP pipeline, AGIs and MCPYs and the wards/districts that may be impacted.

<table>
<thead>
<tr>
<th>ID</th>
<th>Project</th>
<th>Nearest KP</th>
<th>MCPY/AGI/Pipeline</th>
<th>Ward or District Potentially Impacted</th>
<th>Land Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ03</td>
<td>Rural electrification</td>
<td>298–446</td>
<td>Pipeline (several transmission lines cross the pipeline at KP358, 366, 378, 404 and 425) PS3 (approximately 1.5 km from TZ03) MCPY6 (approximately 5 km from TZ03)</td>
<td>Kassambya ward Missenyi district Kyamulaile, Butulage, Kibirizi Rukoma wards Bukoba rural Ngenge, Mushabago, Burungura, Mubunda Karambi, Kyebitembe and Kasharunga wards</td>
<td>10-m RoW during construction</td>
</tr>
<tr>
<td>TZ04</td>
<td>Ngono dam</td>
<td>333.5</td>
<td>Pipeline MCPY5 (approximately 6 km from TZ04)</td>
<td>Kayaka ward, Missenyi district</td>
<td>No data available</td>
</tr>
<tr>
<td>TZ05</td>
<td>Geita airport</td>
<td>498.5</td>
<td>Pipeline MCPY7 (approximately 10 km from TZ05)</td>
<td>Katende and Bukombe wards Chato district</td>
<td>No data available</td>
</tr>
<tr>
<td>TZ13</td>
<td>Housing development</td>
<td>665</td>
<td>Pipeline</td>
<td>Mhungula, Nyahanga and Zongomera wards, Kahama town Shinyanga region</td>
<td>Land take for 50 houses</td>
</tr>
<tr>
<td>TZ14</td>
<td>Transmission line</td>
<td>955</td>
<td>Transmission line crosses the pipeline at KP955</td>
<td>Itaja, Merya and Kinyagigi wards Singida district</td>
<td>70-m RoW</td>
</tr>
</tbody>
</table>
Table 8.15-4  Cumulative Impacts: Land and Property

<table>
<thead>
<tr>
<th>ID</th>
<th>Project</th>
<th>Nearest KP</th>
<th>MCPY/AGI/ Pipeline</th>
<th>Ward or District Potentially Impacted</th>
<th>Land Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ16</td>
<td>Extension water supply project from Lake Victoria to Tabora, Nzega and Igunga</td>
<td>730–819.5</td>
<td>Pipeline (TZ 16 runs parallel to the pipeline between KP750 and 820 and crosses it at KP740) MCPY10 (approximately 2 km from TZ16), Pipeline runs parallel to EACOP and crosses the pipeline PS5 (approximately 5 km from TZ16)</td>
<td>Nzegandogo, Ijanija and Miguwa wards, Nzega district, Ziba, Nyandekwa, Nanga, Bukoko, and Igunga wards, Igunga district</td>
<td>10-m RoW Approximately 204 ha will be disturbed during construction</td>
</tr>
<tr>
<td>TZ27</td>
<td>Road upgrade Handeni to Singida</td>
<td>1061 and 1080</td>
<td>Pipeline (TZ27 runs parallel to pipeline and crosses it at KP1060 and 1080), PRS1 (approximately 10 km from TZ27), MCPY13 (approximately 12 km from TZ27) and crosses the pipeline, MCPY14 (approximately 15 km from TZ27)</td>
<td>Kingale ward, Kondoa district, Paranga, Dalai, Goima, Songoro, Chandama and Mrijo ward, Chemba district, Olborot, Njoro, Partimbo and Loolera wards, Kiteto district, Kibirashi and Kisangasa wards, Kilindi district</td>
<td>No data available but it has been assumed that the road will not be widened</td>
</tr>
<tr>
<td>TZ28</td>
<td>Mpirani waste facility</td>
<td>1437.5</td>
<td>MST (approximately 5 km from TZ28)</td>
<td>Chongoleani ward, Tanga district</td>
<td>Up to 1.14 ha may be affected</td>
</tr>
</tbody>
</table>
Table 8.15-4  Cumulative Impacts: Land and Property

<table>
<thead>
<tr>
<th>ID</th>
<th>Project</th>
<th>Nearest KP</th>
<th>MCPY/AGI/ Pipeline</th>
<th>Ward or District Potentially Impacted</th>
<th>Land Requirements</th>
</tr>
</thead>
</table>
| TZ34 | Mining concessions | Feature along the pipeline route including:  
• Kasharunga, Karambi and Burungura wards in Muleba district  
• Nyamigogo ward in Biharamulo district  
• Bukome, Makurugusi, Butengorumasa, Iparamasa and Bwanga wards in Chato district  
• Kaseme ward in Geita district  
• Lulembela, Ikunguigazi, Nyakafu, Bukandwe and Ng’homolwa wards in Mbogwe district  
• Lyambamongo and Bukombe wards in Bukombe district  
• Ngogwa, Isagehe, Mondo, Mwendakulima, Zongomera and Busoka wards in Kahama Township Authority  
• Mbogwe, Miguwa, Nzegandogo, Mwango, Mwamala, Igusule and Kasela wards in Nzega district  
• Igunga, Bukoko, Nyandekwa, Nanga, Itunduru and Ziba wards in Igunga district  
• Mtoa, Mgongo, Kinampanda, Ulemo and Kyengege wards inlrama district  
• Iguguno ward in Makalama district  
• Serya and Suruke wards in Kondoa district  
• Mrijo and Chandama wards in Chemba district  
• Ndido, Loolera, Njoro and Olboroti wards in Kiteto district  
• Mkindi, Kisangasa and Kibirashi wards in Kilindi district  
• Malezi and Mabanda wards in Handeni Township Authority  
• Sindeni, Misima and Kwamutuku wards in Handeni district  
• Mnyuzi ward in Korogwe district  
• Ngomeni and Mlingano wards in Muheza district  
• Pongwe, Mzizima, Mabokweni, Kiomoni wards in Tanga district |Permanent Land Loss
Permanent loss of land due to several sequential land acquisition processes from the project and third-party developments may cause double resettlement, where a household is required to relocate by one project and then again because of another project.
Implementation of the RAP for the EACOP project will consider cumulative effects of projects that have preceded or run concurrently with EACOP. With the mitigation measure implemented, the preferred condition will be achieved and the residual cumulative impact is considered not significant.

**Land Speculation**

The EACOP project and the third-party developments shown in Table 8.15-4 may jointly lead to a rise in third-party investors purchasing land with the intention to subsequently secure a financial return on selling land to project developers. As the exact boundaries of land required for the developments are not necessarily known to investors and local communities, land speculation may affect entire wards.

Land speculation may lead to inflated land prices and a shift in land tenure patterns, which may reduce access to land for poorer community members.

To support the management of potential cumulative impacts relating to speculation, the project will engage with relevant stakeholders (authorities and civil society) to identify patterns of population in-migration, associated consequences and identify appropriate mitigation measures and interventions.

With the additional mitigation measure implemented, the preferred condition will be achieved, and the residual cumulative impact is considered not significant.

**Exacerbation of Pre-Existing Disputes and Conflict**

Consultation for the EACOP project identified a history of disputes over land in the MST area (see Section A11.4.8 in Appendix A11). The land acquisition and construction activities for the EACOP project and the Mpirani waste facility, and the potential for PIIM of economic migrants to the area because of both developments increases the potential for aggravation of pre-existing disputes and conflict over land.

Assuming the construction of the waste facility and the EACOP project occur concurrently, to manage the cumulative impact, the project will work with the Mpirani waste facility, the local government and communities on the Chongoleani Peninsula to understand the dispute and conflict context and to co-ordinate management approaches and develop joint mitigation measures.

In addition to the potential cumulative impacts of the EACOP project and the Mpirana waste facility, existing land disputes may be aggravated, and new disputes arise in wards within the shared AOI of the EACOP project and third-party developments because of their cumulative land requirements. The wards potentially affected are presented in Table 8.15-4. Available data were insufficient at the time of writing to provide a more detailed analysis of the PACs potentially affected.

The project will engage proponents of the third-party developments and government agencies to consider options for management measures to address significant cumulative impacts. This may include liaising with the third-party projects on their land requirements and collaborating on stakeholder engagement.

With the additional mitigation measure implemented, it is predicted that the preferred condition will be achieved and hence the cumulative residual impact is not considered significant.
Loss of Access to Informal Support Networks and Social Services After Physical Displacement due to Project Land Acquisition

Cumulative impacts on a PAC’s land may cause a shortage of land for resettlement in the same PAC, thereby affecting resettled households in terms of their access to support networks and social services. This may apply to the following PAC:

• Bulyang’ombe, because of cumulative impacts of Lake Victoria to Kahama, Shinyanga and Tabora water pipeline and MCPY 10.

Insufficient data were available on mining activities at the time of writing to assess potential cumulatively impact on any particular PACs.

The project will engage proponents of the third-party developments and appropriate government agencies to consider options for management measures to address significant cumulative impacts. The project will liaise with the third-party developments to assess cumulative resettlement risks.

With the additional mitigation measure implemented, it is predicted that the preferred condition will be achieved and hence the cumulative residual impact is not considered significant.

8.16 Workers’ Health, Safety and Welfare

This section describes the potential impacts on workers’ health, safety and welfare during construction, commissioning and operation of the EACOP project and associated mitigation measures to be adopted.

There is the potential for traffic to impact workers’ health, safety and welfare through project-related road traffic accidents, which are considered in Section 9, Unplanned Events.

8.16.1 Key Sensitivities and Considerations

The workers’ health, safety and welfare baseline conditions are described in Section 6.4.3.11, as well as:

• workers’ health, safety and welfare key VECs and their sensitivity ranking based on the relevant tables in Appendix D
• key considerations for the workers’ health, safety and welfare impact assessment.

Sensitivity in the workers’ health, safety and welfare AOI is ranked as very high for the local workforce owing to low levels of occupational health and safety awareness.

Key considerations are:

• unscrupulous recruitment agencies exist in Tanzania and potential workers may be asked to pay fees to ‘register’ their interest in being part of a workforce
• a low level of awareness of health and safety and worker rights in the PACs
• low levels of understanding of a nondiscriminatory work culture such as with a mixed gender workforce in the PACs
• human rights of workers with regards to health and safety.
Section A11.4.9 in Appendix A11 identifies that workers’ health, safety and welfare does not provide ecosystem services.

The main human right that is relevant to this VEC is the right to safe and healthy working conditions. International standards for responsible business require that minimum labour standards are respected by companies and that they use their leverage to ensure that contractors and suppliers also respect labour rights. Another human right applicable to this VEC is the worker’s right to security (see Section 4).

8.16.2 Potential Project Impacts

8.16.2.1 Construction

Generic Benefits

Employment

Many companies in Tanzania have no previous exposure to basic health and safety standards. It is estimated that less than 5% of the working population has access to Occupational Health and Safety (OHS) services (ILO 2017, Internet site). Workers active in informal economic sectors typically receive no OHS training and hazards are not identified by their employers. Baseline data revealed a low level of awareness of health and safety and workers’ rights in the PACs.

Benefit: An improvement in the health and safety of people employed from disease awareness and reduction programmes.

The project will employ PAC members. As part of the project health and safety plan, the local workforce will be trained in safety principles and be subject to disease awareness and reduction programmes implemented during project employment. Increased knowledge about health and safety on a personal level may lead to a more comprehensive understanding of diseases and improve health-seeking behaviour (HSB), all of which may lead to an improvement in general health.

The improvement in general HSB and disease knowledge may extend to the employees’ immediate family, increasing general health status among additional PAC members.

The impacts are considered beneficial.

There may be a positive impact on the human right to life, the right to health and the right to safe and healthy working conditions.

Generic Impacts

Employment

Impact: Risk of wildlife interaction/animal bites and contracting zoonotic diseases.

This may lead to direct and indirect impacts.

Zoonotic diseases are prevalent in most of the districts traversed by the AOI. Transmission of certain zoonotic diseases (e.g., rabies) depends on close contact.
interaction between animal hosts while others (e.g., leptospirosis) can be transmitted through other mediums, such as water.

Activities related to construction, such as bush clearing, may cause an increase of animal encounters by the project workforce, including workers from PACs. This may lead to a potential increase in disease transmission, bites (including snake bites) and an increase in morbidity and mortality among members of the local workforce. Workers charged with clearing vegetation will be most vulnerable.

The impacts will be medium-term and will affect some individuals within the PACs. Owing to their localised extent, before mitigation the impacts are considered not significant.

Impact: Other occupational health and safety incidents causing diseases, injuries and mortality

This may lead to direct and indirect impacts.

As stated above, baseline findings show that occupational health services across the project area are limited in number and scope. Existing laws and regulations do not reach the entire population and therefore may not offer sufficient protection to workers. Workers who are involved in the project as part of the supply chain may lack access to occupational health and safety protection.

Unskilled workers, especially those from PACs, are unlikely to have had exposure to work conditions and safety standards associated with a project of this nature and magnitude. Although it is anticipated that local unskilled workers will not be utilised in high-risk activities, the risk of involvement in occupational incidents, causing injury and mortality, remains.

It is expected that the local unskilled workforce will be working in environments where moving objects will be commonly encountered, including supply vehicles and diggers transporting heavy equipment. Therefore, incidents associated with moving objects pose a major risk. The potential impacts may result in injury, permanent incapacity and even mortality in certain instances for those involved. This will in turn have an impact on families, who may lose a breadwinner.

Risks to workers’ health and safety may also arise where unidentified contaminated soil is encountered during construction (see Section 8.5). In addition, the border of Tanzania and Uganda has been identified as a potential UXO area (see Section 2 and Section 8.5.2.1), which could pose a risk to workers’ health and safety during construction.

There may be an impact on the human right to life, the right to health and the right to safe and healthy working conditions.

The impacts will be very long-term and will affect some households within the PACs. Owing to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.
Location-Specific Impacts

Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147), Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)

The potential generic impacts are applicable to the 38 PACs near the 12 MCPYs and one CF. The following location-specific impacts are also applicable to these PACs:

Employment

Impact: Increased risk of vector-related diseases among the local workforce

This may lead to direct impacts.

Malaria and other vector-related diseases, such as dengue fever, are prevalent throughout the districts traversed by the AOI. An increase in vector-related diseases may be experienced in the MCPYs and in the workforce due to:

- changes in the environment in and around camps that may create vector breeding areas and, as a result, increase the density of disease transmitting vectors
- movement of people in and out of camps who may increase the risk for the transmission of disease as they may harbour parasites
- proximity of the MCPYs to PACs or make-shift settlements (caused by PIIM) that support an increased transmission of disease in the workforce due to a high burden of disease in the community.

Both expatriate and local workers (who reside in the PACs) may be exposed to this increased localised risk, with a potential increase in morbidity and mortality. Malaria is the biggest risk and workforce members with limited naturally acquired immunity from malaria will be more vulnerable.

The impacts will be long-term and will affect some households within the PACs. Owing to their localised extent, before mitigation the impacts are considered not significant.

Pumping Station 3 (Muleba District, KP405) and Pumping Station 5 (Igunga District, KP825)

The potential generic impacts are also applicable to the four PACs near the staffed pumping stations (PS3 and PS5).

Pressure Reduction Station 1 (Kiteto District, KP1172) and Pressure Reduction Station 2 (Handeni District, KP1330)

The potential generic impacts are also applicable to the three PACs near the two pressure reduction stations.
Marine Storage Terminal and Load-Out Facility (Tanga District)
The potential generic impacts are also applicable to the three PACs near the MST and LOF.

8.16.2.2 Operation

Generic Benefits
The following potential generic benefit, described during construction, is also applicable during pipeline, AGI, MST and LOF operation:

Employment
Benefit: An improvement in the health and safety of people employed from disease awareness and reduction programmes
The impacts are considered beneficial.

Generic Impacts
The following potential generic impact, described during construction, is also applicable during pipeline, AGI, MST and LOF operation:

Employment
Impact: Other occupational health and safety incidents causing diseases, injuries and mortality
This may lead to direct and indirect impacts.

The impacts will be very long-term and will affect some households within the PACs. Owing to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Personnel during operations will be employed in accordance with national and project requirements. In addition, a set of management measures will apply (described in Section 8.16.3).

Location-Specific Impacts

Pumping Station 3 (Muleba District, KP395), Pumping Station 5 (Igunga District, KP826), MST and LOF (Tanga District)
The following specific impact is applicable to the seven PACs near PS3, PS5, the MST and LOF:

Employment
Impact: Increased risk of developing noncommunicable diseases in local workers
This may lead to direct and indirect impacts.

Baseline findings show that, in general, noncommunicable diseases (NCD) are an emerging health burden in the project area. Cardiovascular disease is the most common NCD, with hypertension noted as the leading risk factor. All districts traversed by the AOI recorded hundreds of cases of hypertension and cardiovascular disease annually. Diabetes also occurs in the project area, but generally at low rates.
The enhanced standard of living for the local long-term workforce is likely to increase life expectancy and promote the adoption of a more sedentary, Western lifestyle and diet, which may pre-dispose individuals to an increase in lifestyle related diseases such as obesity, hypertension, diabetes, dental caries and some forms of cancer. Development of an NCD may indirectly impact the household if the employee loses his or her job due to ill health.

The impacts will be long-term and will affect some households within the PACs. Due to their localised extent, before mitigation the impacts are considered not significant.

8.16.3 Enhancement and Mitigation Measures

This section describes the enhancement and impact avoidance and mitigation measures that will be applied to the aspects and activities that could affect workers’ health, safety and welfare.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management plan and other measures that are included in Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.

8.16.3.1 Design

**Generic Mitigation Measures**

As described in Section 3, Alternatives, route identification for the pipeline has considered social aspects relating to workers’ health, safety and welfare such as population density, security, and social and community infrastructure. The selected pipeline route was chosen partly because it had the lowest number of social constraints of the routing options available.

**Location-Specific Mitigation Measures**

There are no location-specific mitigation measures relating to the design of the construction facilities, AGIs, MST and LOF.

8.16.3.2 Construction

**Generic Enhancement Measures**

**Employment**

Benefit: An improvement in the health and safety of people employed from disease awareness and reduction programmes

The occupational health, safety and security plan will include measures that contribute to the wellbeing of the workforce.

A risk-based worksite and construction camp training programme will be developed for the workforce, vendor representatives and site visitors.
Generic Mitigation Measures

Employment

Impact: Risk of wildlife interaction/animal bites and contracting zoonotic diseases

The occupational health, safety and security plan will include measures that contribute to management of worker-animal interactions.

The risk to worker health posed by wildlife at each camp and yard will be assessed and procedures will be developed to maintain the condition of each camp and to ensure camp facilities are kept clean and hygienic. A pest control plan will be developed, and pets will be prohibited in MCPYs.

Welded pipe sections will be capped to prevent fauna entering, morning trench inspection will be conducted, and fauna ladders will be placed in open excavations.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the duration of impact from medium-term to short-term. The residual impact is not significant.

Impact: Other occupational health and safety incidents causing diseases, injuries and mortality

The occupational health, safety and security plan, labour management plan and community health, safety and security plan will include measures that will contribute to the management of this impact.

A job-specific risk assessment process will be developed to identify specific risks associated with project activities and the appropriate associated mitigation measures; pre-deployment screenings will be implemented, there will be requirements for use of personal protective equipment, a medical emergency response plan will be developed and implemented, and a first aid needs assessment will be undertaken.

Mitigation of risks form worker fatigue will be addressed in the occupational health, safety and security plan and the transport and road safety management plan. A risk-based worksite and construction camp training programme will be developed and administered to the workforce, vendor representatives and site visitors.

Application of these mitigation measures will reduce the magnitude of impact from large to medium and the duration of impact from long-term to short-term. The residual impact is not significant.
Location-Specific Mitigation Measures

Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147), Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)

The generic mitigation measures are also applicable to the 38 PACs near the 12 MCPYs and one CF. The additional location-specific mitigation measures for workers are:

Employment

Impact: Increased risk of vector-related diseases among the local workforce

The occupational health, safety and security plan will include measures to manage worker vector-related diseases.

Measures include development and implementation of a camp malaria and other vector control management plan and provision of workers with personal protection from prevalent diseases, for example insecticide treated bed nets at camps.

Vector management on all project sites (camps and construction) will aligns with national vector control programmes and strategies.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the duration of impact from long-term to short-term. The residual impact is not significant.

Pumping Station 3 (Muleba District, KP405) and Pumping Station 5 (Igunga District, KP825)

The generic mitigation measures are also applicable to the four PACs near the staffed pumping stations (PS3 and PS5).

Pressure Reduction Station 1 (Kiteto District, KP1172) and Pressure Reduction Station 2 (Handeni District, KP1330)

The generic mitigation measures are also applicable to the three PACs near the two pressure reduction stations.

Marine Storage Terminal and Load-Out Facility (Tanga District)

The generic mitigation measures are also applicable to the three PACs near the MST and LOF.
8.16.3.3 Operation

**Generic Enhancement Measures**

The following generic enhancement measure, described for construction, is also applicable during pipeline, AGI, MST and LOF operation:

Employment

Benefit: An improvement in the health and safety of people employed

The occupational health and safety plan will include measures that contribute to the wellbeing of the workforce.

A risk-based worksite and MCPY training programme will be developed for the workforce, vendor representatives and site visitors.

**Generic Mitigation Measures**

The following generic mitigation measures, described for construction, are also applicable during pipeline, AGI, MST and LOF operation:

Employment

Impact: Other occupational health and safety incidents causing diseases, injuries and mortality

The occupational health, safety and security plan and the transport and road safety management plan will include measures that will contribute to the management of this impact.

Mitigation of risks from worker fatigue will be addressed in the occupational health, safety and security plan and the transport and road safety management plan. A risk-based worksite and an operational training programme will be developed and administered to the workforce, vendor representatives and site visitors.

Application of these mitigation measures will reduce the magnitude of impact from large to medium and the duration of impact from very long-term to short-term. The residual impact is not significant.

With respect to Human Rights:

The labour management plan and the occupational health, safety and security plan will ensure that project performance regarding the Voluntary Principles on Security and Human Rights (VPSHR) will be reviewed and performance improvement addressed where necessary.

**Location-Specific Mitigation Measures**

**Pumping Station 3 (Muleba District, KP395), Pumping Station 5 (Igunga District, KP826), MST and LOF (Tanga District)**

The following specific mitigation measures are recommended for the seven PACs near PS3, PS5, the MST and LOF:
Employment
Impact: Increased risk of developing noncommunicable diseases in local workers
The occupational health, safety and security plan will include measures that will contribute to the management of this impact.
Basic workplace wellness programmes that are culturally and religiously acceptable will be developed and implemented and backed up by a worker health monitoring system.
As part of camp management standards, project facility canteen menus acceptable to all workers will be developed in consultation with a dietician to ensure adequate nutrition, cultural acceptability, portion size and diversity.
Application of these mitigation measures will reduce the magnitude of impact from large to small and the duration of impact from long-term to short-term. The residual impact is not significant.

8.16.4 Residual Impacts and Significance Summary
This section summarises the residual impacts on workers’ health, safety and welfare after mitigation measures have been implemented.
Table 8.16-1 summarises the potential generic workers’ health, safety and welfare impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation.
Table 8.16-2 summarises the location-specific impacts.
After mitigation has been implemented, the potential residual impacts on workers’ health, safety and welfare are considered not significant.

8.16.4.1 Ecosystem Services
Section A11.4.9.4 in Appendix A11 identifies that workers’ health, safety and welfare does not provide ecosystem services.
### Table 8.16-1  Workers’ Health, Safety and Welfare – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment</td>
<td>An improvement in the health and safety of people employed from disease awareness and reduction programmes</td>
<td>C &amp; O</td>
<td>-</td>
<td>Occupational health, safety and security plan</td>
<td>B</td>
</tr>
<tr>
<td>Employment</td>
<td>Risk of wildlife interaction/animal bites and contracting zoonotic diseases</td>
<td>C</td>
<td>-</td>
<td>Occupational health, safety and security plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td></td>
<td>Other occupational health and safety incidents causing diseases, injuries and mortality</td>
<td>C &amp; O</td>
<td>-</td>
<td>Community health, safety and security plan Occupational health, safety and security plan Labour management plan Transport and road safety management plan</td>
<td>6 2 1 5 14</td>
</tr>
</tbody>
</table>

### Table 8.16-2  Workers’ Health, Safety and Welfare – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACs near the 12 MCPYs and one CF</td>
<td>Employment</td>
<td>Increased risk of vector-related diseases among the local workforce</td>
<td>C</td>
<td>-</td>
<td>Occupational health, safety and security plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>PACs near PS3, PS5, MST and LOF</td>
<td>Employment</td>
<td>Increased risk of developing noncommunicable diseases in local workers</td>
<td>O</td>
<td>-</td>
<td>Occupational health, safety and security plan</td>
<td>4 2 1 3 10</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.

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8.16.5 Transboundary Project Impacts
No transboundary project impacts have been identified.

8.16.6 Cumulative Impacts
No cumulative impacts have been identified in relation to workers’ health, safety and welfare.

8.17 Social Infrastructure and Services
This section describes potential impacts on social infrastructure and services during construction, commissioning and operation of the EACOP project and associated mitigation measures to be adopted.

Impacts associated with road traffic accidents are described in Section 9, Unplanned Events.

8.17.1 Key Sensitivities and Considerations
The social infrastructure and services baseline conditions are described in Section 6.4.3.12 and the traffic baseline conditions are described in Section 6.4.3.15, as well as:

- social infrastructure and services key VECs and their sensitivity ranking based on the relevant tables in Appendix D
- key considerations for the social infrastructure and services impact assessment.

Sensitivity in the social infrastructure and services AOI is ranked as moderate for:

- PACs in relation to electricity; most PACs do not have access to grid electricity and rely on other means for cooking and lighting (e.g., firewood, fuel lamps)
- households without mobile phones and internet: these households may become increasingly vulnerable as media is increasingly shared through those platforms

Sensitivity is ranked as low for:

- PACs in relation to media (radio, television, newspapers); all households in the PACs have access to one or more media information source.

Sensitivity in the traffic AOI ranges from medium to very high, depending on the road type, condition and current levels of congestion.

Key considerations are:

- PACs rely on radio as the main means of receiving information
- mobile phone and internet is becoming increasingly important to exchange information
- rural electrification is still low, limiting general development
- in many parts of the AOI, the road network condition will be improved by upgrades made by the government as part of its ongoing improvements or by the project for construction purposes
• traffic levels are low, so congestion is rare, except at the border with Uganda and in Dar es Salaam.

Access to water, health and waste management facilities are described in Section 8.18.

Section A11.4.10 in Appendix A11 identifies ecosystem services associated with social infrastructure and services in the AOI. The following ecosystem services have been considered:

Provisioning services:

• electricity from hydro, fossil fuels and solar energy
• cooking fuel from biomass and firewood (see Section A11.4.6.4, baseline Condition of Natural Resources Use).

The key human rights relevant to social infrastructure and services relate to the right to health, right to an adequate standard of living, right to education and right to water. International standards for responsible business also require that negative impacts of projects on communities should be avoided or at least minimised (see Section 4).

8.17.2 Potential Project Impacts

8.17.2.1 Construction

Generic Benefits

Use of Road Network

Benefit: Road widening and improvement

Many parts of the road network are in poor condition and will need to be upgraded to accommodate increased volumes of traffic generated by the project. In these instances, the roads will be widened and resurfaced or repurposed to accommodate two-way traffic and ensure that the surface is even, which could otherwise lead to vehicle and motorbike damage and risk of accidents.

One of the criteria for the selection of construction facilities’ locations was to maximise the use of existing roads that could be upgraded. Approximately 37 km of existing roads will be upgraded and 23 km of new access roads will be constructed. These access roads will have an unsealed surface and will be maintained regularly by the project during construction. Once their construction is completed, these enhancements will improve road conditions for road users.

The potential benefits of road widening and improvement include enabling goods to be transported to market more quickly and reduced travel times for people commuting to major towns and cities for work. It will also improve access to healthcare and may improve health-seeking behaviour among PAC members, decrease diagnosis and treatment times, simplify distribution of supplies to peripheral health facilities and assist in the provision of health-related outreach activities by district health authorities. Emergency response times may also be reduced. Where new access roads are constructed, communities nearby, who previously did not have good access to the national road network, may benefit.
In addition, the risk of accidents is likely to reduce as roads are improved, and the incidence of potholes is reduced. However, the improved surface may lead to higher speeds and partially offset the reduction in accident risk.

The impacts are considered beneficial. Disruption to traffic flows is covered below.

**Use of Rail Network**

The Tanzanian Railway Limited (TRL) operates the government-owned railway system, which is used for the transportation of freight and passengers across a railroad network, predominantly as a single track and nonstandard gauge across the country. However, the age of the network has led to speed restrictions, typically around 25–30 km/h, for safety reasons. The Government of Tanzania is in the process of investing in new rail infrastructure and rehabilitation to contribute toward making the country a regional transport hub by 2021. Construction of the first phase of the Dar es Salaam–Mwanza–Kigoma Standard Gauge Railway began in April 2016 as a first step in the rehabilitation process.

To reduce road transportation requirements, the railroad may be used by the project to transport pipe on an existing railroad from the port of Dar es Salaam to Isaka (KP700), where an inland container terminal is located. From there to pipe will be transported by truck to the CF. The railroad could enable project freight to be transported to Isaka before being transferred to road, and transport to the coating facility at Sojo village, Igusule ward, Nzega district, Tabora region, thereby avoiding Dar es Salaam’s congested road network.

The port of Dar es Salaam currently has non-operational rail infrastructure. TRL will implement rehabilitation and maintenance for the required railroad sections to meet project logistics requirements.

**Benefit: Railroad improvements between Dar es Salaam and Isaka**

This may lead to direct and indirect impacts.

Currently functional but requiring maintenance, the existing railroad between the port of Dar es Salaam and Isaka may be rehabilitated to meet project requirements and maintained by TRL.

The potential impacts of railroad improvements, including the rehabilitation of port railroad infrastructure and maintenance of the existing railroad to Isaka, will connect the port facilities to Isaka, enable goods to be transported reliably and potentially reduce the travel time and the possibility of delays. It will also contribute to the wider rehabilitation of railroads within the country to meet the 2021 goal set by the Government of Tanzania. With an improved railroad system, trade between Tanzania and other members of the East African Community (EAC) could potentially grow.

The impacts are considered beneficial.
**Generic Impacts**

**Damage to Third-Party Infrastructure (Pipelines, Cables and Community Infrastructure)**

The level of electrification in the PACs is low. The large majority of households rely on fuel lamps and for light and firewood for cooking. Access to electricity for businesses and services in more urbanised PACs is slightly higher, however usage remains limited.

Mobile phones play an increasingly important role in PACs, enabling PAC members to communicate with one another and share information (including market information relating to produce pricing), access the internet and utilise mobile money services. Most PAC members rely on radios to access news and information concerning the local area.

**Impact:** Temporary disruption of power supply due to planned outage or accidental damage to cables or other pipelines during pipeline construction

This may lead to direct and indirect impacts.

**Use of Road Network**

During the construction period, traffic impacts may arise from vehicle movements, specifically:

- movement of pipe sections and other imported construction materials from a particular location, which usually follow defined routes for much of the journey
- national, regional or local movements of nationally sourced materials, often from several different locations and not following defined routes
- movement of workers from MCPYs to worksites.

Parts of the existing road network are currently in poor condition and not capable of accommodating increased traffic volumes. Poor road conditions increase travel time and costs considerably, particularly during the rainy season (described in Section 8.12). Potholes create a hazard for motorists, motorbikes (used as taxis) and bicycles. Local roads typically are murram and are mostly single lane. The poor quality of roads constitutes a substantial challenge for PACs.
New permanent and temporary access roads will need to be constructed to accommodate project traffic movements as some activities will take place on sites remote from the existing road network.

The development of construction facilities and access roads will require specialist materials and labour, which will be imported, and nonspecialist materials and labour, which will be sourced locally, regionally or nationally. Access road upgrades and construction of new access roads will lead to traffic-related impacts from importing aggregates, plant and other materials and the movement of labour.

The MCPYs will be developed sequentially for each pipeline spread as the works move from the eastern end and progresses westwards. Therefore, it is likely that only one MCPY will be under construction at any time in each spread. Nonlocal workers are expected to live within temporary camps within the MCPY site during their construction and therefore the impacts of their movements to and from site are expected to be minimal. Locally sourced workers from the surrounding villages that live outside the camp will travel to work by shuttle bus service.

The only site expected to require specialist materials is the coating facility, which will require containers to be transported to the facility from the port at Dar es Salaam. It is expected that 40% of these specialist materials will travel by train to the railhead at Isaka and 60% will be transported by road.

Table 8.17-1 summarises the heavy-goods-vehicle (HGV) movements required to transport construction materials to each location before construction starts.

### Table 8.17-1  Heavy Goods Vehicle Movements Required to Transport Construction Materials to Each Location

<table>
<thead>
<tr>
<th>Facility</th>
<th>Purpose of Material Movements to the Facility</th>
<th>Average Daily No. of HGVs (Two Way)</th>
<th>Duration of Impact (Months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCPY5</td>
<td>Camp construction plus upgraded access road</td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>PS3</td>
<td>New and upgraded access road</td>
<td>60</td>
<td>5</td>
</tr>
<tr>
<td>MCPY6</td>
<td>Camp construction plus new access road</td>
<td>30</td>
<td>3</td>
</tr>
<tr>
<td>MCPY7</td>
<td>Camp construction</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>MCPY8</td>
<td>Camp construction plus upgraded access road</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td>PS4</td>
<td>New and upgraded access road</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>CF</td>
<td>Camp construction, new access road plus container haulage from Dar es Salaam Port</td>
<td>63</td>
<td>4</td>
</tr>
<tr>
<td>MCPY9</td>
<td>Camp construction</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>MCPY10</td>
<td>Camp construction plus new access road</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td>PS5</td>
<td>New and upgraded access road</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>MCPY11</td>
<td>Camp construction</td>
<td>20</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 8.17-1  Heavy Goods Vehicle Movements Required to Transport Construction Materials to Each Location

<table>
<thead>
<tr>
<th>Facility</th>
<th>Purpose of Material Movements to the Facility</th>
<th>Average Daily No. of HGVs (Two Way)</th>
<th>Duration of Impact (Months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS6</td>
<td>New and upgraded access road</td>
<td>60</td>
<td>5</td>
</tr>
<tr>
<td>MCPY12</td>
<td>Camp construction plus upgraded access road</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td>MCPY13</td>
<td>Camp construction plus upgraded access road</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td>PRS1</td>
<td>New access road</td>
<td>60</td>
<td>2</td>
</tr>
<tr>
<td>MCPY14</td>
<td>Camp construction plus upgraded access road</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td>MCPY15</td>
<td>Camp construction</td>
<td>20</td>
<td>3</td>
</tr>
<tr>
<td>PRS2</td>
<td>New and upgraded access road</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>MCPY16</td>
<td>Camp construction plus upgraded access road</td>
<td>30</td>
<td>3</td>
</tr>
<tr>
<td>MST/LOF</td>
<td>Camp construction plus new and upgraded access road</td>
<td>80</td>
<td>9</td>
</tr>
</tbody>
</table>

The construction of the pipeline will require a major movement of pipe to the RoW from the nearest MCPY, along with a smaller number of movements for other materials. Each MCPY will accommodate up to 1000 workers at any one time. Daily transport will typically consist of 200 local workers travelling to the MCPY and up to 300 pipeline workers travelling between the MCPY and the worksites. Pipeline construction will start from the eastern end and progress westwards. For the purposes of the impact assessment, the worst-case assumption of all four spreads being constructed concurrently has been adopted. However, it is expected that only one MCPY will typically be in use at any one time in each spread.

The operation of MCPYs will require regular locally sourced deliveries to service the camps, including food and fuel for plant, and services like the removal of waste.

AGI construction will be transient and therefore traffic volumes at some VECs may only be present for a few months as construction progresses in a linear fashion. However, the impacts may be felt for longer where construction traffic uses national roads to reach more than one MCPY, and on the access roads around the camps.

A summary of the transportation requirements for each location during pipeline construction is provided in Table 8.17-2 and illustrated in Figure 8.17-1.
<table>
<thead>
<tr>
<th>Facility</th>
<th>Purpose of Transport</th>
<th>Daily No. of Cars/Motorcycles (Two Way)</th>
<th>Daily No. of Buses (30-Seater) (Two Way)</th>
<th>Daily No. of HGVs (Two Way)</th>
<th>Daily No. of Total Vehicles (Two Way)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCPY5</td>
<td>Pipe delivery, daily commuting and pipeline workers</td>
<td>72</td>
<td>28</td>
<td>60</td>
<td>160</td>
</tr>
<tr>
<td>PS3</td>
<td>Specialist materials, daily commuting</td>
<td>0</td>
<td>14</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>MCPY6</td>
<td>Pipe delivery, daily commuting and pipeline workers</td>
<td>72</td>
<td>42</td>
<td>32</td>
<td>146</td>
</tr>
<tr>
<td>MCPY7</td>
<td>Pipe delivery, daily commuting and pipeline workers</td>
<td>72</td>
<td>28</td>
<td>30</td>
<td>130</td>
</tr>
<tr>
<td>MCPY8</td>
<td>Pipe delivery, daily commuting and pipeline workers</td>
<td>72</td>
<td>28</td>
<td>30</td>
<td>130</td>
</tr>
<tr>
<td>PS4</td>
<td>Specialist materials, daily commuting</td>
<td>0</td>
<td>14</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>CF</td>
<td>Pipe delivery to MCPY</td>
<td>0</td>
<td>0</td>
<td>122</td>
<td>122</td>
</tr>
<tr>
<td>MCPY9</td>
<td>Pipe delivery, daily commuting and pipeline workers</td>
<td>72</td>
<td>42</td>
<td>46</td>
<td>160</td>
</tr>
<tr>
<td>MCPY10</td>
<td>Pipe delivery, daily commuting and pipeline workers</td>
<td>72</td>
<td>42</td>
<td>46</td>
<td>160</td>
</tr>
<tr>
<td>PS5</td>
<td>Specialist materials, daily commuting</td>
<td>0</td>
<td>14</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>MCPY11</td>
<td>Pipe delivery, daily commuting and pipeline workers</td>
<td>72</td>
<td>42</td>
<td>46</td>
<td>160</td>
</tr>
<tr>
<td>PS6</td>
<td>Specialist materials, daily commuting</td>
<td>0</td>
<td>14</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>MCPY12</td>
<td>Pipe delivery, daily commuting and pipeline workers</td>
<td>72</td>
<td>28</td>
<td>30</td>
<td>130</td>
</tr>
<tr>
<td>MCPY13</td>
<td>Pipe delivery, daily commuting and pipeline workers</td>
<td>72</td>
<td>34</td>
<td>46</td>
<td>152</td>
</tr>
<tr>
<td>PRS1</td>
<td>Specialist materials, daily commuting</td>
<td>0</td>
<td>6</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>MCPY14</td>
<td>Pipe delivery, daily commuting and pipeline workers</td>
<td>72</td>
<td>28</td>
<td>44</td>
<td>144</td>
</tr>
</tbody>
</table>
Table 8.17-2 Predicted Traffic Increases

<table>
<thead>
<tr>
<th>Facility</th>
<th>Purpose of Transport</th>
<th>Daily No. of Cars/Motorcycles (Two Way)</th>
<th>Daily No. of Buses (30-Seater) (Two Way)</th>
<th>Daily No. of HGVs (Two Way)</th>
<th>Daily No. of Total Vehicles (Two Way)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCPY15</td>
<td>Pipe delivery, daily commuting and pipeline workers</td>
<td>72</td>
<td>34</td>
<td>30</td>
<td>136</td>
</tr>
<tr>
<td>PRS2</td>
<td>Specialist materials, daily commuting</td>
<td>0</td>
<td>6</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>MCPY16</td>
<td>Pipe delivery, daily commuting and pipeline workers</td>
<td>72</td>
<td>58</td>
<td>45</td>
<td>175</td>
</tr>
<tr>
<td>MST/LOF</td>
<td>MST and LOF construction workers</td>
<td>0</td>
<td>30</td>
<td>30</td>
<td>60</td>
</tr>
</tbody>
</table>

Impact: Deterioration of road conditions

This may lead to direct and indirect impacts.

Roads typically deteriorate because of the number and weight of vehicles passing over them. Therefore, the additional traffic generated by the project, including HGVs, could lead to an increase in the rates at which road conditions deteriorate.

The potential impacts of deterioration in road conditions include an increase in the number and size of potholes and edge subsidence, particularly on unsealed roads. This could lead to increased accident rates as drivers swerve to avoid potholes, and come into conflict with other road users, or damage their vehicles when they cannot swerve.

Project traffic will make a relatively small contribution to the total volume of HGVs on the road network during the construction of the pipeline, AGIs, MST and LOF. The volume, intensity and duration of traffic is expected to be greater during pipeline, AGI, MST and LOF construction. Regardless of the level of change, the types of project traffic are likely to make pipeline, AGI, MST and LOF construction traffic noticeable at local VECs because there are generally low traffic volumes at PAC level. In particular:

- locations between the trunk roads and the work sites are expected to experience impacts, but for a short duration owing to the transient nature of the works
- trunk road locations within the AOI; these will experience project related traffic for around 18 months
- no location is predicted to experience an increase in total traffic of more than 20%
- large parts of the road network within the AOI; these parts will experience an increase of more than 100 two-way HGV movements per day; location specific traffic increases are described below.
The impacts will be short-term and will affect entire PACs. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Impact: Traffic congestion leading to delays

This may lead to direct and indirect impacts.

Sections of the road network are susceptible to traffic congestion where there are obstacles, such as buildings, stalls and people walking in the road (including children going to school), which interfere with two-way flow of traffic. This is particularly the case on the Dar es Salaam–Chalinze road, but all communities along the road network use the road primarily for walking on. Although much of the road network in the AOI is not heavily used, these constraints can lead to congestion where traffic is reduced to a single lane. Where roads are narrow and winding, slow moving vehicles, or convoys of vehicles can cause congestion problems. In these instances, driver frustration may lead to dangerous overtaking and an increased risk of accidents.

An increase in congestion and delays may increase journey time for traffic road users and pedestrians who use the road to head load goods to markets or to access farming plots of the peripheries of communities. Costs associated with delay caused by traffic congestion are described in Section 8.12. This may also have negative outcomes for PAC business owners travelling to purchase supplies (i.e., reduction in business opening times, increase in product prices) and people seeking health services. Public transport providers may also choose to increase fare prices.

The impacts will be short-term and will affect entire PACs. Owing to their short-term nature and small extent, before mitigation the impacts are considered not significant.

Impact: Disruption of traffic flows

This may lead to direct and indirect impacts.

The development of construction facilities will include upgrading the access roads connecting project locations to trunk roads. During the road upgrades and new road construction, local communities may experience disruption of traffic flows where a full or partial road closure will be required.

The pipeline will cross roads connecting local communities to major trunk roads. The construction methods at these road crossings will vary, depending on the importance of the road, the traffic volumes travelling along it and the availability of alternative routes. For roads with low traffic volumes open cut crossings may be used.

The potential impacts of traffic disruption to local users may prevent access to local markets or require use of an alternative route, which could introduce a delay to their journey causing inconvenience.

The level of traffic-flow disruption will depend on the construction method at each location. The activity will be transient during facility construction as the upgrade
works progress along the access road. However, where there are no alternative routes, a full road closure would cause a transient impact for local users.

The AOI for the social infrastructure and services will change with the construction method selected for each location. The activity will generally be transient as the construction works progress along the pipeline route. However, there may be a short-term impact for local users where there are no alternative routes, or where travel times are significantly increased.

The impacts will be transient and will affect entire PACs. Due to their transient nature and small extent, before mitigation the impacts are considered not significant.

Use of Rail Network
Impact: Temporary disruptions to freight and passenger movements on railroad

This may lead to direct and indirect impacts.

During construction, project goods movements will make a relatively small contribution to the total volume of goods already transported by the existing railroad network. Pipes to be transported from Dar es Salaam port to Isaka will take two days each way with one day for loading and one day for offloading at each end. Nevertheless, disruptions in the schedule may hold up other goods being transported on the same rail road, which is single track. Delays could potentially be protracted and costly to other railroad users.

Pipeline construction will transect the TRL network at KP700, KP1377 and KP1408. Pipeline engineering design will be such that railroad infrastructure will not be affected. Nevertheless, possible disruptions may occur, causing delays.

The impacts will be transient and will affect districts. Due to their transient nature and medium extent, before mitigation the impacts are considered not significant.

Location-Specific Impacts

Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147), Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)

The traffic associated with developing each of the construction facilities will transport materials on the national road network and access roads. This additional traffic will vary in different parts of the road network depending on the concentration of facilities and the extent of road upgrades and new access roads.

Appendix A12 describes the baseline traffic volumes and HGV content for representative locations on the national road network. The impacts of the additional project traffic shown in Table 8.17-1 and Table 8.17-2 have been quantitatively
assessed in each of these locations. The results are considered representative of the impacts on the road network surrounding each location. They are shown in Table 8.17-3 and are illustrated in Figure 8.17-1.

Table 8.17-3 Location-Specific Traffic Increases

<table>
<thead>
<tr>
<th>Location</th>
<th>Daily Baseline Traffic (All Vehicles)</th>
<th>Daily Baseline Traffic (HGVs)</th>
<th>Average Daily No. of All Project Vehicles (Two Way)</th>
<th>Average Daily No. of Project HGVs and Buses (Two Way)</th>
<th>Increase in All Vehicles (%)</th>
<th>Increase in HGVs and Buses (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bukoba</td>
<td>9,132</td>
<td>758</td>
<td>297</td>
<td>225</td>
<td>3%</td>
<td>30%</td>
</tr>
<tr>
<td>Biharamulo</td>
<td>687</td>
<td>93</td>
<td>140</td>
<td>140</td>
<td>20%</td>
<td>151%</td>
</tr>
<tr>
<td>Kahama</td>
<td>2,889</td>
<td>881</td>
<td>590</td>
<td>518</td>
<td>20%</td>
<td>59%</td>
</tr>
<tr>
<td>Singida</td>
<td>2,862</td>
<td>1076</td>
<td>366</td>
<td>294</td>
<td>13%</td>
<td>27%</td>
</tr>
<tr>
<td>Kondoa</td>
<td>862</td>
<td>169</td>
<td>152</td>
<td>80</td>
<td>18%</td>
<td>47%</td>
</tr>
<tr>
<td>Dodoma</td>
<td>5,148</td>
<td>1096</td>
<td>190</td>
<td>190</td>
<td>4%</td>
<td>17%</td>
</tr>
<tr>
<td>Handeni</td>
<td>5,991</td>
<td>319</td>
<td>179</td>
<td>107</td>
<td>3%</td>
<td>34%</td>
</tr>
<tr>
<td>Tanga</td>
<td>8,281</td>
<td>1,956</td>
<td>206</td>
<td>134</td>
<td>2%</td>
<td>7%</td>
</tr>
<tr>
<td>Tanga Port Access</td>
<td>2,334</td>
<td>696</td>
<td>15</td>
<td>15</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>Chongoleani</td>
<td>1,293</td>
<td>392</td>
<td>76</td>
<td>76</td>
<td>6%</td>
<td>19%</td>
</tr>
<tr>
<td>Dar es Salaam</td>
<td>31,625</td>
<td>6,934</td>
<td>174</td>
<td>174</td>
<td>1%</td>
<td>3%</td>
</tr>
</tbody>
</table>

The impacts for all vehicles are either a negligible increase in traffic volumes (less than 10%) or a small increase (10–20%) with only Biharamulo and Kahama exceeding 20%.

There are a range of increases in HGVs and buses as follows:

- negligible (less than 10%): Tanga, Tanga Port Access and Dar es Salaam
- small (10–30%): Bukoba, Singida, Dodoma and Chongoleani
- medium (30–100%): Kahama, Kondoa and Handeni
- large (100–200%): Biharamulo (the baseline traffic rate was very low).

The potential generic impacts are also applicable to the 38 PACs near the 12 MCPYs and one CF. However, the following generic impact may be more likely in PACs near MCPY6 and MCPY12:

Damage to Third-Party Infrastructure (Pipelines, Cables and Community Infrastructure)

Impact: Temporary disruption of power supply

A low-voltage power cable crosses the footprints of MCPY6 and MCPY12. Therefore, there may be a higher chance of temporary disruptions of power supply occurring.
The impacts will be transient and will affect entire PACs. Due to their transient nature and small extent, before mitigation the impacts are considered not significant.

The following generic impact may be more pronounced in Tanganyika (KP1405):

Use of Road Network

Impact: Traffic congestion leading to delays

This may lead to direct and indirect impacts.

Tanganyika is the nearest urban area to MCPY16, approximately 1 km away. This PAC is densely populated and growing in size due to rural–urban migration. Many local businesses are already present, acting as a service centre and attracting residents from neighbouring PACs which offer fewer goods and services. Traffic levels are higher in Tanganyika than in other PACs close to the MCPYs. Understanding the pull factors of in-migration, this PAC, as an established urban centre, is more likely to experience PIIM of opportunistic job seekers than neighbouring PACs due to proximity to the MCPY. This may exacerbate traffic volumes with increased public transport, congestion and delays even further.

The impacts will be short-term and will affect the entire PAC. Owing to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.
Figure 8.17-1  Baseline Traffic Flows (Blue) and Predicted Traffic Movements at Project Locations (Green) (Per Day)
Pumping Stations 3 (Muleba District, KP405.4), Pumping Stations 4 (Mbogwe District, KP610), Pumping Stations 5 (Igunga District, KP824.8) and Pumping Stations 6 (Singida District, KP931)

The potential generic impacts are also applicable to the eight PACs near the four pumping stations.

Pressure Reduction Station 1 (Kiteto District, KP1172) and Pressure Reduction Station 2 (Handeni District, KP1330)

The potential generic impacts are also applicable to the three PACs near the two pressure reduction stations.

Marine Storage Terminal (Tanga District)

The potential generic impacts are also applicable to the three PACs near the MST.

8.17.2.2 Operation

Generic Impacts

There are no generic impacts during pipeline, AGI, MST and LOF operation. Vehicle movements for the duration of this period will mainly be to facilitate movement of people to and from the RoW and AGIs. The operation of the pipeline, AGIs, MST and LOF will therefore introduce traffic onto the road network in the immediate vicinity, primarily for maintenance and inspection. However, the extent to which it affects the existing traffic volumes will depend on the origin of workers.

The traffic volumes from the operation of the pipeline, AGIs, MST and LOF is unlikely to materially increase the baseline given the frequency of visits to any single location and the number of workers required daily at crewed locations.

The operation of the pipeline, AGIs, MST and LOF across Tanzania is predicted to have a not significant impact on infrastructure (e.g., power lines, roads), traffic volumes and movements.

Location-Specific Impacts

There are no location-specific impacts during pipeline, AGI, MST and LOF operation.

8.17.3 Enhancement and Mitigation Measures

This section describes the enhancement and impact avoidance and mitigation measures that will be applied to the aspects and activities that could affect social infrastructure and services.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management plan and other measures that are included in Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.
8.17.3.1 Design

**Generic Mitigation Measures**

As described in Section 3, Alternatives, route identification for the pipeline has considered social aspects relating to social infrastructure and services such as minimising impacts on settlements and social and community infrastructure. The selected pipeline route was chosen partly because it had the lowest number of social constraints of the routing options available.

The project will generate its own power and is thus independent of locally supplied electricity (see Section 2). This will mitigate increased pressure on local electricity supplies due to construction activities. Project water and waste management requirements are also described in Section 2.

**Location-Specific Mitigation Measures**

There are no location specific mitigation measures relating to the design of the construction facilities, pipeline, AGIs, MST and LOF.

8.17.3.2 Construction

**Generic Mitigation Measures**

Damage to Third-Party Infrastructure (Pipelines, Cables and Community Infrastructure)

Impact: Temporary disruption of power supply due to planned outage or accidental damage to cables or other pipelines during pipeline construction

An infrastructure and utilities management plan will be developed, describing the specific mitigation measures to be implemented to ensure infrastructure and utility services are identified and protected during construction.

Potentially affected landowners, land users and communities will be consulted if there is likely to be any disruption to the existing infrastructure and utility services which will be communicated at least 72 hours before the work starts and where disruption to infrastructure and utilities will occur for more than 12 hours, a risk analysis of impacts on affected settlements will be completed. Feedback from communities will inform planning of the works, especially when determining the options for temporary alternatives.

The project will notify third-party utility services of any damage and the damage will be repaired promptly in consultation with the service operator or utility owner.

Application of these mitigation measures will reduce the magnitude of impact from small to negligible with no significant residual impact.

**Use of Road Network**

Impact: Deterioration of road conditions

The infrastructure and utilities management plan will include these measures that will contribute to the management of this impact.
An initial survey will be completed of the condition of roads to be used by the project including bridges, drainage structures, signage, traffic management and other road infrastructure. A post-construction exit survey will assess the condition of dwellings, roads used, bridges, drainage structures, signage, traffic management and other road infrastructure upon the completion of construction. Any actions, such as repairs, arising from the exit survey will be closed out on a timely basis.

Vehicle movements will be restricted to defined access routes and demarcated working areas. Where feasible, preference will be given to transport of pipe and other construction materials by rail.

Application of these mitigation measures will reduce the magnitude of impact from very large to medium with no significant residual impact.

Impact: Traffic congestion leading to delays

The transport and road safety management plan and stakeholder engagement plan will include this measure that will contribute to the management of this impact to manage congestion.

The transport and road safety management plan will address site-specific traffic risk assessments and safe driving procedures. Vehicle movements will be restricted to defined access routes and demarcated working areas. Where feasible, preference will be given to transport of pipe and other construction materials by rail.

In addition to the mitigations for the deterioration of road conditions, the following mitigation also applies to this impact:

Community liaison officers will encourage PAC leadership to provide advance warning of local events so that construction activities can be avoided at these times.

Application of these mitigation measures will reduce the magnitude of impact from large to small with no significant residual impact.

Impact: Disruption of traffic flows

The transport and road safety management plan and infrastructure and utilities management plan will restrict vehicle movements and times (unless in the event of an emergency). At major road crossings where it is necessary to maintain traffic flow, consideration will be given to trenchless crossing techniques or the crossing will be made in two stages and only half of the road width will be used at a time.

Application of these mitigation measures will reduce the sensitivity of impact from very high to low with no significant residual impact.

Mitigation for deterioration of road conditions and traffic conditions leading to delay will manage impacts from disruption to traffic flows; no additional mitigation is necessary.

Use of Rail Network

Impact: Temporary disruptions to freight and passenger movements on railroad

The infrastructure and utilities management plan will provide measures to address disruption to the rail movement.
To avoid disruption to Tanzania Railways Limited's (TRL's) existing railroad schedule, a timetable of movement of project-related goods will be agreed. In the event of unplanned disruptions to the scheduled movement of project-related goods, TRL will be consulted 72 hours in advance.

Application of the mitigation measures will reduce the magnitude of impact from small to negligible with no significant residual impact.

Location-Specific Mitigation Measures

Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147), Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)

The generic mitigation measures are applicable to the 38 PACs near the 12 MCYPs and one CF.

Pumping Station 3 (Muleba District, KP405.4), Pumping Station 4 (Mbogwe District, KP610), Pumping Station 5 (Igunga District, KP824.8) and Pumping Station 6 (Singida District, KP931)

The generic mitigation measures are applicable to the eight PACs near the four pumping stations.

Pressure Reduction Station 1 (Kiteto District, KP1172) and Pressure Reduction Station 2 (Handeni District, KP1330)

The generic mitigation measures are applicable to the three PACs near the two pressure reduction stations.

Marine Storage Terminal (Tanga District)

The generic mitigation measures are applicable to the three PACs near the MST.

8.17.3.3 Operation

Generic Mitigation Measures

As there are no predicted generic impacts for pipeline, AGI, MST and LOF operation, no mitigation measures are required.

Location-Specific Mitigation Measures

As there are no predicted location-specific impacts for pipeline, AGI, MST and LOF operation, no mitigation measures are required.
8.17.4 Residual Impacts and Significance Summary

This section summarises the residual impacts on social infrastructure and services after mitigation measures have been implemented.

Table 8.17-4 summarises the potential generic social infrastructure and services impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation. Table 8.17-5 summarises the location-specific impacts.

After mitigation has been implemented, the potential residual impacts on social infrastructure and services are considered not significant.

8.17.4.1 Ecosystem Services

Section A11.4.10.3 in Appendix A11 identifies ecosystem services associated with social infrastructure and services in the AOI. The following ecosystem services have been assessed in Section 8.17.2 and 8.17.3:

Provisioning services:

- electricity from hydro, fossil fuels and solar energy
- cooking fuel from biomass and firewood (see Section A11.4.6.4, Baseline Condition of Natural Resources Use).

With the implementation of the planned mitigation measures, the residual impact on the above services will be not significant.
Table 8.17-4  Social Infrastructure and Services – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of Road Network</td>
<td>Road widening and improvement</td>
<td>C Y</td>
<td>Y</td>
<td>Infrastructure and utilities management plan</td>
<td>B</td>
</tr>
<tr>
<td>Use of Rail Network</td>
<td>Railroad improvements between Dar es Salaam and Isaka</td>
<td>C Y</td>
<td>Y</td>
<td>Infrastructure and utilities management plan</td>
<td>B</td>
</tr>
<tr>
<td>Damage to Third-Party Infrastructure (pipelines, cables and community infrastructure)</td>
<td>Temporary disruption of power supply due to planned outage or accidental damage to cables or other pipelines during pipeline construction</td>
<td>C -</td>
<td></td>
<td>Infrastructure and utilities management plan</td>
<td>2 1 2 2 7</td>
</tr>
<tr>
<td>Use of Road Network</td>
<td>Deterioration of road conditions</td>
<td>C Y</td>
<td>Y</td>
<td>Stakeholder engagement plan</td>
<td>6 2 2 5 15</td>
</tr>
<tr>
<td>Use of Road Network</td>
<td>Traffic congestion leading to delays</td>
<td>C -</td>
<td></td>
<td>Stakeholder engagement plan</td>
<td>4 2 2 3 11</td>
</tr>
<tr>
<td>Use of Road Network</td>
<td>Disruption of traffic flows</td>
<td>C -</td>
<td></td>
<td>Stakeholder engagement plan</td>
<td>4 1 2 2 9</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y= stakeholder concern; –= no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.17-4  Social Infrastructure and Services – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of Rail Network</td>
<td>Temporary disruptions to freight and passenger movements on railroad</td>
<td>C</td>
<td>-</td>
<td>Infrastructure and utilities management plan</td>
<td>2 1 3 3 9</td>
</tr>
</tbody>
</table>

### Table 8.17-5  Social Infrastructure and Services – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACs near MCPY6 and MCPY12</td>
<td>Damage to Third-Party Infrastructure (Pipeline, Cables and Community Infrastructure)</td>
<td>Temporary disruption to power supply due to planned outage or accidental damage to cables or other pipelines during pipeline construction</td>
<td>C</td>
<td>-</td>
<td>Infrastructure and utilities management plan</td>
<td>4 1 2 2 9</td>
</tr>
<tr>
<td>Tanganyika (KP1405)</td>
<td>Use of Road Network</td>
<td>Traffic congestion leading to delays</td>
<td>C</td>
<td>-</td>
<td>Stakeholder engagement plan Transport and road safety management plan</td>
<td>6 2 2 3 13</td>
</tr>
</tbody>
</table>

**NOTES:** C = construction; O = operation; C&O = construction and operation; B = beneficial impact; M = magnitude of impact; D = duration of impact; E = extent of impact; S = sensitivity; SS = significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
8.17.5 Transboundary Project Impacts

8.17.5.1 Generic Transboundary Project Impacts

The following generic transboundary project impacts have been identified:

Use of Road Network
Impact: Deterioration of road conditions
Impact: Traffic congestion leading to delays
Impact: Disruption of traffic flows

Traffic generated in Tanzania will cross the border to Uganda to transport goods and materials. The potential transboundary impacts related to traffic are described in Section 8.17.6.3.

The potential for deterioration of road conditions, traffic congestion leading to delays and disruption of traffic flows will be managed through the mitigation measures described in Section 8.17.3. After mitigation has been implemented, the potential residual impact is considered not significant.

8.17.5.2 Location-Specific Transboundary Project Impacts

No location-specific transboundary project impacts have been identified in relation to social infrastructure and services.

8.17.6 Cumulative Impacts

8.17.6.1 Context

Section A11.4.10 in Appendix A11 describes the baseline condition of the social infrastructure and services, the trends and sensitivity to change. Table 8.17-4 and Table 8.17-5 summarise project residual impacts. Section A12.4.1 in Appendix A12 describes the traffic baseline conditions, the trends and sensitivity to change.

Poor road conditions increase travel time and costs considerably. New permanent and temporary access roads will be constructed to accommodate project traffic movements as some activities will take place on sites remote from the existing road network. Traffic levels tend to be low, so congestion is rare outside the main urban areas.

Project impacts that may contribute to cumulative impacts include:

- several roads will be widened and improved as part of the project
- the temporary disruption of power supply due to planned outage or accidental damage to cables or other pipelines during construction traffic congestion and disruption of flow from the movement of equipment and people leading to delays
- additional project traffic, including HGVs, could lead to an increase in the rates at which road conditions deteriorate.
Third-party developments that are in the AOI of the EACOP project are shown in the cumulative impacts matrix, described and mapped in Appendix H. These are:

- Geita airport (TZ05)
- Extension water supply project from Lake Victoria to Tabora, Nzega and Igunga (TZ16)
- Road upgrade (TZ27).

No cumulative impacts with the associated facilities were identified.

No threshold is required for the long-term beneficial impact of road improvements.

The preferred condition is defined as return to, or near the original condition of, social infrastructure and services before construction.

8.17.6.2 Cumulative Impacts

There is the potential for permanent road improvements from the combination of EACOP and third-party developments.

Potential cumulative impacts are predicted where the EACOP project and the above mentioned third-party developments have similar construction phase timelines, causing an additional demand on infrastructure through increased traffic volumes. Table 8.17-6 shows the above-mentioned third-party developments, EACOP AGIs and MCPYs and the wards/districts that may be impacted.

Table 8.17-6  Cumulative Impacts: Social Infrastructure and Services

<table>
<thead>
<tr>
<th>ID</th>
<th>Project</th>
<th>Nearest KP</th>
<th>MCPY/AGI Description</th>
<th>Ward or District Potentially Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ05</td>
<td>Geita airport</td>
<td>498.5</td>
<td>MCPY7 (approximately 10 km from TZ05)</td>
<td>Katende and Bukombe wards, Kagera</td>
</tr>
<tr>
<td>TZ16</td>
<td>Extension water supply project from Lake Victoria to Tabora, Nzega and Igunga</td>
<td>730–819.5</td>
<td>MCPY10 (approximately 2 km from TZ16). Pipeline runs parallel to EACOP and crosses the pipeline</td>
<td>Urban area of Nzega and Ingunga district</td>
</tr>
<tr>
<td>TZ27</td>
<td>Road upgrade</td>
<td>1061 and 1080</td>
<td>MCPY13 (approximately 12 km from TZ27) and crosses the pipeline</td>
<td>Kiteto district</td>
</tr>
</tbody>
</table>

Road Widening and Improvement

A long-term beneficial cumulative impact is likely to occur from the upgrade of the EACOP project access road and the third-party road upgrade between Handeni and Singida (see Figure 8.17-2).

EACOP project access roads will be widened and resurfaced to ensure that two-way traffic can pass, therefore reducing vehicle damage and risk of accidents. Where new roads are constructed, these are expected to benefit local communities by enhancing access to the national road network. Also, the combined result of the improved project access roads and the national road, is that goods can be
transported to markets more quickly and travel times will reduce. Access to health care and response times in emergency situations will be improved.

Figure 8.17-2  Cumulative Impacts of New and Upgraded Roads

Traffic Congestion, Disruption of Traffic Flows and Deterioration of Road Conditions

The transportation of materials, equipment and personnel to and from construction camps and worksites will increase traffic on the assigned routes on public roads, causing congestion and disrupting traffic flows. EACOP routes may be affected by the third-party developments during their construction with the potential to increase the risk of congestion or accelerate deterioration of road conditions, bridges and communal infrastructure. The potentially affected routes are:

- Bukoba to Muleba
- Chato to Bwanga
- Kahama to Singida
- Singida to Kondoa
- Kondoa to Handeni
- Tanga to Chongoleanii.

It should be noted that assumptions have been made about routes and traffic volumes for third-party developments, as detailed data were not available, and therefore detailed assessment has not been completed.

To manage the cumulative impact, the project will liaise with third-party developers, the police and authorities to identify and implement additional traffic management measures that limit disruption. With the additional mitigation measure implemented, it is predicted that the limit of acceptable change will be achieved and hence the cumulative residual impact is not considered significant.

### 8.17.6.3 Transboundary Cumulative Impacts

No transboundary cumulative impacts were identified as the time of writing.

### 8.18 Community Health

This section describes potential impacts on community health during construction, commissioning and operation of the EACOP project and associated mitigation measures to be adopted.

#### 8.18.1 Key Sensitivities and Considerations

The community health baseline conditions are described in Section 6.4.3.13, as well as:

- community health key VECs and their sensitivity ranking based on the relevant tables in Appendix D
- key considerations for the community health impact assessment.

Sensitivity in the community health AOI is ranked as potentially moderate for:

- households close to access roads.

Sensitivity in the community health AOI is ranked as potentially high for:

- children
- the elderly
- pregnant women
- people living in crowded areas
- PACs with decreased access to appropriate healthcare facilities
- people with poor access to clean water and adequate sanitation
- households using biomass fuel for indoor cooking and lighting
- female headed households
- women and young girls
- sex workers
- PACs near to artisanal mining sites, along transport routes and access roads
- PAC members with less access to wild foods
- PACs with members employed by the project and PACs where PIIM is likely.

Sensitivity is ranked as potentially very high in immune-compromised individuals.

Key considerations are:

- population growth (natural and as a result of PIIM) may lead to local health care facilities being over-stretched
- interaction between PACs and an expatriate labour force may increase the risk of transmission of communicable diseases
- given the high incidence of communicable diseases and the poor health facilities, potential PIIM into the PACs may increase the prevalence of communicable diseases
- construction activities can lead to changes such as an increase in bodies of standing water that provide breeding habitat for mosquitoes and thus an increase in malaria
- vector management treatments, if not performed in alignment with national strategies, may cause an increase in vector resistance and negatively affect local preventative interventions that are implemented by local authorities
- PIIM may cause changes that promote vector breeding, disease transmission, changes in the distribution of vector-borne diseases and an increased burden on health systems
- environmental sanitation, health care services and prophylaxis, vector control programmes and PIIM management are key for controlling malaria
- PIIM into PACs may reduce the availability of water, exacerbate unsanitary conditions and increase disease spread and burden of disease (BOD)
- districts have a high prevalence of STDs and PIIM and a growing population are likely to cause further increase
- most farmers in the AOI are subsistence farmers and an increase in external demand may cause food shortages for the more vulnerable groups
- PIIM into the AOI may result in an increase in food prices and, as a result, may impact on the food security of the vulnerable groups
- unless there is a sustainable growth of the districts’ economies, an increase in NCD is unlikely
- zoonotic diseases remain a risk to PACs, in particular those that are impacted by PIIM
- PAC households that experience a sudden increase in disposable income may be impacted by a loss of cohesion through increased use of substances such as alcohol and drugs and increased levels of prostitution
- PIIM may lead to impaired healthcare services.

Section A11.4.11 in Appendix A11 identifies ecosystem services associated with community health in the AOI. The following ecosystem services have been assessed in Section 8.18.2 and 8.18.3:
Soil-, water- and waste-related diseases are linked to safe water, which provides the following ecosystem services:

**Provisioning services:**
- general health
- form of livelihood (see Section 8.14 on river-, lake- and marine-based livelihoods).

Cultural health practices are linked to the use of wild plants, which provides the following ecosystem service:

**Provisioning services:**
- ingredients for treatment of common illnesses (traditional medicine).

The key human rights that are relevant to community health relate to the right to health, which is also a component of the right to an adequate standard of living. Women and children’s rights should also be considered as they are particularly vulnerable to certain health risks related to EACOP. International standards for responsible business also require that negative impacts of projects on the health of the communities should be avoided or at least minimised (see Section 4).

### 8.18.2 Potential Project Impacts

#### 8.18.2.1 Construction

**Generic Impacts**

**Resettlement**

Project land requirements for construction facilities and associated access roads will be permanent. The project has developed a Resettlement Policy Framework (RPF) that will guide all land acquisition consistent with national and IFC requirements (see Section 8.15). Due to the land requirements, specific VECs in communities may be impacted through physical resettlement or economic displacement.

**Impact:** Resettled households’ exposure to areas of higher vector densities, increasing the burden of vector-related diseases

This may lead to direct impacts.

Physical displacement of households may cause households being moved to areas where environmental, semi-urban and urban conditions are more suitable for vector breeding, causing an increase in vector densities (e.g., wetlands and densely populated areas).

This may cause households being exposed to higher vector densities and a corresponding higher BOD. This impact not only relates to malaria but also to other vector-related diseases that are prevalent in the AOI, such as:

- arboviral diseases (dengue, rift valley fever and chikungunya)
- human African trypanosomiasis
- lymphatic filariasis
• onchocerciasis.

From a human rights perspective, there is a potential impact on the right to health. The impacts will be long-term and will affect some households within the PACs. Due to their localised extent, before mitigation the impacts are considered not significant.

Impact: Resettled households’ decreased food security

This may lead to direct impacts.

Households affected by loss of land without adequate in-kind compensation may experience a decrease in food security if suitable alternatives to producing or procuring food and seeds for planting are not available. Any increase in longer-term food insecurity for sensitive VECs (female-headed households, children, pregnant women, elderly) may lead to nutritional disorders. Food insecurity has already been noted as a concern in the districts of Geita, Handeni, Missenyi and Kahama.

From a human rights perspective, there is a potential impact on the right to food and the right to health.

The impacts will be medium-term and will affect some households within the PACs. Due to their localised extent, before mitigation the impacts are considered not significant.

Community Health

Construction activities such as site clearing and road construction will cause changes in the natural environment, which may increase the number and suitability of breeding habitats for vectors.

Equipment, materials and other goods will be shipped to Tanga and Dar es Salaam and transported to project sites, thus allowing for the movement of vectors to these locations.

Impact: Project activities leading to an increase in vector-related diseases

This may lead to direct and indirect impacts.

An increase in vector density may increase the risk for localised disease transmission. High risk activities that may contribute to this impact include:

• site clearing activities
• borrow pit development
• road construction (with a specific focus on drainage)
• construction sites and MCPY drainage
• poor housekeeping at construction sites and MCPYs, resulting in conditions that promote the collection of standing water.

A localised increase in mosquito vectors that transmit arboviral conditions (Aedes spp.) may also give rise to an increased risk for the potential spread of rift valley fever if a localised outbreak was to occur. This disease is a zoonosis in East Africa, mosquitoes play an important role in transmission and higher densities may increase the risk. Areas and objects allowing pooling of water provide the preferred
breeding areas for these species of mosquito and MCPYs are therefore considered to be high risk areas.

There is a risk that movement of goods and materials via road from the ports of Tanga and Dar es Salaam can introduce vector-related diseases as shipments will arrive from global locations and may be stored in the port. Countries of origin may be endemic to different strains and types of arboviral diseases (particularly in dengue and chikungunya) and infected larva and eggs may be transferred in goods or packaging, introducing these diseases to Tanzania and the AOI.

The impacts will be medium-term and will affect districts and regions. Due to their medium-term nature, before mitigation the impacts are considered not significant.

Noise

Construction activities are expected to change the noise environment in the immediate vicinity of construction sites. Sources of noise such as excavators, dozers, dump trucks, graders and vehicles may add a new noise character to the existing noise environment.

Impact: Excessive noise exposure due to project activities

This may lead to direct and indirect impacts.

The role of noise as an environmental pollutant and its impact on health are increasingly recognised. Beyond potential damage on the auditory system, noise causes annoyance, disturbs sleep and impairs cognitive performance.

Furthermore, evidence from epidemiological studies has shown that environmental noise is associated with an increased incidence of arterial hypertension, myocardial infarction, disruptions of sleep structure and increases in stress hormone levels (Munzel et al. 2014).

Based on the available information (see Section 8.10), the following activities have been identified as potential contributors to noise exposure during the construction phase of the project:

- coating facility (CF) construction and power generation
- MCPY construction and power generation during pipeline and AGI construction
- access road construction and use
- RoW earthworks and blasting activities
- AGI construction
- MST and LOF construction

An increase in general economic activity due to improved access caused by road improvement may cause an increase of nonproject related traffic in PACs. This increase in traffic may contribute to potentially excessive environmental noise exposure.

The impacts will be short-term and will affect entire PACs. Children (especially under the age of five) may be more vulnerable. Due to their short-term nature and small extent, before mitigation the impacts are considered not significant.
Disposal of Solid and Liquid Waste

It is anticipated that the project will generate different types of solid and liquid waste which will need to be managed.

Impact: Increased pressure on regional waste management facilities due to project activities

This may lead to direct impacts.

All the project districts have limited local capacity to process municipal and household waste. Waste management facilities are virtually non-existent and formal waste handling and disposal procedures are scarce. Project activities have the potential to generate significant amounts of waste belonging to diverse waste streams (see Section 2).

Improper management and disposal of waste streams have the potential to impact on community health in the following ways:

- Contamination of water sources and soil by general waste such as oils and metals and infectious wastes from sanitary waste streams has the potential to spread disease to PACs that come into contact with these. This is of particular concern as it relates to spread of infectious diarrhoeal disease.
- Exposure of community members to improperly discarded medical waste poses a biological exposure risk from waste that may harbour infectious diseases, injuries from contaminated needles and other sharp objects pose a substantial risk as HIV and hepatitis B and C can be transmitted as a result.
- Improperly managed waste sites have the potential to attract vermin and animals, which can also increase the potential for human-animal interactions. This may cause injuries from bites (snake or animal) as well as the potential spread of zoonotic diseases.

The impacts could potentially be long-term but, due to their small extent, before mitigation the impacts are considered not significant.

Use of Road Network

It is anticipated that project logistics will be extensive during the construction phase; transport of materials from Dar es Salaam and Tanga will include the transport of materials from harbours and the movement of the construction workforce.

Impact: An increase in the burden of disease along the project’s transport corridors caused by drivers spreading communicable diseases

This may lead to direct impacts.

There is the potential for increased high-risk sexual behaviours along transport corridors to, from and within the project area. Drivers are a well-documented high-risk group, often having multiple sexual partners and supporting sexual networks along transport corridors. Thus, there is the potential for an increase in high-risk sexual practices that may promote the spread and incidence of sexually transmitted infections, including HIV.

Women who are already engaged in commercial sex, often target truck drivers for commercial or transactional sex as they are away from their usual family network and have disposable income. Truck drivers (mainly men) generally target women
for company and entertainment. These encounters are often transactional in nature. Women and young girls, engaged in transactional and commercial sex, are considered sensitive VECs to this impact.

The impacts may be felt along the whole transport route. Truck rest stops (as drivers will be expected to take rest-stops every two hours and overnight stops after 10 hours of driving) are considered high risk areas.

From a human rights perspective, there are potential impacts on the right to health associated with commercial sex work. There are also potential impacts on the rights of women and children who may be vulnerable to exploitation in commercial sex work.

The impacts will be long-term and will affect districts and regions. Due to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Location-Specific Impacts

Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147), Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)

The potential generic impacts are also applicable to the 38 PACs near the 12 MCPYs and one CF. The following specific impacts are also applicable to these PACs:

Abstraction of Groundwater

The baseline data revealed that 37% of households in the sample PACs relied on community wells for domestic water supply, while 18% had access to boreholes. However, during the dry season, water sources may dry up and households have to buy water. Shortage of clean drinking water is a concern in most of the PACs, particularly during the dry season. The districts of Igunga, Chemba, Kilindi and Handeni, where some of the construction camps will be located, reported low levels of access to clean water.

Impact: Reduced availability of groundwater

This may lead to direct impacts.

Abstraction of groundwater to supply MCPYs may have a direct impact on the groundwater table near the wells through drawdown effects. This may have an adverse impact on the yield of nearby community boreholes and wells, negatively affecting the availability of safe water to PACs. This may negatively impact on the quantity and quality of available safe water for PACs near the MCPYs. During the dry season it may even lead to a total loss of the water source. A decrease in the
availability of safe water may, in turn, lead to an increase in sanitation-related diseases. Households without alternative water sources in their vicinity will be most vulnerable.

From a human rights perspective, there is a potential impact on the human rights to water, sanitation and health.

The impacts will be short-term and will affect entire PACs that rely on a ground water source that is used for the project. Due to their short-term nature and small extent, before mitigation the impacts are considered not significant.

Employment

The project will employ both skilled and unskilled labour (see Sections 8.11 and 8.12). The majority will be skilled labour which will be sourced outside the AOI and will be accommodated in the MCPYs.

Despite the requirement that camp residents must remain in the MCPYs after working hours, a certain amount of interaction between the project workforce and local PACs is unavoidable, primarily through the hiring of unskilled workers from PACs who will reside at home. These local workers may act as a conduit through which communicable diseases may be transferred from camp residents to PAC populations.

Impact: The transmission of communicable diseases between the project’s externally contracted workforce and PACs

This may lead to direct impacts.

The utilisation of an externally contracted project workforce, including expatriates and Tanzanian nationals from outside the AOI, may cause an increase in burden of communicable disease in PACs in the following ways:

- The externally contracted workforce may originate from a country or area where the burden of communicable diseases is appreciably higher than in the PACs. This refers in particular to PTB and HIV. This may increase local transmission patterns in both the project workforce and ultimately the communities, as workers work and reside in close association with one another, especially in the MCPYs. An additional risk related to the incoming workforce and PTB transmission is the potential introduction of multidrug or extreme drug resistant strains of the disease.

- Inadequate design and construction of the MCPYs may lead to favourable conditions that promote the spread of communicable diseases, leading to an increase in burden of communicable diseases in the workforce, and ultimately spreading to PACs through local workers working closely with MCPY residents.

- Inadequate development and implementation of pre-deployment and fitness-to-work medical screening programmes for project personnel may lead to the introduction of communicable diseases that may have significant public health implications, such as pandemic influenza and other novel communicable conditions.

The baseline data has shown that the capacity and capabilities of local health systems in the AOI are limited, a factor that will likely affect the initial identification and effective subsequent management of a communicable disease outbreak in
PACs. It is anticipated that persons with a compromised immune status, the elderly and children below five years of age are the more sensitive VECs.

The impacts will be long term and will affect entire PACs. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Impact: Inadequate vector management activities, causing an increase in vector resistance and negative impacts on preventative interventions implemented by local authorities

This may lead to direct impacts.

Malaria and other vector control plans that are implemented by the project to provide protection to its construction workforce may, if not implemented to an adequate technical standard and in alignment with national malaria control strategies, may cause the development of insecticide resistance in vectors. This may cause resistant vector populations that are no longer susceptible to vector control measures and bite prevention strategies implemented in PACs. The failure of vector control and bite prevention strategies are likely to lead to an increase in the burden of disease and associated morbidity and mortality.

The impacts will be short-term and will affect entire PACs. Due to their short-term nature and small extent, before mitigation the impacts are considered not significant.

Impact: Outbreaks of infectious conditions within MCPYs affecting the health of PACs

This may lead to direct impacts.

Following interaction between the local workforce based in the MCPYs and PACs, infectious conditions may be transferred to the PACs.

The impacts will be long-term and will affect some individuals in the PACs. Due to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

PIIM

As a result of the perceived potential for employment prospects and other indirect economic possibilities, PIIM of potential job seekers, commercial sex workers and business opportunity seekers is likely to occur in the project area, in particular near the MCPYs. It is anticipated that the living conditions and housing standards of these job seekers may be of a poor standard as job opportunities may be of a temporary nature only and migrants may not settle permanently but elect to migrate along the pipeline route. Poor standards of housing, associated with overcrowding and poor environmental hygiene, is a contributing factor to the development and spread of diseases in communities.

Impact: PIIM of jobseekers into PACs carrying communicable diseases

This may lead to indirect impacts.
Multiple factors may lead to an increase in communicable disease in PACs:

- The job seekers may originate from areas where the burden of various communicable diseases may be higher than in the PACs they migrate to, resulting in the introduction of a higher disease burden.
- Migrant job seekers may have different hygiene standards and sanitation practices that may increase the risk of disease spread.
- The increase in social ills, introduced by PIIM of job seekers, may lead to an increase in commercial sex work, which, in the existing polygamous environment, may cause an increase in sexually transmitted diseases.

The increased burden of disease introduced to the PACs combined with living conditions that are conducive to the spread of these conditions may lead to an increase in incidence of diseases, including but not limited to:

- communicable diseases linked to the living environment (e.g., acute respiratory infections (ARI), PTB, measles)
- soil-, waste- and water-related diseases (diarrhoeal disease, cholera, schistosomiasis)
- sexually transmitted diseases, including HIV and AIDS.

Community members with a compromised immune status, the elderly, children under five are considered sensitive VECs with regards to communicable diseases linked to the living environment and soil-, waste- and water-related diseases. Young women and women engaged in transactional and commercial sex may be more vulnerable to sexually transmitted diseases.

The impacts will be very long-term and will affect districts. Owing to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Impact: PIIM of job seekers causing environmental changes in PACs that promote vector breeding

This may lead to indirect impacts.

Job seekers are likely to lodge in informal settlements generally characterised by poor housekeeping and environmental hygiene standards that promote standing water, increasing breeding habitats for vectors. This could lead to an increase in vector-related diseases in the PACs.

Community members with compromised immunity, the elderly, children under five and women are considered sensitive VECs.

The impacts will be medium-term and will affect entire PACs. Owing to their small extent, before mitigation the impacts are considered not significant.

Impact: PIIM of job seekers causing increased pressure on existing health services at a PAC level

This may lead to indirect impacts.

The existing health services in the districts traversed by the AOI reported significant challenges in relation to both capacity and capabilities. In general, all project districts reported inadequate infrastructure, number of personnel and equipment.
required to provide an acceptable service to their target populations. None of the districts included potential impacts by the proposed project in their comprehensive council health plans but were confident that they would be able to manage potential impacts if these were planned for and if external support was rendered.

PIIM related to job seekers would, however, place additional pressure on, and in some instances even exceed the capacity of, what are already limited district level health care capabilities.

There is minimal institutional capacity to support this potential growth either from a planning, budget or delivery perspective; without early consultation, awareness and support, the inability to meet a sudden increase in demand will impact on local health service delivery. This can include acceptable infrastructure, effective supply chain for medications and consumables and diagnostic equipment.

The impacts will be medium-term and will affect entire PACs. Owing to their small extent, before mitigation the impacts are considered not significant.

Impact: PIIM of job seekers causing uncontrolled disposal of waste in PACs

This may lead to indirect impacts.

Baseline findings show that there is limited local capacity to process municipal and household waste. Household waste is predominantly burnt in the open air near to homesteads, buried in the ground or often eaten by livestock. PIIM of job seekers may place an additional burden on existing waste management services with the potential for the spread of disease.

Most sanitation facilities conditions in PACs do not adequately prevent contact with human sewage. Development of informal settlements may exacerbate this situation. This has the potential to impact on the health of the PACs in the following ways:

- There is an existing high burden of diarrhoeal disease, and deterioration in waste management has the potential to increase the risk for spread of sanitation related diseases in the PACs. This can include diarrhoeal disease (of viral, parasitic and bacterial origin), typhoid fever, forms of dysentery, cholera, soil-transmitted helminths and schistosomiasis.
- Unregulated dumping and accumulation of domestic wastes may attract insects, vermin and other animals which may potentially cause injuries to PAC inhabitants (due to human-animal interactions) and a risk for zoonotic disease transmission.
- Discarded domestic waste may cause an increase in favourable breeding sites for vectors and an increase in vector-related diseases.

The impacts will be short-term and will affect entire PACs. Due to their short-term nature and small extent, before mitigation the impacts are considered not significant.

Impact: Reduction in the availability of potable water in PACs due to PIIM

This may lead to indirect impacts.

PIIM may increase the pressure on local water resources and the scarcity of water supplies in many settlements may make it difficult for PACs to cope with additional demands for water. This may cause a decline in the quality and quantity of available
potable water resources. In combination with poor sanitation facilities and potential poor hygiene practices, this may cause an increase in water-related diseases (i.e., diarrhoea) and potentially increase the risk of outbreaks of typhoid, dysentery and cholera.

Access to potable water is a sensitive matter because it is a fundamental human right. There is also potential for conflicts to arise in PACs where local residents and newcomers compete for access to this vital resource.

The impacts will be long-term and will affect entire PACs. Due to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

Provision of Goods and Services
Commercial activity in the PACs consists predominantly of informal small-scale enterprises that trade in agricultural produce, daily necessity goods and basic services.

Impact: Nutrition of PACs compromised by reduced food security
This may lead to direct and indirect impacts.

Procurement of food by the project from local markets may lead to a rise in the cost of basic foodstuffs. This may impact on food security and limit the diversity of diets in households that are dependent on food procurement as opposed to subsistence agricultural activities. This may manifest as an increase in malnutrition rates. Baseline findings identified the following districts where lack of food security was already reported: Geita, Handeni, Missenyi and Kahama.

The impacts will be short-term and will affect entire PACs. Due to their short-term nature and small extent, before mitigation the impacts are considered not significant.

8.18.2.2 Operation

Generic Impacts
The following potential generic impact, described for construction, is also applicable to pipeline, AGI, MST and LOF operation:

Use of Road Network
Impact: An increase in the burden of disease along the project’s transport corridors caused by drivers spreading communicable diseases
This may lead to direct and indirect impacts.

The operation of the pipeline, AGIs, MST and LOF will introduce traffic onto the road network in the immediate vicinity, primarily for the purposes of maintenance and inspection.

The mobilisation of the operational project workforce, or a portion thereof, may result in workers engaging in casual sexual practices on routes, increasing the spread and incidence of sexually transmitted infections, including HIV.
The impacts will be long-term and will affect districts and regions. Due to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

**Location-Specific Impacts**

Pumping Station 3 (Muleba District, KP405), Pumping Station 4 (Mbogwe District, KP610), Pumping Station 5 (Igunga District, KP826), Pumping Station 6 (Singida District, KP930) and MST (Tanga District)

The following potential generic impacts, described for construction, are also applicable to the 11 PACs near the four pumping stations and the MST during operation:

**Noise**

Impact: Excessive noise exposure due to project activities

This may lead to direct and indirect impacts.

The permanent project AGIs have the potential to operate 24 hours a day, 7 days a week, causing continuous noise exposure to PACs near these structures. Based on information in Section 8.10.1.1, it is evident that this impact is restricted to AGI locations. As with construction, continued noise exposure may cause annoyance, disturb sleep and impair cognitive performance. Nocturnal operational noise levels within a 1-km radius are expected to range between 40 dB (A) and 70 dB (A) $L_{Aeq,T}$. This will impact 232 dwellings near PS3, seven dwellings near PS4, 13 dwellings near PS5, eight dwellings near PS6 and 138 near the MST during night time; and 51 dwellings near PS3, one dwelling near PS4, ten dwellings near PS5, one dwelling near PS6 and 13 near the MST during day time.

This exceeds the recommended maximum limits caused by an operation on residential, institutional and educational VECs. These limits are 55 dB (A) $L_{Aeq}$ (overall average ambient noise levels) and 45 dB (A) $L_{Aeq}$ during the day and night, respectively.

The impacts will be long-term, of a large magnitude and will affect some households in the PACs. Owing to their localised extent, before mitigation the impacts are considered not significant.

**Disposal of Solid and Liquid Waste**

Impact: Increased pressure on regional waste management facilities due to project activities

This may lead to direct and indirect impacts.

During operations, the project will continue to generate waste belonging to diverse waste streams.

The impacts will be long-term and will affect entire PACs. Due to their small extent, before mitigation the impacts are considered not significant.
The following location-specific impact is also applicable to PACs near PS3, PS5 and the MST during operation:

Release of Gases, Exhausts and Vapours to Atmosphere
Impact: Increased risk of respiratory diseases due to project activities
This may lead to direct and indirect impacts.

During operations, power generation will take place through the use of oil-fired generators at PS3, PS5 and the MST to provide power to the project. The operation of these generators will result in the emission of particulate matter (PM) as well as oxides of sulphur (SOx) and nitrogen (NOx). Exposure to these pollutants has the potential to increase the risks for developing acute and chronic respiratory conditions, including secondary infections such as community acquired pneumonia.

Emissions from these oil-fired power generators may cause the development and exacerbation of acute and chronic respiratory conditions, cardiovascular conditions and respiratory cancers and may increase the risk of developing secondary respiratory infections as mentioned above (WHO 2016).

The impacts will be very long-term and will affect some households within the PACs. Elderly individuals, children (especially under the age of five) and immuno-compromised individuals are considered highly sensitive VECs. Due to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

8.18.3 Mitigation Measures
This section describes the enhancement and impact avoidance and mitigation measures that will be applied to the aspects and activities that could affect community health.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management plan and other measures that are included in Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.

8.18.3.1 Design

Generic Mitigation Measures
As described in Section 3, Alternatives, route identification for the pipeline has considered social aspects relating to community health such as minimising impacts on settlements, water points/sources and social and community infrastructure. The selected pipeline route was chosen partly because it had the lowest number of social constraints of the routing options available.

Location-Specific Mitigation Measures
There are no location specific mitigation measures relating to the design of the construction facilities, pipeline, AGIs, MST and LOF.
8.18.3.2 Construction

Generic Mitigation Measures

Resettlement

Impact: Resettled households’ exposure to areas of higher vector densities, increasing the burden of vector-related diseases

and

Impact: Resettled households’ decreased food security

The resettlement action plan and grievance procedure will include measures that will all contribute to the management of health impacts for resettled households.

A resettlement action plan will describe the procedures related to compensation for loss of assets and livelihood restoration strategies. Post-resettlement monitoring of livelihood restoration measures will be implemented.

The grievance procedure allows PAC inhabitants to express grievances about the project and resettlement action plan procedures. The grievance process will be communicated to PACs and it will be clearly communicated that complaints related to interactions with public or private security forces will be addressed.

For the impact resettled households’ exposure to areas of higher vector densities increasing the burden of vector-related diseases, application of these mitigation measures will reduce the magnitude of impact from medium to small and the duration of impact from long-term to short-term. The residual impact is not significant.

For the impact resettled households’ decreased food security, application of these mitigation measures will reduce the magnitude of impact from large to small and the duration of impact from medium-term to short-term. The residual impact is not significant.

Community Health

Impact: Project activities leading to an increase in vector-related diseases

The community health, safety and security plan, occupational health, safety and security plan and the stakeholder engagement plan will include measures to manage vector-related diseases.

As part of the CHSSP, community-based programmes will be developed and implemented, in cooperation with health management teams which consider the development and implementation of a community malaria control programme.

Project design specifications such as adequate drainage and the avoidance of standing water in construction sites will help manage PAC member health.

Application of these mitigation measures will reduce the magnitude of impact from large to medium and duration of impact from medium-term to short-term. The residual impact is not significant.
Noise
Impact: Excessive noise exposure due to project activities.

The community health, safety and security plan, pollution prevention plan and the stakeholder engagement plan will include measures to manage noise.

Detailed acoustic design will be undertaken for sensitive receptors which should consider location of noisy equipment away and the incorporation of noise abatement measures (e.g., acoustic barriers).

A monitoring plan will be developed and implemented to ensure that environmental noise exposure levels are periodically monitored and documented corrective measures will be implemented.

Application of these mitigation measures will reduce the magnitude of impact from small to negligible and the residual impact is not significant.

Disposal of Solid and Liquid Waste
Impact: Increased pressure on regional waste management facilities due to project activities

The waste management plan will identify suitable offsite disposal sites for waste soil and rock and implement appropriate management measures. Provision of food to workers will be planned to cater for workforce requirements and therefore minimise food waste as far as possible. Application of these mitigation measures will reduce the magnitude of impact from medium to small and the residual impact is not significant.

Application of these mitigation measures will reduce the magnitude of impact from medium to small and the residual impact is not significant.

Use of Road Network
Impact: An increase in the burden of disease along the project’s transport corridors caused by drivers spreading communicable diseases

The community health, safety and security plan, occupational health, safety and security plan, infrastructure and utilities management plan and the stakeholder engagement plan will include measures to manage the transport corridor burden of disease.

A workers’ code of conduct outlining expected worker behaviours will cover the interaction between the national, international and local workforce, including interactions with PAC members.

A community health, safety and security plan will be developed to manage infectious disease outbreaks in MCPYs and to prevent their spread to PACs. A HIV/STD awareness and prevention programme, which includes monitoring, will be put in place at the rest stops used by project drivers to address the risks of HIV and STDs and the preventative measures they can take.

An awareness campaign targeting schools in PACs will address risks of relationships with transient workers, transactional and commercial sex.
Application of these mitigation measures will reduce the magnitude of impact from large to medium and duration of impact from long-term to medium-term. The residual impact is not significant.

**Location-Specific Mitigation Measures**

**Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147) Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318), Main Camp and Pipe Yard 16 (Muheza District, KP1404)**

The generic mitigation measures are also applicable to the 38 PACs near the 12 MCPYs and one CF. The following additional mitigation measures are recommended for these PACs:

**Abstraction of Groundwater**

Impact: Reduced availability of groundwater

The following mitigations will be included in the natural resource management plan, pollution prevention plan, waste management plan and the stakeholder engagement plan to manage groundwater availability.

As part of the project’s permit application, hydraulic testing and hydrogeological impact assessments will be undertaken to evaluate the potential impact on local groundwater abstraction points. If the assessment indicates potential impacts to local users, alternative borehole locations will be considered. During project water abstraction procedure will describe requirements for monitoring community water sources including surface water and groundwater.

Application of these mitigation measures will reduce the magnitude of impact from medium to small and the duration of impact from short-term to transient. The residual impact is not significant.

**Employment**

Impact: The transmission of communicable diseases between the project’s externally contracted workforce and PACs

Impact: Inadequate vector management activities, causing an increase in vector resistance and negative impacts on preventative interventions implemented by local authorities

Impact: Outbreaks of infectious conditions within MCPYs affecting the health of PACs

The following mitigations will be included in the community health, safety, security plan, occupational health, safety and security plan, natural resource management plan, pollution prevention plan, waste management plan and the stakeholder engagement plan to contribute to the management of these impacts.
As part of the CHSSP, community-based programmes will be developed and implemented in cooperation with government health management teams which consider the implementation of a community malaria control programme, a community HIV/TB programme, a community water, sanitation and hygiene (WASH) programme and a communicable disease plan will be developed to manage infectious disease outbreaks in MCPYs and prevention of spread to PACs.

As part of the OHSSP, a malaria and other vector control management plan will be developed and implemented to ensure adequate control over malaria and other vector-related conditions in camps.

Pre-deployment screenings will be described in the labour management plan and communicated during the recruitment process and vaccinations will be identified and administered for the prevention of communicable diseases being transmitted between the national/international and local workforce. In addition, measures will be implemented to reduce the risk of water- and food-borne disease outbreaks in camps and the associated risk of transmission to local communities.

MCPYs will be designated as having “closed” status to prevent interactions between the workforce and PACs and prevent the spread of communicable disease. Policies will be developed to manage transgressions within the project disciplinary procedures and structures and a workers’ code of conduct outlining expected worker behaviours will be developed and implemented.

For the impact of the transmission of communicable diseases between the project’s externally contracted workforce and PACs, application of these mitigation measures will reduce the magnitude of impact from very large to medium and the duration of impact from long-term to short-term. The residual impact is not significant.

For the impact of inadequate vector management activities, causing an increase in vector resistance and negative impacts on preventative interventions implemented by local authorities, application of these mitigation measures will reduce the magnitude of impact from large to small and the residual impact is not significant.

For the impact of outbreaks of infectious conditions within MCPYs affecting the health of PACs, application of these mitigation measures will reduce the magnitude of impact from very large to medium and the residual impact is not significant.

PIIM

Impact: PIIM of jobseekers into PACs carrying communicable diseases.

The following mitigation will be included in the PIIM management plan, community health, safety and security plan, and the stakeholder engagement plan to manage effects of PIIM on communicable diseases.

A PIIM management plan will be developed and implemented for the project with the aim of reducing the number of people that arrive into PACs and mitigating the impacts of PIIM that does occur.

Application of these mitigation measures will reduce the magnitude of impact from large to medium and the duration of impact from very long-term to long-term. The residual impact is not significant.
Impact: PIIM of job seekers causing environmental changes in PACs that promote vector breeding
Impact: PIIM of job seekers causing increased pressure on existing health services at a PAC level
Impact: PIIM of job seekers causing uncontrolled disposal of waste in PACs
Impact: Reduction in the availability of potable water in PACs due to PIIM

The following mitigations will be included in the PIIM management plan, community health, safety and security plan, occupational health, safety and security plan, resettlement action plan, natural resource management plan, pollution prevention plan, waste management plan and the stakeholder engagement plan to contribute to the management of these impacts.

A PIIM management plan will be developed and implemented for the project with the aim of reducing the number of people that arrive into PACs and mitigating the impacts of PIIM that does occur.

In addition, a cooperation agreement with the council health management teams will be reached to evaluate potential health impacts, proposed mitigation measures and monitoring of specific key health indicators during construction.

For the impact of PIIM of job seekers causing environmental changes in PACs that promote vector breeding, application of these mitigation measures will reduce the magnitude of impact from large to medium and the residual impact is not significant.

For the impact of PIIM of job seekers causing increased pressure on existing health services at a PAC level, application of these mitigation measures will reduce the magnitude of impact from medium to small and the duration of impact from medium-term to short-term. The residual impact is not significant.

For the impact of PIIM of job seekers causing uncontrolled disposal of waste in PACs, application of these mitigation measures will reduce the magnitude from medium to small and the residual impact is not significant.

For the impact of reduction in the availability of potable water in PACs due to PIIM, application of these mitigation measures will reduce the magnitude of impact from large to small and the duration of impact from long-term to short-term. The residual impact is not significant.

Provision of Goods and Services
Impact: Nutrition of PACs compromised by reduced food security

The community health, safety and security plan, occupational health, safety and security plan, resettlement action plan, natural resource management plan, pollution prevention plan, waste management plan and the stakeholder engagement plan to contribute to the management of this impact.

An agreement with the council health management teams (CHMT) will be reached to discuss potential health impacts, proposed mitigation measures and longitudinal monitoring of specific key health indicators during construction.
Application of these mitigation measures will reduce the magnitude of impact from large to small and the residual impact is not significant.

8.18.3.3 Operation

**Generic Mitigation Measures**

**Use of Road Network**

Impact: An increase in the burden of disease along the project’s transport corridors caused by drivers spreading communicable diseases

The community health, safety and security plan, occupational health, safety and security plan, the infrastructure and utilities management plan and the stakeholder engagement plan will include measures that will contribute to the management of this impact.

A workers’ code of conduct outlining expected worker behaviours will be developed and implemented. This code of conduct will cover the interaction between the national and international workforce and local workforce but also interactions with PAC members.

A community health, safety and security plan will be developed to manage infectious disease outbreaks in MCPYs and prevention of spread to PACs and a HIV/STD awareness and prevention programme will be put in place at the rest stops used by project drivers to raise awareness about the risks of HIV and STDs and preventative measures that they can take.

An awareness campaign targeting schools within the project AOI will be developed, addressing risks particularly to girls of relationships with transient workers, and transactional sex.

Application of these mitigation measures will reduce the magnitude of impact from large to medium and the duration from long-term to medium-term. The residual impact is not significant.

**Location-Specific Mitigation Measures**

**Pumping Station 3 (Muleba District, KP405), Pumping Station 4 (Mbogwe District, KP610), Pumping Station 5 (Igunga District, KP826), Pumping Station 6 (Singida District, KP930) and MST (Tanga District)**

The following generic mitigation measures, described for construction, are also applicable to the 11 PACs near the four pumping stations and the MST during operation:

**Noise**

Impact: Excessive noise exposure due to project activities

The community health, safety and security plan, pollution prevention plan and the stakeholder engagement plan will include measures that will contribute to the management of this impact.
Acoustic design will be undertaken for sensitive receptors and will consider the location of noisy equipment away and the incorporation of noise abatement measures (e.g., acoustic barriers).

A monitoring plan will be developed and implemented to ensure that environmental noise exposure levels are periodically monitored and documented and procedures for corrective measures will be implemented.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the residual impact is not significant.

Disposal of Solid and Liquid Waste
Impact: Increased pressure on regional waste management facilities due to project activities

The waste management plan will identify suitable offsite disposal sites for waste soil and rock and implement appropriate management measures. Provision of food to workers will be planned to cater for workforce requirements and therefore minimise food waste as far as possible. Application of these mitigation measures will reduce the magnitude of impact from medium to small and the residual impact is not significant.

Application of these mitigation measures will reduce the magnitude of impact from medium to small and the residual impact is not significant.

The following additional mitigation measures are recommended for PACs near PS3, PS5 and the MST during operation:

Release of Gases, Exhausts and Vapours to Atmosphere
Impact: Increased risk of respiratory diseases due to project activities

The following mitigation will be included in the pollution prevention plan, to contribute to the management of this impact:

All combustion plants will be designed to meet national regulations and project standards with regards to air quality and emission limits and construction and operational marine vessels will obtain an International Air Pollution Prevention Certificate.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the residual impact is not significant.

8.18.4 Residual Impacts and Significance Summary

This section summarises the residual impacts on community health after mitigation measures have been implemented.

Table 8.18-1 summarises the potential generic community health impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation. Table 8.18-2 summarises location-specific impacts.

After mitigation has been implemented, the potential residual impacts on community health are considered not significant.
8.18.4.1 Ecosystem Services

Section A11.4.11 in Appendix A11 identifies ecosystem services associated with community health in the AOI. The following ecosystem services have been assessed in Section 8.18.2 and 8.18.3:

Soil-, water- and waste-related diseases are linked to safe water, which provides the following ecosystem services:

Provisioning services:
- general health
- form of livelihood (see Section 8.14 on river-, lake- and marine-based livelihoods)

Cultural health practices are linked to the use of wild plants, which provides the following ecosystem service:

Provisioning services:
- ingredients for treatment of common illnesses (traditional medicine).

With the implementation of the planned mitigation measures, the residual impact on the above services will be not significant.
### Table 8.18-1  Community Health – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resettlement</td>
<td>Resettled households’ exposure to areas of higher vector densities, increasing the burden of vector-related diseases</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>Resettlement</td>
<td>Resettled households’ decreased food security</td>
<td>C</td>
<td>Y</td>
<td>Resettlement action plan</td>
<td>4 2 1 4 11</td>
</tr>
<tr>
<td>Community Health</td>
<td>Project activities leading to an increase in vector-related diseases</td>
<td>C</td>
<td>-</td>
<td>Community health, safety and security plan Occupational health, safety and security plan Stakeholder engagement plan</td>
<td>6 2 3 4 15</td>
</tr>
<tr>
<td>Noise</td>
<td>Excessive noise exposure due to project activities</td>
<td>C</td>
<td>-</td>
<td>Community health, safety and security plan Pollution prevention plan Stakeholder engagement plan</td>
<td>2 2 2 4 10</td>
</tr>
<tr>
<td>Disposal of Solid and Liquid Waste</td>
<td>Increased pressure on regional waste management facilities due to project activities</td>
<td>C</td>
<td>-</td>
<td>Waste management plan</td>
<td>4 2 2 5 13</td>
</tr>
<tr>
<td>Use of Road Network</td>
<td>An increase in the burden of disease along the project’s transport corridors caused by drivers spreading communicable diseases</td>
<td>C &amp; O</td>
<td>Y</td>
<td>Community health, safety and security plan Occupational health, safety and security plan Infrastructure and utilities management plan Stakeholder engagement plan</td>
<td>6 4 2 5 17</td>
</tr>
</tbody>
</table>

NOTES: C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.

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### Table 8.18-2 Community Health – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACs near the 12 MCPYs and one CF</td>
<td>Abstraction of Groundwater</td>
<td>Reduced availability of groundwater</td>
<td>C</td>
<td>Y</td>
<td>Natural resource management plan, Pollution prevention plan, Waste management plan, Stakeholder engagement plan</td>
<td>4 1 2 4 11</td>
</tr>
<tr>
<td>PACs near the 12 MCPYs and one CF</td>
<td>Employment</td>
<td>The transmission of communicable diseases between the project’s externally contracted workforce and PACs</td>
<td>C</td>
<td>Y</td>
<td>Community health, safety and security plan, Occupational health, safety and security plan, Natural resource management plan, Pollution prevention plan, Waste management plan, Stakeholder engagement plan</td>
<td>6 2 2 5 15</td>
</tr>
<tr>
<td>PACs near the 12 MCPYs and one CF</td>
<td>Employment</td>
<td>Inadequate vector management activities, causing an increase in vector resistance and negative impacts on preventative interventions implemented by local authorities</td>
<td>C</td>
<td>-</td>
<td>Community health, safety and security plan, Occupational health, safety and security plan, Natural resource management plan, Pollution prevention plan, Waste management plan, Stakeholder engagement plan</td>
<td>4 2 1 5 12</td>
</tr>
</tbody>
</table>

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<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
</table>
| PACs near the 12 MCPYs and one CF | Employment | Outbreaks of infectious diseases within MCPYs affecting the health of PACs | C     | Y                        | Community health, safety and security plan  
Occupational health, safety and security plan  
Natural resource management plan  
Pollution prevention plan  
Waste management plan  
Stakeholder engagement plan | 6 4 1 4 15 |
| PACs near the 12 MCPYs and one CF | PIIM | PIIM of job seekers affecting PACs by: carrying communicable diseases | C     | Y                        | Project-induced in-migration management plan  
Community health, safety and security plan  
Stakeholder engagement plan | 6 4 3 5 18 |
| PACs near the 12 MCPYs and one CF | PIIM | PIIM of job seekers affecting PACs by: causing environmental changes in PACs that promote vector breeding | C     | Y                        | Project-induced in-migration management plan  
Community health, safety and security plan  
Occupational health, safety and security plan  
Resettlement action plan  
Natural resource management plan  
Pollution prevention plan  
Waste management plan  
Stakeholder engagement plan | 6 3 2 4 15 |

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<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Project-induced in-migration management plan</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Community health, safety and security plan</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>Occupational health, safety and security plan</td>
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<td></td>
<td>Resettlement action plan</td>
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<td></td>
<td>Natural resource management plan</td>
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<td></td>
<td>Pollution prevention plan</td>
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<td>Waste management plan</td>
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<td></td>
<td>Stakeholder engagement plan</td>
<td></td>
</tr>
<tr>
<td>PACs near the 12 MCPYs and one CF</td>
<td>PIIM</td>
<td>PIIM of job seekers affecting PACs by: causing increased pressure on existing health services at a PAC level</td>
<td>C</td>
<td>Y</td>
<td></td>
<td>4 2 2 5 13</td>
</tr>
<tr>
<td>PACs near all 12 MCPYs and one CF</td>
<td>PIIM</td>
<td>PIIM of job seekers affecting PACs by: causing uncontrolled disposal of waste in PACs</td>
<td>C</td>
<td>-</td>
<td></td>
<td>4 2 2 5 13</td>
</tr>
</tbody>
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<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACs near all 12 MCPYs and one CF</td>
<td>PIIM</td>
<td>Reduction in the availability of potable water in PACs due to PIIM</td>
<td>C</td>
<td>Y</td>
<td>Project-induced in-migration management plan&lt;br&gt;Community health, safety and security plan&lt;br&gt;Occupational health, safety and security plan&lt;br&gt;Resettlement action plan&lt;br&gt;Natural resource management plan&lt;br&gt;Pollution prevention plan&lt;br&gt;Waste management plan&lt;br&gt;Stakeholder engagement plan</td>
<td>4 2 2 5 13</td>
</tr>
<tr>
<td>PACs near all 12 MCPYs and one CF</td>
<td>Provision of Goods and Services</td>
<td>Nutrition of PACs compromised by reduced food security</td>
<td>C</td>
<td>Y</td>
<td>Community health, safety and security plan&lt;br&gt;Occupational health, safety and security plan&lt;br&gt;Resettlement action plan&lt;br&gt;Natural resource management plan&lt;br&gt;Pollution prevention plan&lt;br&gt;Waste management plan&lt;br&gt;Stakeholder engagement plan</td>
<td>4 2 2 5 13</td>
</tr>
</tbody>
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Table 8.18-2  Community Health – Location-Specific Impacts

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<tr>
<th>Location</th>
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<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACs near PS3, PS4, PS5, PS6 and MST</td>
<td>Noise</td>
<td>Excessive noise exposure due to project activities</td>
<td>O</td>
<td>-</td>
<td>Community health, safety and security plan&lt;br&gt;Pollution prevention plan&lt;br&gt;Stakeholder engagement plan</td>
<td>4   4   1   4   13</td>
</tr>
<tr>
<td>PACs near PS3, PS4, PS5, PS6 and MST</td>
<td>Disposal of Solid and Liquid Waste</td>
<td>Increased pressure on regional waste management facilities due to project activities</td>
<td>O</td>
<td>-</td>
<td>Waste management plan</td>
<td>4   4   2   5   15</td>
</tr>
<tr>
<td>PACs near PS3, PS5 and MST</td>
<td>Release of Gases, Exhaunts and Vapours to Atmosphere</td>
<td>Increased risk of respiratory diseases due to project activities</td>
<td>O</td>
<td>Y</td>
<td>Pollution prevention plan</td>
<td>4   5   1   5   15</td>
</tr>
</tbody>
</table>
8.18.5 Transboundary Project Impacts

8.18.5.1 Generic Transboundary Project Impacts

Use of Road Network

Impact: An increase in the burden of disease along the project’s transport corridors caused by drivers spreading communicable diseases.

It is anticipated that project long-range movements will be extensive during construction with transport of materials, equipment and personnel across the Tanzania–Uganda border. There is the potential for transfer of communicable disease between countries.

The potential for an increase in the BOD along the project’s transport corridors will be managed through the mitigation measures described in Section 8.18.3. After mitigation has been implemented, the potential residual impact is considered not significant.

8.18.5.2 Location-Specific Transboundary Project Impacts

No location-specific transboundary project impacts have been identified in relation to community health.

8.18.6 Cumulative Impacts

8.18.6.1 Context

Section 6.4.3.13 describes the baseline condition of community health, the trends and sensitivity to change. Table 8.18-1 and Table 8.18-2 summarise project residual impacts.

There are several community health challenges in Tanzania. These include inadequate cover by health facilities, a high burden of communicable, vector-related and infectious diseases, an increasing burden of noncommunicable diseases, inadequate waste, water and sanitation facilities, and a shortage of medical supplies and equipment.

Section 8.18.2 describes the project impacts. The project impacts that may contribute to cumulative impacts include:

- decreased food security
- an increase in the burden of disease along the project’s transport corridors as a result of drivers spreading communicable diseases
- outbreaks of infectious diseases in the construction camps
- PIIM of job seekers who may:
  - carry and transmit communicable diseases
  - create local environments conducive to vector breeding
  - increase pressure on existing health services and waste management.

Third-party developments that are in the AOI of the EACOP project are shown in the cumulative impacts matrices, described and mapped in Appendix H. These are:
• rural electrification project (TZ03)
• Ngono dam (TZ04)
• Geita Airport (TZ5)
• extension water supply project from Lake Victoria to Tabora, Nzega and Igunga (TZ16)
• road upgrade (TZ27)
• waste facility (TZ28).

No cumulative impacts with the associated facilities were identified.

The preferred condition is no outbreak or increase in disease and no overburdening of the health care system caused by EACOP in combination with the associated facilities and third-party developments.

8.18.6.2 Cumulative Impact

Potential cumulative impacts are predicted where the EACOP project and the third-party developments have large labour forces and similar construction phase timelines. Table 8.18-3 shows the third-party developments, EACOP MST and MCPYs and the wards/districts that may be impacted.

Table 8.18-3  Cumulative Impacts: Community Health

<table>
<thead>
<tr>
<th>ID</th>
<th>Project</th>
<th>Nearest KP</th>
<th>MCPY or AGI</th>
<th>Ward or District Potentially Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ03</td>
<td>Rural electrification</td>
<td>298–446</td>
<td>MCPY5 (approximately 10 km from TZ03) MCPY6 (approximately 5 km from TZ03)</td>
<td>Missenyi district Muleba district</td>
</tr>
<tr>
<td>TZ04</td>
<td>Ngono dam</td>
<td>333.5</td>
<td>MCPY5 (approximately 6 km from TZ04)</td>
<td>Kyaka, Kilimilil and Mushasha wards Missenyi district</td>
</tr>
<tr>
<td>TZ05</td>
<td>Geita Airport</td>
<td>498.5</td>
<td>MCPY7 (approximately 13 km from TZ05)</td>
<td>Katende and Bukombe wards, Chato district</td>
</tr>
<tr>
<td>TZ16</td>
<td>Extension water supply project from Lake Victoria to Tabora, Nzega and Igunga</td>
<td>730–819.5</td>
<td>MCPY10 (approximately 2 km from TZ16). Pipeline runs parallel to EACOP and crosses the pipeline</td>
<td>Nanga ward Igunga district</td>
</tr>
<tr>
<td>TZ27</td>
<td>Road upgrade Handeni to Singida</td>
<td>1061 and 1080</td>
<td>MCPY13 (approximately 12 km from TZ27) and crosses the pipeline</td>
<td>Serya, Suruke, Kingale, Chemchem, Kilimani, Kondoa Mjini wards Kondoa district</td>
</tr>
<tr>
<td>TZ27</td>
<td></td>
<td>1230–1240</td>
<td>MPCY14 (approximately 15 km from TZ27)</td>
<td>Kibirashi ward Kilindi district Loolera ward Kiteto district</td>
</tr>
</tbody>
</table>
### Table 8.18-3 Cumulative Impacts: Community Health

<table>
<thead>
<tr>
<th>ID</th>
<th>Project</th>
<th>Nearest KP</th>
<th>MCPY or AGI</th>
<th>Ward or District Potentially Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ28</td>
<td>Mpirani waste facility</td>
<td>1437.5</td>
<td>MST (approximately 5 km from TZ28)</td>
<td>Chongoleani, Mabokweni wards (and wards of Tanga city)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tanga district</td>
</tr>
<tr>
<td>TZ34</td>
<td>Mining concessions</td>
<td>Along the pipeline route</td>
<td></td>
<td>Kasharunga and Karambi ward, Muleba district</td>
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<tr>
<td></td>
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<td>Bukome ward with Chato district</td>
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<td>Bukombe ward in Bukombe district</td>
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<td>Igusule ward in Nzega district</td>
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<td>Nanga ward in Igunga district</td>
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<td>Serya ward in Kondoa district</td>
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<td></td>
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<td>Loolera ward and Njoro wards in Kiteto district</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Mabanda in Handeni Township Authority</td>
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<td>Kibirashi in Kilindi district</td>
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**Noise**

The potential cumulative noise impacts are covered in Section 8.10.6.

**Decreased Food Security**

Cumulative impact on land belonging to a PAC may leave insufficient land available in the PAC for farming, grazing and collection of natural resources (as described in Section 8.13.6.2) and potentially affecting households’ abilities to generate some cash to afford basic needs (i.e., education, health care). This may apply to the following PACs:

- Bulyang’ombe because of cumulative impacts of Lake Victoria to Kahama, Shinyanga and Tabora water pipeline and MCPY10.

Insufficient data was available at the time of writing on proposed activities in the mining concessions to assess cumulative impact on PACs from mining. The wards that could be affected are presented in Table 8.18-3.

The project will engage proponents of the third-party developments and relevant government agencies to consider options for management measures to address
significant cumulative impacts. This may include collaboration on livelihood restoration programmes

With the additional mitigation measure implemented, the preferred condition will be achieved and the residual cumulative impact is considered not significant.

**Infectious and Communicable Diseases**

Outbreaks and spread of infectious and communicable diseases (including HIV and AIDS) could occur because of EACOP and third-party labour forces engaging with PAC members and each other’s labour forces. There is a heightened cumulative risk of outbreaks and spread of diseases in the situations described below.

**Transport Routes**

The use of transport routes by both EACOP and the third-party developments may increase the potential spread of communicable diseases as rest stops are reputed for increased risk of sexually transmitted diseases and other communicable diseases. Section 8.17.6.2 describes transport routes and traffic.

This cumulative impact may apply to the following wards:

- wards where roads are jointly used by the EACOP project and the rural electrification project. These include:
  - Kassambya, Gera, Bugandika, Bugorora, Kyaka, Mushasha wards, Missenyi district
  - Katoma, Karabagaine, Bujugo, Kanyangereko, Kemondo, Rukoma, Kibirizi, Butulage, Ruhunga, Mugajwale, Kyamulaile, Katoro and Kasharu wards, Bukoba rural district
  - Ijuganyondo, Kibeta, Kagondo and Rwamishenye wards, Bukoba urban
  - Muhutwe, Mayondwe, Izigo, Katoke, Kagoma, Kikuku, Bureza, Muleba, Magata (Karutanga), Gwanseli, Kasharunga, Rulanda, Kimwani, Nyakabango, Kyebitembe, Mubunda, Bisheke and Burungura wards, Muleba district wards

- wards where roads are jointly used by the EACOP project and the Ngono dam. These include:
  - Bugandika, Bugorora, Kyaka, Mushasha and Gera wards, Missenyi district
  - Katoma, Karabagaine, Maruku, Kemondo and Katoro wards, Bukoba rural district
  - Ijuganyondo, Kibeta, Kagondo and Rwamishenye wards, Bukoba rural district
  - Muhutwe, Katoke, Kagoma, Mayondwe and Izigo wards, Muleba district wards

- wards where roads are jointly used by the EACOP project and the transmission line construction project. These include:
  - Mitunduru, Umyambwa, Mungu maji, Kindai, Utumi, Minga, Misuna, Unyamikumbi, Majengo, Mughanga and Ipembe wards, Singida Urban district
  - Siyu ward, Ikungi district
  - Itaja, Mughamo, Kinyagigi and Merya wards, Singida district
  - Gehandu, Mogitu, Nangwa, Katesh and Ganana wards, Hanang district
• wards where roads are jointly used by the EACOP project and the Lake Victoria to Kahama, Shinyanga and Tabora water pipeline. These include:
  o Didia, Itwangi, Tinde, Puni, Nyida and Nsalala wards, Shinyanga rural district
  o Miguwa, Itilo, Ijanija, Nzegandogo, Nata and Nzega Mjini, Nzega district
  o Igunga, Bukoko, Nyandekwa, Nanga and Ziba wards, Igunga district
• wards where roads are jointly used by the EACOP project and the road upgrade development. These include:
  o Mughanga, Mitunduru, Majengo, Umyambwa, Mungu maji, Ipeembe, Utemini, Minga and Misuna wards, Singida Urban district
  o Kilimani and Kalamba wards, Kondoa district
  o Songoro, Mondo, Dalai, Mrijo, Chandama and Goima wards, Chemba district
  o Partimbo, Loolera, Njoro, Olboroti, Bwagamoyo and Kijungu wards, Kiteto district
  o Mkindi, Kwediboma, Jaila, Msanja, Kisangasa, Mabalanga and Kibirashi wards, Kilindi district
  o Kwenjugo, Chanika, Mdoe and Kwediyamba wards, Handeni Township Authority district
• wards where roads are jointly used by the EACOP project and the Mpirani waste facility. These include:
  •Nguvumali, Chumbageni, Mzizima, Mabokweni, Kiomoni and Chongoleani wards, Tanga district.

The project will liaise with the proponents of third-party developments and relevant government bodies to consider options for management measures to address the cumulative impacts. This may include sharing information about their worker and community health management strategies, to enable an efficient and coordinated HIV prevention plan.

With the additional mitigation measure implemented, the preferred condition will be achieved and the residual cumulative impact is considered not significant.

Construction Camps

The EACOP project and third-party construction camps may increase the risk of outbreaks of contagious diseases if their construction schedules coincide. Diseases could be transmitted from any construction camp to PACs in the wards shared by the EACOP project and third-party developments. However, due to lack of available data on the existence and location of construction camps in third-party developments at the time of writing no detailed analysis could be conducted of this potential cumulative impact. Table 8.18-3 presents the wards that may be affected.

The project will engage proponents of the third-party developments and relevant government agencies to consider options for management measures to address significant cumulative impacts. This may include sharing information about their worker and community health management strategies, to enable an efficient and coordinated response to any potential disease outbreak.

With the mitigation measures implemented, the preferred condition will be achieved and the residual cumulative impact is considered not significant
PIIM

Effects of PIIM identified for the project-only assessment, such as, water shortage in certain PACs., increased rates of diseases overburdening the local health facilities, increased uncontrolled disposal of waste leading to environmental and health hazards, and increased vector breeding, increasing transmission of malaria may be exacerbated by multiple projects nearby.

PAC’s that may be cumulatively impacted include:

- Missenyi, Bulifani and Kashaba, because of cumulative impacts of Ngono dam and the EACOP project
- Chato and Mkungo, because of cumulative impacts of the Geita airport development and the EACOP project
- Singida, because of cumulative impacts of the transmission line construction and the EACOP project
- Bulyang’ombe village, because of cumulative impacts of Lake Victoria to Kahama, Shinyanga and Tabora water pipeline development and the EACOP project
- Kondoa, Seye and Gitu, because of cumulative impacts of road upgrade and the EACOP project.

Insufficient data was available for the mining concessions to assess any potential cumulative impacts from PIIM on particular PACs. Table 8.18-3 presents the wards potentially impacted.

The project will engage with relevant stakeholders (authorities and civil society) to identify patterns of population in-migration, associated consequences and identify appropriate mitigation measures and interventions.

With the management measure implemented, the preferred condition will be achieved, and the residual cumulative impact is considered not significant.

8.18.6.3 Transboundary Cumulative Impacts

No transboundary cumulative impacts have been identified at the time of writing.

8.19 Community Safety, Security and Welfare

This section describes potential impacts on community safety, security and welfare during construction, commissioning and operation of the EACOP project and associated mitigation measures to be adopted.

There is potential for traffic to impact upon community safety, security and welfare due to project-related road traffic accidents involving PAC members. Road traffic accidents are considered in Section 9, Unplanned Events.

8.19.1 Key Sensitivities and Considerations

The community safety, security and welfare baseline conditions are described in Section 6.4.3.14, as well as:

- community safety, security and welfare key VECs and their sensitivity ranking based on the relevant tables in Appendix D
key considerations for the community safety, security and welfare impact assessment.

Sensitivity in the community safety, security and welfare AOI is ranked as very high for women; cultural attitudes toward women and their role within the household hinders many females in PACs from engaging in income-generating activities and decision-making processes. Widow-headed households and the elderly are ranked as very highly sensitive because they are challenged to meet basic household needs and afford health care. Children are ranked as very highly sensitive, particularly those from poor households and AIDS orphans, who will be less likely to attend school and are more likely to be relied upon to perform household tasks. Youths are also ranked as very highly sensitive because of their limited access to productive assets, lack of education and vocational skills and scarce employment opportunities.

Sensitivity is ranked as high for landless people dependent on subsistence agriculture; they do not have any form of tenure on the land and are therefore vulnerable to loss of land due to the project. Nomadic groups and hunter gatherers are also ranked highly sensitive as they are vulnerable to loss of access to areas where they can graze, hunt and collect wild plants as they have no legal claim on those areas.

Key considerations are:

- there are several vulnerable groups which will need special considerations
- there are increasing security risks
- domestic and gender violence will need to be considered in developing mitigation measures
- community development NGOs and TASAF continue to be active in the districts traversed by the AOI and may be considered as partners in the execution of mitigation measures

Section A11.4.12.3 in Appendix A11 identifies that community safety, security and welfare does not provide any ecosystem services.

The right to life and the right to health are the main human rights at risk. Women’s rights also apply as they are particularly vulnerable to health risks related to interactions with truck drivers along trucking routes. International standards for responsible business also require that negative impacts of projects on communities should be avoided or at least minimised, and for organisations to be prepared to react to emergency situations to prevent and mitigate harm to people and the environment. The UN has proclaimed 2011–2020 the International Decade of Road Safety and has developed documents to address the matter. Traffic safety is described in Section 9, Unplanned Events.

Regarding community security, the right to life can be at risk as well as the related rights to liberty and security of the person and the right to be free from cruel, inhuman or degrading treatment. Women’s rights also apply as they are particularly vulnerable to certain security risks related to EACOP. The Voluntary Principles on Security and Human Rights (VPSHR) are the main reference in terms of security and human rights. International standards for responsible business also require that negative impacts of projects on communities should be avoided or at least
minimised, and that security personnel hired must be chosen and trained to ensure that they are not a threat to persons inside or outside the project.

Regarding community welfare, the right to health, the rights to liberty and security of the person, the right to an adequate standard of living and the right to a healthy environment are all potentially affected by PIIM into communities in the AOI (see Section 4).

8.19.2 Potential Project Impacts

8.19.2.1 Construction

Generic Impacts

Community Safety

Baseline data indicates that PACs are generally not safety conscious. Children often roam freely around the village without adult supervision and may approach the construction sites. Risks to people from project traffic are addressed in Section 9.

Impact: Community health and safety incidents associated with construction activities causing accidents other than traffic accidents

This may lead to direct and indirect impacts.

The project activities that may pose a risk of accidents and injuries include:

- inadequate access control of project sites. This may result in the community gaining entry to construction and other sites and sustaining injuries from accidental interaction with mobile construction equipment or through injuries sustained from falling into excavations, or interaction with construction materials and other environmental changes.
- spills and accidental discharges of hazardous chemical substances (HCS).

The project will utilise different types of HCS in construction to support elements of the project, including:

- insecticides, pesticides and rodenticides to control insect and other vermin such as rats
- chlorine and associated water treatment chemicals used in the treatment of potable water as well as waste water
- materials for construction and maintenance, including paints and solvents as well as flux and welding rods
- domestic cleaning agents.
- petroleum products to support heavy vehicles and light duty vehicles, including diesel fuel, mineral oils, grease, degreasers and so forth
- potentially contaminated surface water including storm water, fire water and wash-down water originating from dirty areas.

Accidental discharge of any of the abovementioned HCS during the construction phase may affect PACs near the spill, through various impact pathways, and deteriorate health in PACs.
The impacts will be short-term and affect some households in the PACs. Owing to their short-term nature and localised extent, before mitigation the impacts are considered not significant.

Community Dynamics
PACs are usually peaceful but conflicts, mostly over land and traditional beliefs, occasionally arise.

Households are tightly knit and highly interdependent with regards to livelihood activities. However, domestic disputes do occur and GBV is common.

Conflicts are predominantly resolved by the parties involved or village councils; when these mechanisms fail, third parties (i.e., the police, local government officers) may get involved. The establishment of formal policing mechanisms in the PACs is minimal but community policing initiatives have expanded in recent years.

Women are typically marginalised with regards to education, employment opportunities, access to and ownership of assets (both land and property) and decision-making. Widows and female-headed households are considered particularly vulnerable and thus women are very highly sensitive VECs to several of the impacts described under this VEC.

Impact: The capturing of project benefits by men leads to a decrease in quality of life and access to resources for women and children in PACs

This may lead to direct and indirect impacts.

Men in the PACs may benefit from employment or compensation payments for loss of assets by the project. Existing cultural and social norms in the project districts favour the available project-related employment opportunities to be allocated to men.

Among PAPs, the main preference for compensation among men tends to be cash payments rather than in-kind compensation. The increased disposable income of men from compensation may not necessarily be used for the benefit of the household. Increased access to cash by men in the PACs may negatively impact on the quality of life of women and children in the household. It may lead to:

- increase in the incidence of social ills such as substance abuse, crime and a rise in GBV with regards to spouses and children
- loss of food security, especially for those households that do not, or no longer, engage in subsistence agriculture and depend on procuring food due to the income being spent on nonfood items.

The impacts may be long-term and will affect some households within the PACs. Poor households where women do not have access to income-earning opportunities are likely to be most affected. Due to their localised extent, before mitigation the impacts are considered not significant.

Impact: Conflict between PACs and project security personnel

This may lead to direct and indirect impacts.
During pipeline construction, security measures will be implemented along the pipeline RoW. Security posts and facilities will be established at pumping stations, along the RoW and at MCPYs.

Dissatisfaction in PACs over lack of project opportunities and benefits may lead to resentment among PAC members and may cause hostility toward project personnel. This could lead to conflict, demonstrations against the project and blockages. Any potential further escalation of conflict may require intervention by the national police force. The use of inexperienced security personnel or local security forces, who have not been adequately trained in the VPSHR, may lead to an escalation of conflict and the inappropriate use of force causing injuries to community members.

Members of PACs involved in ASM are considered sensitive VECs as it may be more difficult to keep them away from known mineral deposits (particularly gold). This may increase the interactions between miners and project security personnel. The impacts will be long-term and will affect entire PACs. Due to their large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

**Location-Specific Benefits**

**Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147) Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)**

**Community Welfare**

Benefit: Conversion of MCPY structures into community facilities, leading to improved service provision in PACs

After construction has been completed, the MCPYs, or some of the camp structures, may be transferred to the government (see Section 2). The government may convert the structures into community facilities (i.e., schools, medical facilities) and manage them on behalf of the host communities. In this case, there may be a positive impact on public service provision in PACs. This may lead to improvements at the household level with regards to living standards, health and education.

There may be a positive impact on the human right to health, education and an adequate standard of living.

The impacts are considered beneficial.
Location-Specific Impacts

Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147) Main Camp and Pipe Yard 14 (Kiteto District, KP1147), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)

The potential generic impacts are applicable to the 38 PACs near the 12 MCPYs and one CF. The following specific impacts are also applicable to these PACs:

Community Dynamics

Impact: Change in local community dynamics due to employment opportunities

This may lead to direct and indirect impacts.

The availability of economic opportunities for some PAC members could create income disparities and prompt a shift in local power dynamics and community structure. Employed youth may begin to challenge established local hierarchies and leadership structures, potentially resulting in a decline in community social cohesion. This may cause deterioration in well-being at the community level and a sense of insecurity and distrust among PAC members.

Women are considered sensitive VECs as their employment may challenge household and community power structures. Marital clashes may occur where spousal support for women's employment in the project is absent.

The impacts will be medium-term and will affect the entire PACs. Due to their small extent, before mitigation the impacts are considered not significant.

Impact: PIIM causing an increase in social ills.

This may lead to indirect impacts.

PIIM is likely to occur in areas and PACs where the potential for employment is perceived to be higher and other indirect benefits of the project may be anticipated. The PIIM of job seekers may result in a loss of social cohesion and traditional values and structures in these PACs which, in turn, may cause an increase in social ills (e.g., substance abuse, crime, commercial sex work, unplanned pregnancies and so forth).

Substance abuse is a significant contributor to social ills and gender-based domestic violence, as well as influencing crime and practices such as transactional sex and commercial sex work.

The impacts will be short-term and will affect the entire PACs. Women, commercial sex workers and vulnerable groups (e.g., the elderly, disabled) will be particularly vulnerable. Due to their short-term nature and small extent, before mitigation the impacts are considered not significant.
Impact: Tensions between nonlocal construction workforce and PACs
This may lead to direct and indirect impacts.
A proportion of project workers will be nonlocal and will belong to different ethnic groups and nationalities that have different cultural traditions and values from the PACs. These workers will be housed in the MCPYs near PACs and their lack of local social ties may encourage anti-social behaviour, causing tension and potentially conflict with PAC members.

The impacts will be short-term and will affect the entire PACs. Due to their short-term nature and small extent, before mitigation the impacts are considered not significant.

**Pumping Station 3 (Muleba District, KP405.4), Pumping Station 4 (Mbogwe District, KP610), Pumping Station 5 (Igunga District, KP824.8) and Pumping Station 6 (Singida District, KP931)**

The potential generic impacts are also applicable to the eight PACs near the four pumping stations.

**Pressure Reduction Station 1 (Kiteto District, KP1172) and Pressure Reduction Station 2 (Handeni District, KP1330)**

The potential generic impacts are also applicable to the three PACs near the two pressure reduction stations.

**Marine Storage Terminal and Load-Out Facility (Tanga District)**

The potential generic impacts are also applicable to PACs near the MST and LOF. The following generic impact may be more likely in Mleni mtaa (KP1429), Mabokweni mtaa (KP1435), Helani hamlet (KP1437), Putini mtaa (KP1441.5) and Chongoleani mtaa (KP1442.5):

**Community Dynamics**

Impact: Conflict between PACs and project security personnel
This may lead to direct and indirect impacts.

During construction of the LOF, specific security measures will be applied to enable offshore construction activities to be safely undertaken, including the establishment of a 50-m construction exclusion zone before the establishment of the permanent 500-m marine exclusion zone (MEZ) for operations.

Residents of these PACs use the proposed LOF area for access to fishing grounds, fish landing sites and fish markets in the Tanga Bay area. Due to the construction exclusion zone, these PACs may experience difficulties in accessing their fishing grounds. This may increase the potential for conflict between PAC members and project security personnel, particularly those who rely on fishing as their main source of livelihood (impacts of the MEZ on marine-based livelihoods in these PACs are described in Section 8.14). Fisherfolk are therefore deemed to be highly sensitive VECs to this impact.
The impacts will be long-term and will affect the entire PACs. Owing to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

8.19.2.2 Operation

Generic Impacts

There are no generic impacts during pipeline, AGI, MST and LOF operation. Security provision during operations will be in accordance with international and project requirements.

Location-Specific Impacts

Road safety, including for pedestrians near the MST and manned pumping stations, is considered in Section 9.

Marine Storage Terminal and Load-Out Facility (Tanga District)

Owing to the permanence of the 500-m MEZ, the following generic impact, described for construction, is applicable to Mleni mtaa (KP1429), Mabokweni mtaa (KP1435), Helani hamlet (KP1437), Putini mtaa (KP1441.5) and Chongoleani mtaa (KP1442.5) during MST and LOF operation:

Community Dynamics

Impact: Conflict between PACs and project security personnel

This may lead to direct and indirect impacts.

The impacts will be long-term and will affect the entire PACs. Owing to their very large magnitude and very high sensitivity, before mitigation the impacts are considered significant.

8.19.3 Mitigation Measures

This section describes the enhancement measures and impact avoidance and mitigation measures that will be applied to the aspects and activities that could affect community safety, security and welfare.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management plan and other measures that are included in Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.

8.19.3.1 Design

Generic Mitigation Measures

As described in Section 3, Alternatives, route identification for the pipeline has considered social aspects relating to community safety, security and welfare such as minimising impacts on settlements, social and community infrastructure (including places of worship) and security. The selected pipeline route was chosen
partly because it had the lowest number of social constraints of the routing options available.

**Location-Specific Mitigation Measures**

There are no location-specific mitigation measures relating to the design of the construction facilities, pipeline, AGIs, MST and LOF.

**8.19.3.2 Construction**

**Generic Mitigation Measures**

Mitigation measures relating to road safety, including for pedestrians, are described in Section 9.

**Community Safety**

Impact: Community health and safety incidents associated with construction activities causing accidents other than traffic accidents

The community health, safety and security plan, occupational health, safety and security plan and the stakeholder engagement plan will include measures to manage incidents. Regular meetings will be held with PAC representatives during construction to provide updates on construction progress and to receive comments or queries. In addition, specific measures will be implemented including, but not limited to:

- Construction barriers will have visible warning signs understandable by local communities. Signage will be in accordance with internationally accepted symbols and/or be well known to local communities.
- Welded pipe sections will be capped to prevent people entering a risk assessment will be conducted for excavations with consideration to community safety
- A first aid needs assessment will be undertaken for each camp to determine first aider and first aid kit requirements (e.g., qualifications, content of kits, locations).

Application of these mitigation measures will reduce the magnitude of impact from very large to small and the residual impact is not significant.

**Community Dynamics**

Impact: The capturing of project benefits by men leads to a decrease in quality of life and access to resources for women and children in PACs.

The community health, safety and security plan, stakeholder engagement plan, labour management plan and the resettlement action plan will include measures that contribute to management of project benefits.

Financial management workshops will be held with workers to raise levels of financial literacy. During the recruitment process and throughout their contract, workers will be advised regularly that the duration of their employment is temporary and that they should maintain their existing livelihoods and prepare for the termination of their employment.
An information, education and communication programme will be developed for workers addressing social conduct and including topics such as gender-based violence and drug and alcohol misuse.

In relation to resettlement, during the land surveys, entitlement briefings and compensation agreement, both spouses will be consulted and present and both will sign the compensation agreements.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the duration of impact from long-term to short-term. The residual impact is not significant.

Impact: Conflict between PACs and project security personnel

The community health, safety and security plan and stakeholder engagement plan will include measures to manage conflicts with security personnel.

The Voluntary Principles on Security and Human Rights will be implemented by the project. Security personnel (this will include where army and / or security forces engaged by the project) will receive training and their performance in relation to VPSHR compliance will be monitored.

Public awareness programmes for stakeholders will include information on the security presence around camps and security protocols which apply. The project grievance procedure will be available for grievances related to security considerations.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the duration from long-term to short-term. The residual impact is not significant.

**Location-Specific Mitigation Measures**

Main Camp and Pipe Yard 5 (Missenyi District, KP326), Main Camp and Pipe Yard 6 (Muleba District, KP419), Main Camp and Pipe Yard 7 (Chato District, KP513), Main Camp and Pipe Yard 8 (Bukombe District, KP595), Main Camp and Pipe Yard 9 and Coating Facility (Nzega District, KP701-02), Main Camp and Pipe Yard 10 (Igunga District, KP800), Main Camp and Pipe Yard 11 (Singida District, KP915), Main Camp and Pipe Yard 12 (Kondoa District, KP1038), Main Camp and Pipe Yard 13 (Kiteto District, KP1147) Main Camp and Pipe Yard 14 (Kilindi District, KP1238), Main Camp and Pipe Yard 15 (Handeni Town, KP1318) and Main Camp and Pipe Yard 16 (Muheza District, KP1404)

Community Dynamics

Impact: Change in local community dynamics due to employment opportunities and

Impact: PIIM causing an increase in social ills

The following mitigations will be included in the PIIM management plan, community health, safety and security plan and the stakeholder engagement plan to contribute to the management of local community dynamics and PIIM causing an increase in social ills.
A PIIM management plan will be developed and implemented for the project with the aim of reducing the number of people that arrive into PACs and mitigating the impacts of PIIM that does occur.

The grievance procedure will be communicated to and promoted within all PACs and it will be clearly communicated to PACs that complaints related to PIIM will be addressed.

For the impact changes in local community dynamics due to employment opportunities, application of these mitigation measures will reduce the magnitude of impact from medium to small and the duration of impact from medium-term to short-term. The residual impact is not significant.

For the impact of PIIM causing an increase in social ills, application of these mitigation measures will reduce the magnitude of impact from medium to small and the residual impact is not significant.

Impact: Tensions between nonlocal construction workforce and PACs

The community health, safety and security plan, stakeholder engagement plan and the resettlement action plan will include measures that contribute to management of community – workforce tensions.

A workers’ code of conduct outlining expected worker behaviours will be developed and implemented. This code of conduct will cover the interaction between the national and international workforce and local workforce but also interactions with PAC members not employed by the project. Compliance with the workers’ code of conduct will be a contractual requirement for all contractors, including subcontractor employees.

Application of these mitigation measures will reduce the magnitude of impact from large to small and the residual impact is not significant.

**Pumping Station 3 (Muleba District, KP405.4), Pumping Station 4 (Mbogwe District, KP610), Pumping Station 5 (Igunga District, KP824.8) and Pumping Station 6 (Singida District, KP931)**

The generic mitigation measures are also applicable to the eight PACs near the four pumping stations.

**Pressure Reduction Station 1 (Kiteto District, KP1172) and Pressure Reduction Station 2 (Handeni District, KP1330)**

The generic mitigation measures are also applicable to the three PACs near the two pressure reduction stations.

**Marine Storage Terminal and Load-Out Facility (Tanga District)**

The generic mitigation measures are also applicable to PACs near the MST and LOF. The following additional location-specific mitigation measures are recommended for Mleni mtaa (KP1429), Mabokweni mtaa (KP1435), Helani hamlet (KP1437), Putini mtaa (KP1441.5) and Chongoleani mtaa (KP1442.5):
Community Dynamics

Impact: Conflict between PACs and project security personnel.

The community health, safety and security plan, stakeholder engagement plan and resettlement action plan will include measures that contribute to the management of community – security personnel conflicts.

These management plans will be developed consistent with the Voluntary Principles on Security and Human Rights, other relevant international standards and address interactions with fisherfolk, agreements and protocols governing interactions between public and private security forces.

The project will liaise with fishermen and marine users to provide information on the construction activities, the construction vessel routes, and to notify them of the construction exclusion zones and their implementation for safety reasons.

Application of these mitigation measures will reduce the magnitude of impact from very large to small and the duration of impact from long-term to short-term. The residual impact is not significant.

8.19.3.3 Operation

Generic Mitigation Measures

As there are no predicted generic impacts for pipeline, AGI, MST and LOF operation, no mitigation measures are required.

With Respect to Human Rights

The labour management plan, occupational health, safety and security plan and, the community health, safety and security plan will ensure that project performance regarding the Voluntary Principles on Security and Human Rights will be reviewed and performance improvement addressed where necessary.

Location-Specific Mitigation Measures

MST and LOF (Tanga District)

The following location-specific mitigation measures are recommended for Mleni mtaa (KP1429), Mabokweni mtaa (KP1435), Helani hamlet (KP1437), Putini mtaa (KP1441.5) and Chongoleani mtaa (KP1442.5):

Community Dynamics

Impact: Conflict between PACs and project security personnel.

The community health, safety and security plan, stakeholder engagement plan and resettlement action plan will include measures that contribute to the management of community – security personnel conflicts.

These management plans will be developed consistent with the Voluntary Principles on Security and Human Rights, other relevant international standards and address interactions with fisherfolk, agreements and protocols governing interactions between public and private security forces.
The project will liaise with fishermen and marine users to provide information on the construction activities, the construction vessel routes, and to notify them of the construction exclusion zones and their implementation for safety reasons.

Application of these mitigation measures will reduce the magnitude of impact from very large to small and the duration of impact from long-term to short-term. The residual impact is not significant.

### 8.19.4 Residual Impacts and Significance Summary

This section summarises the residual impacts on community safety, security and welfare after mitigation measures have been implemented.

Table 8.19-1 summarises the potential generic community safety, security and welfare impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation.

Table 8.19-2 summarises location-specific impacts.

After mitigation has been implemented, the potential residual impacts on community safety, security and welfare are considered not significant.

### 8.19.4.1 Ecosystem Services

Section A11.4.12.4 in Appendix A11 identifies that community safety, security and welfare does not provide ecosystem services.
### Table 8.19-1 Community Safety, Security and Welfare – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Safety</td>
<td>Community health and safety incidents associated with construction activities causing accidents other than traffic accidents</td>
<td>C</td>
<td>Y</td>
<td>Community health, safety and security plan, Occupational health, safety and security plan, Stakeholder engagement plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>Community Dynamics</td>
<td>The capturing of project benefits by men leads to a decrease in quality of life and access to resources for women and children in PACs</td>
<td>C</td>
<td>Y</td>
<td>Community health, safety and security plan, Stakeholder engagement plan, Labour management plan, Resettlement action plan</td>
<td>4 2 1 5 12</td>
</tr>
<tr>
<td>Community Dynamics</td>
<td>Conflict between PACs and project security personnel</td>
<td>C</td>
<td>-</td>
<td>Community health, safety and security plan, Stakeholder engagement plan</td>
<td>4 2 2 5 13</td>
</tr>
</tbody>
</table>

NOTES: C = construction; O = operation; C&O = construction and operation; B = beneficial impact; M = magnitude of impact; D = duration of impact; E = extent of impact; S = sensitivity; SS = significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
### Table 8.19-2 Community Safety, Security and Welfare – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location</th>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACs near the 12 MCPYs and one CF</td>
<td>Community Welfare</td>
<td>Conversion of MCPY structures into community facilities, leading to improved service provision in PACs</td>
<td>C</td>
<td>Y</td>
<td>Project-induced in-migration management plan</td>
<td>B</td>
</tr>
<tr>
<td>PACs near the 12 MCPYs and one CF</td>
<td>Community Dynamics</td>
<td>Change in local community dynamics due to employment opportunities</td>
<td>C</td>
<td>Y</td>
<td>Project-induced in-migration management plan</td>
<td>4 2 2 4 12</td>
</tr>
<tr>
<td>PACs near the 12 MCPYs and one CF</td>
<td>Community Dynamics</td>
<td>PIIM causing an increase in social ills</td>
<td>C</td>
<td>Y</td>
<td>Project-induced in-migration management plan</td>
<td>4 2 2 4 12</td>
</tr>
<tr>
<td>PACs near the 12 MCPYs and one CF</td>
<td>Community Dynamics</td>
<td>Tensions between nonlocal construction workforce and PACs</td>
<td>C</td>
<td>Y</td>
<td>Project-induced in-migration management plan</td>
<td>4 2 2 5 13</td>
</tr>
<tr>
<td>Mleni mtaa, Mabokweni mtaa, Helani hamlet, Putini mtaa and Chongoleani mtaa (KP1429 to 1442.5)</td>
<td>Community Dynamics</td>
<td>Conflict between PACs and project security personnel</td>
<td>C &amp; O</td>
<td>-</td>
<td>Project-induced in-migration management plan</td>
<td>4 2 2 5 13</td>
</tr>
</tbody>
</table>

**NOTES:** C= construction; O= operation; C&O= construction and operation; B= beneficial impact; M= magnitude of impact; D= duration of impact; E= extent of impact; S= sensitivity; SS= significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity.
8.19.5 Transboundary Project Impacts

8.19.5.1 Generic Transboundary Project Impacts
No generic transboundary project impacts have been identified in relation to community safety, security and welfare.

8.19.5.2 Location-Specific Transboundary Project Impacts
No location-specific transboundary project impacts have been identified in relation to community safety, security and welfare.

8.19.6 Cumulative Impacts

Section 6.4.3.14 describes the baseline condition of community safety, security and welfare, the trends and sensitivity to change. Table 8.19-1 and Table 8.19-2 summarise project residual impacts.

Crime in Tanzania, including in the sample PACs, is on the rise, however community policing has been established to help curb the increase. Gender-based violence also constitutes a significant and growing problem.

Section 8.19.2 describes the project impacts on community safety, security and welfare. The project impacts which may contribute to cumulative impacts include:

- potential increase in social ills (e.g., crime, drug use, alcoholism, commercial sex work, gender-based violence and unplanned pregnancies) due to PIIM
- change in community dynamics due to employment opportunities.

Third-party developments in the AOI of the EACOP project are shown in the cumulative impacts matrix, described and mapped in Appendix H. The developments are:

- Ngono dam (TZ04)
- Geita airport (TZ05)
- transmission line construction (TZ14)
- extension water supply project from Lake Victoria to Tabora, Nzega and Igunga (TZ16)
- road upgrade (TZ27)
- waste facility (TZ28)
- mining concessions (TZ34).

No cumulative impacts with the associated facilities were identified.

The preferred condition is no increase in social ills and no change in social cohesion and community wellbeing following the completion of construction.

8.19.6.1 Cumulative Impacts

The potential cumulative impacts will mainly arise between EACOP project and third parties with large labour forces and similar construction timelines. Table 8.19-3 shows third-party developments, EACOP AGIs and MCPYs and the districts/wards that may be impacted.
Table 8.19-3  Cumulative Impacts: Community Safety, Security and Welfare

<table>
<thead>
<tr>
<th>ID</th>
<th>Project</th>
<th>Nearest KP</th>
<th>MCPY/AGI</th>
<th>Ward or District Potentially Impacted</th>
</tr>
</thead>
<tbody>
<tr>
<td>TZ04</td>
<td>Ngono dam</td>
<td>333.5</td>
<td>MCPY5 (approximately 6 km from T204)</td>
<td>Kayaka, Kilimilil and Mushaha wards Missenyi district</td>
</tr>
<tr>
<td>TZ05</td>
<td>Geita airport</td>
<td>498.5</td>
<td>MCPY7 (approximately 13 km from T205)</td>
<td>Katende and Bukombe wards, Chato district</td>
</tr>
<tr>
<td>TZ14</td>
<td>Transmission line construction</td>
<td>955.5–956</td>
<td>Transmission line crosses the pipeline at KP955</td>
<td>Singida urban district and Singida district</td>
</tr>
<tr>
<td>TZ16</td>
<td>Extension water supply project from Lake Victoria to Tabora, Nzega and Igunga</td>
<td>730–819.5</td>
<td>MCPY10 (approximately 2 km from TZ16). Pipeline runs parallel to EACOP and crosses the pipeline</td>
<td>Nanga ward Ingunga district</td>
</tr>
<tr>
<td>TZ27</td>
<td>Road upgrade Handeni to Singida</td>
<td>1061 and 1080</td>
<td>MCPY13 (approximately 12 km from TZ27) and crosses the pipeline</td>
<td>Serya, Suruke, Kingale, Chemchem, Kilimani, Kondoa and Mjini wards, Kondoa district</td>
</tr>
<tr>
<td>TZ27</td>
<td></td>
<td>1230–1240</td>
<td>MPCR14 (approximately 15 km from TZ27)</td>
<td>Kibirashi ward Kilindi district Loolera ward Kiteto district</td>
</tr>
<tr>
<td>TZ28</td>
<td>Mpirani waste facility</td>
<td>1437.5</td>
<td>MST (approximately 5 km from TZ28)</td>
<td>Chongoleani, Mabokweni wards (and wards of Tanga city), Tanga district</td>
</tr>
</tbody>
</table>
| TZ34 | Mining concessions                                                       |            | Features along the pipeline route:  
  - Kasharunga and Karambi ward, Muleba district  
  - Bukome ward with Chato district  
  - Bukombe ward in Bukombe district  
  - Igusule ward in Nzega district  
  - Nanga ward in Igunga district  
  - Serya ward in Kondoa district  
  - Loolera ward and Njoro wards in Kiteto district  
  - Mabanda in Handeni Township Authority  
  - Kibirashi in Kilindi district |

**PIIM and Social Ills**

Multiple projects in close vicinity may encourage PIIM that is larger than PIIM created by the EACOP project alone. This could exacerbate social ills. Increased PIIM induced social ills may occur if projects are constructed consecutively but may also occur if they are constructed sequentially which would extend the duration of the effects. Exacerbated effects on social ills may occur anywhere where the EACOP project and third-party developments overlap in terms of activities and
interactions with PACs. However, the areas that are most susceptible to cumulative impacts on community welfare are the wards and PACs in which both the EACOP project and the third-party developments have construction camps as these have the greatest attraction for opportunistic job seekers and entrepreneurs.

Cumulative impacts are most likely to occur in the following PACs:

- Missenyi, Bulifani and Kashaba, because of cumulative impacts from the Ngono water project and the EACOP project. The Ngono project will have a peak construction workforce of 1400 people. The EACOP project will include 2000 workers per spread including 200 unskilled workers.
- Chato and Mkungo, because of cumulative impacts from Geita Airport and the EACOP project. The construction workforce for Geita airport is estimated to be smaller than for the EACOP project.
- Singida, because of cumulative impacts from the transmission line project and the EACOP project. The construction workforce for the transmission line is estimated to be smaller than that of the EACOP project.
- Bulyang’ombe village, because of cumulative impacts from the water pipeline project and the EACOP project. It is estimated that the workforce for the water pipeline may be as large as that of the EACOP project.
- Kondoa, Seye and Gitu, because of cumulative impacts from the Handeni and Singida road upgrade and the EACOP project. The construction workforce for the road upgrades is estimated to be smaller than for the EACOP project.
- Mabokweni, Putini, Ndaoya, Bagamoyo and Tanga city, because of cumulative impacts from the Miprani waste facility and the EACOP project. A construction workforce similar to that of the EACOP project is estimated for the waste facility.

The project will engage proponents of the third-party developments and relevant government agencies to consider options for management measures to address significant cumulative impacts. This may include collaboration to combat potential increase of social ills.

With the mitigation measures implemented, the preferred condition will be achieved and the residual cumulative impact is considered not significant.

Community Dynamics

The presence of multiple projects in an area, provides opportunities for employment and entrepreneurship and can prompt a shift in community dynamics. The employed youths, may begin to challenge established local hierarchies and leadership structures, potentially leading to a decline in social cohesion and deterioration in well-being at PAC level or potentially providing an impetus for positive community change.

A change in community dynamics will be unlikely if employment and business opportunities are short term. This would be the case for projects which will be labour intensive, but only for a short period (such as the EACOP project) and where the construction schedules of the EACOP project and the third-party developments are the same. If, however the construction phases are consecutive, or where there will be a permanent large labour force, the potential for change will be higher. Change may therefore be experienced in the same PACs as listed above for PIIM and social ills.
As insufficient data was available at the time of writing on exact construction schedules, construction camps and labour force of the mining concessions no detailed analysis could be conducted with regards to specific PACs being impacted. The project will engage proponents of the third-party developments and appropriate government agencies to consider options for management measures to address significant cumulative impacts. This may include alignment in terms of stakeholder engagement approaches to manage community dynamics.

With the additional mitigation measure implemented, the preferred condition will be achieved and the residual cumulative impact is considered not significant.

8.20 Tangible and Intangible Cultural Heritage

This section describes the potential impacts on tangible and intangible cultural heritage during construction, commissioning and operation of the EACOP project and associated mitigation measures to be adopted.

8.20.1 Key Sensitivities and Considerations

Cultural heritage baseline is described in Section 6.4.3.16 and includes:

- key VECs and their sensitivity, ranked according to Table D38, Appendix D
- key considerations for cultural heritage.

The baseline and impact assessment include three categories of cultural heritage:

- Category 1 – tangible cultural heritage (TCH):
  - archaeological sites
  - areas of high archaeological potential
- Category 2 – tangible cultural heritage with strong intangible elements:
  - cemeteries and graves
  - religious places where worship associated with the main established religions is practised (such as churches or mosques)
- Category 3 – intangible cultural heritage (ICH) with a less well-defined tangible component:
  - sites with an intangible component and/or traditional value; the importance of which is not always a factor of geography but of belief and ritual. Such sites may be used for music making, dancing, storytelling and other rituals. This category may also include rituals that are not linked to any particular site, but to a particular group of people.

The impact of the project on a Category 1 or Category 2 site may be more objectively measurable and thus allowing impact identification based on the methodology presented in Section 5. Sites and features identified as Category 1 were ranked as low or high sensitivity and Category 2 as moderate or high sensitivity in the baseline study. However, the significance of a Category 3 VEC is defined by the local community who visit, use or engage in an intangible practice that is not objectively measurable. It takes time to develop relationships of confidence and trust to establish the sensitivity associated with intangible cultural heritage, making it a challenge to acquire a sense of importance to the communities.
in the time available when a baseline survey is conducted. In general, due to their value to communities, these intangible features are considered to have high sensitivities.

Tanzania’s long and complex history is reflected in the identified TCH and ICH within the study area. The key considerations are as follows:

- The tangible and intangible cultural heritage identified is considered a representative sample. The sample represents the full range of features for categories 1, 2 and 3 likely to be encountered, though there is less certainty for Category 3.
- Cemeteries are the most common Category 2 sites.
- No known nationally or internationally designated sites or critical cultural heritage have been identified.
- Forty-four high sensitivity Category 1 and 2 features are within the AOI of which 26 (24 cemeteries and 2 archaeological sites) are within the RoW.
- The remaining 95 Category 1 and 2 features within the AOI are low or moderate sensitivity.
- Category 3 is closely linked to individual and group identity and therefore sensitive to cultural change.
- Many more features are likely to be identified in the AOI.
- Identification of further Category 3 features requires active participation of local key informants based on establishing a sufficient degree of trust.

Based on professional experience and opinion, and a precautionary principle that acknowledges that archaeological sites may be unique even if superficially similar to others, the definition adopted by the project is that tangible cultural heritage is a finite resource and loss is considered nonreplicable. This is at variance with the IFC definition but considered more conservative (see Section 6.4.3.16).

As described in Section 8.13.1, there are several groups that may be considered indigenous peoples according to international standards. The project is proactively seeking to identify where the project may have potential impacts on indigenous peoples’ rights with regard to cultural heritage. Survey work of tangible and intangible cultural heritage will be undertaken and the project will then be able to understand if Performance Standard 7 is triggered. Until that point, the objective of the project is to reinforce engagement with such groups to ensure their understanding of the project and for the project to understand their concerns.

The Convention for the Protection of the World Cultural and Natural Heritage, 1972 and the UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage refer to international human rights in respect of tangible and intangible cultural heritage and the importance of:

- the tangible and intangible cultural heritage as mainsprings of cultural identity and diversity
- maintaining access to and right to practice traditional cultural heritage and beliefs.
8.20.2 Potential Project Impacts

8.20.2.1 Introduction

Appendices E2 and E3 include all pre-mitigation and post-mitigation generic and location-specific impacts. This includes two types of construction and operational impacts, those from construction facilities and those from the pipeline and AGIs. For impacts on cultural heritage, the construction facility and pipeline and AGI impacts have been aggregated and are described as either construction or operation impacts. If a construction facility or pipeline and AGIs impact was greater than the other before the aggregation, the greater impact was applied. If a pre-mitigation or post-mitigation impact was determined to be significant, it is noted in the text when the other aggregated impact is not significant. All disaggregated impacts are included in Appendices E2 and E3.

8.20.2.2 Construction

Generic Impacts

Disturbance or Loss of Cultural Heritage

Benefit: Increased knowledge of tangible and intangible cultural heritage; employment of people to survey and investigate cultural heritage affected by the project

The pre-construction cultural heritage surveys and investigation and management activities will provide additional information for Category 1 and 2 sites and a better understanding of Category 3 by both internal and external parties. Publication of the TCH results may bring positive benefits, increasing the understanding and awareness of Tanzanian history and development both inside and outside Tanzania.

A further benefit will be the employment of people to undertake tangible and intangible cultural heritage surveys and research.

Impact: Damage, disturbance or disruption of access of unknown Category 1 or 2 cultural heritage

Impact: Damage, disturbance or disruption of access of unknown Category 3 cultural heritage

There is the potential for damage or disturbance, including disruption of access, to previously unknown TCH and ICH discovered during pre-construction surveys or construction. TCH may include evidence of previous settlement and graves. ICH may include meeting places, sacred natural sites, rivers or ceremonial ways, traditional dance, rituals, traditional healing and syncretism31.

The significance of the impact on TCH pre-mitigation will depend on the find and the extent of the damage or disturbance but could range from not significant to significant. A qualitative assessment of the significance of ICH has been

31 Syncretism is the amalgamation of established religions (Islam and Christianity) and traditional African belief systems.
undertaken, for the reasons described in Sections 8.20.1 and 5.6.2.5. In general, owing to the sensitivity of practices at the community level, pre-mitigation impacts should be considered significant.

Location-Specific Impacts

Location: Known Category 1 and Category 2 Tangible Cultural Heritage Locations

Impact: Damage, disturbance or disruption of access of known Category 1 and Category 2 tangible cultural heritage

The following activities have the potential to cause damage or disturbance of the various Category 1 or 2 cultural heritage features identified in Table 8.20-2:

- removal of vegetation from the project footprint
- ground disturbance including:
  - the removal of topsoil and subsoil
  - levelling of the RoW at construction facilities and AGIs
  - excavation of the pipe trench
  - excavation for foundations, utilities or drainage at construction facilities and AGIs
- operation of construction equipment
- traffic movement.

The potential impacts are direct damage or disturbance including:

- physical damage of sites, including from noise, vibration and dust due to plant, equipment and heavy vehicles
- noise and visual intrusion on people’s appreciation of cultural heritage
- disruption of access to cultural heritage sites.

Impacts will be restricted to the footprint or the AOI, which extends to 100 m around the project footprint. It is unlikely that there will be discernible effects from noise, vibration or dust or restriction of access beyond this distance, but this will be checked as part of the proposed programme of cultural heritage construction planning survey and assessment, based on the impact assessment for noise and air emissions and additional engineering studies for noise and air emissions.

Impacts to Category 1 and 2 cultural heritage are generally negligible to small magnitude and limited in extent. The sensitivity varies from low to high, with high scores usually associated with Category 2 cultural heritage, owing to the social and religious sensitivity of some features. Impacts are not significant, pre-mitigation with one exception (a grave directly on the pipeline (site CHT301, KP1030.4), see Appendix E, Table E3). Impacts on Category 1 and 2 features may also lead to impacts on community safety and security, through generation of conflict or dissent and community health. These are discussed in Section 8.19.
**Location: Known Category 3 Intangible Cultural Heritage Locations**

Impact: Damage, disturbance or disruption of access of known Category 3 intangible cultural heritage

Construction has the potential to alter or change traditional cultural practices and belief systems that are tied to identity, but are not represented by any specific tangible place, entity or community structure. This can refer to a connection with the landscape (e.g., sacred trees, as in Category 2) or traditional cultural practices including ritual practices such as dance and traditional healing techniques if associated with a site.

The following activities have the potential to cause damage or disturbance of the various Category 3 sites, features, traditional practices, rituals and beliefs identified in Table 8.20-2:

- removal of vegetation from the project footprint
- ground disturbance from installation of the pipeline, construction facilities and AGIs
- project-induced in-migration (PIIM) of construction workers from outside communities
- resettlement of dwellings
- failure to address all the belief systems within a community leading to alienation of some groups.

The potential impacts are direct and indirect damage or disturbance of traditional beliefs and practices covering:

- physical damage of cultural heritage sites
- loss or change of identity or significance of the intangible cultural heritage
- effects of noise and visual intrusion on communities’ abilities to appreciate and use their ICH
- disruption of access to cultural heritage assets leading to loss of ability to practise traditional beliefs, rituals, dance and healing
- disruption or diminution of cultural ecosystem services including, customary ways of understanding the wider world and for maintaining social relations and group identity.

Local communities did not always comment on the value that they place on intangible cultural heritage (although where there were comments, the value was always ‘very high’), and this, in addition to any concerns they may have about relocating intangible or spiritual values, will vary. Therefore, a qualitative assessment of impacts on ICH is provided. The impacts to ICH will be transient to short-term but owing to the sensitivity of practices at the community level, pre-mitigation impacts should be considered significant.

Impacts of PIIM of job seekers on community cohesion, and traditional values and structures, are assessed in Section 8.19.
8.20.2.3 Operation

Generic Impacts

Disturbance or Loss of Cultural Heritage

Impact: Damage or disturbance of Category 1 and Category 2 tangible cultural heritage

During operations there may be a need to implement soil-erosion prevention measures. These activities carry a low risk of inadvertently exposing new sites or portions of previously known sites that were not previously affected and mitigated as activities may extend to areas outside the RoW.

Impacts will be restricted to areas close to the footprint, for example, eroded slope or bank of watercourse immediately adjacent to the RoW and are likely to range from not significant to significant pre-mitigation.

Impact: Damage or disturbance of Category 3 intangible cultural heritage

Effects on ICH may also occur. For example, there is low risk of impacts related to the presence of camps at PS3, PS5 and the MST or the use of the RoW for ICH activities, but none have been identified at the time of writing; or effects on intangible elements of erosion control works. Effects are likely to be not significant, pre-mitigation.

Location-Specific Impacts

No specific impacts have been identified.

8.20.3 Mitigation Measures

This section describes the avoidance and mitigation measures that will be applied to the aspects and activities that could affect cultural heritage.

Typically, it is not a single mitigation that reduces an impact but the application of several mitigations that all contribute to the management of an impact. The key mitigation measures presented in this section, and the associated management plan and other measures that are included in Appendix E4, have been collectively used to assess residual impacts, and to determine their significance.

8.20.3.1 Design

Generic Mitigation Measures

As described in Section 3, Alternatives, route identification for the pipeline has considered cultural heritage aspects. The selected route including the portion of the Tanzania pipeline avoided known cultural heritage sites identified during route selection.

Location-Specific Mitigation Measures

There are no location-specific mitigation measures relating to the design of the construction facilities, pipeline, AGIs, MST and LOF.
8.20.3.2 Construction

**Generic Enhancement Measures**

Disturbance or Loss of Cultural Heritage

Benefit: Increased knowledge of tangible and intangible cultural heritage; employment of people to survey and investigate cultural heritage affected by the project.

The cultural heritage management plan will include measures that support the increase in knowledge of tangible and intangible cultural heritage. Such measures could include working in conjunction with the Division of Antiquities to ensure that findings are shared within the cultural heritage expert community and programmes are implemented to share findings with a wider audience.

**Generic Mitigation Measures**

Disturbance or Loss of Cultural Heritage

Impact: Damage, disturbance or disruption of access of unknown Category 1 or Category 2 tangible cultural heritage

Impact: Damage, disturbance or disruption of access of unknown Category 3 intangible cultural heritage

The cultural heritage management plan will include measures to manage impacts on unknown resources.

The cultural heritage management plan will be implemented in agreement with government authorities in advance of construction.

Regular meetings will be scheduled with government authorities and appropriate community leaders.

The key mitigation measures are the implementation of a pre-construction survey, including consultations with community leaders, to identify the location and extent of previously unknown cultural heritage resources. The results of the survey will be used to inform location-specific actions. This will be supported by the implementation of the chance finds procedure to address finds during construction. Appropriate management actions will be implemented for chance finds in line with the cultural heritage management plan. Such actions may include preservation by photo-record, excavation by suitably qualified and approved archaeologists in accordance with government authorisations, relocation of graves and maintenance of access to cultural heritage assets.

Awareness training will be given to project personnel and collection of cultural heritage artefacts for their own use will be prohibited. Decompaction/ripping or other ground disturbance activities will be planned to avoid cultural heritage features preserved in situ.

Although the pre-mitigation impact on unknown Category 1 and 2 cultural heritage could be either significant or not significant depending on the site or asset, the residual impact should be not significant, with the reduction of significance depending on the method chosen. For example, the duration of impacts on graves...
or cemeteries could be reduced from permanent to transient due to relocation. At other sites, the magnitude of impact could be reduced if access is maintained. Sensitivity may increase or decrease depending on the information gained as the site or asset is assessed. If sensitivity increases this will lead to the investigation of further mitigation to reduce the magnitude of impacts. As mitigation measures will not be known until sites are identified, a range of significance scores has been included in the Appendix E2 and Table 8.20-1.

Although pre-mitigation impacts on unknown Category 3 intangible cultural heritage should be considered significant the application of the proposed mitigation measures should reduce the residual impact to not significant by reaching agreement with local communities on ways to avoid or manage effects such that access or enjoyment of the ICH is not affected.

Location-Specific Mitigation Measures

Location: Known Category 1 and Category 2 Tangible Cultural Heritage Features

Impact: Damage, disturbance or disruption of access of known Category 1 and Category 2 tangible cultural heritage features

The cultural heritage management plan will manage damage or disturbance to cultural heritage resources.

A pre-construction survey will be undertaken to collect more data on the location, extent and sensitivity of known cultural heritage to assist in the development of location specific mitigation measures, including micro rerouting, preservation by photo-record, excavation by suitably qualified and approved archaeologists in accordance with government authorisations, relocation of graves and maintenance of access to cultural heritage assets.

Although with one exception, the pre-mitigation impact is considered not significant, the application of the above measures should further reduce impacts, depending on the method chosen. The duration of impacts on graves or cemeteries will be reduced from permanent to transient due to relocation. At other sites, the magnitude of impact will be reduced if micro rerouting is undertaken or access maintained. Sensitivity may increase or decrease depending on the information gained during the pre-construction survey. If sensitivity increases this will lead to the investigation of further mitigation to reduce the magnitude of impacts. As mitigation measures will not be finalised until the preconstruction survey has been undertaken, the pre-mitigation and residual magnitude and sensitivity scores are the same in Appendix E3 and Table 8.20-2.

The residual impact of the one significant impact is reduced to not significant due to relocation of the grave.

Location: Known Category 3 Intangible Cultural Heritage

Impact: Damage, disturbance or disruption of access of known Category 3 intangible cultural heritage or disruption of access
The cultural heritage management plan will include measures that contribute to the management of this impact.

A pre-construction survey, including consultations with community leaders, will be undertaken to collect data on the location and extent of intangible cultural heritage; data from the survey will inform the cultural heritage management plan that will describe measures to reduce impacts.

Intangible cultural heritage should be identified with sufficient time to allow mitigations to be agreed with the affected communities.

Although pre-mitigation impacts should be considered significant, the application of the proposed mitigation measures should reduce the residual impact to not significant by reaching agreement with local communities on ways to avoid or manage effects such that access or enjoyment of the ICH is not affected.

8.20.3.3 Operation

Generic Mitigation Measures

Disturbance or Loss of Cultural Heritage

Impact: Damage or disturbance of Category 1 and Category 2 tangible cultural heritage

The cultural heritage management plan will include measures that contribute to the management of this impact. Such actions may include preservation by photo-record, excavation by suitably qualified and approved archaeologists in accordance with government authorisations, relocation of graves and maintenance of access to cultural heritage assets.

The cultural heritage management plan will include description of all cultural heritage features identified before and during construction to inform cultural heritage management measures that may be required during project operation.

Although the pre-mitigation impact could be either significant or not significant depending on the site or asset, the residual impact should be not significant with the reduction of significance depending on the method chosen. For example, the duration of impacts on graves or cemeteries could be reduced from permanent to transient due to relocation. At other sites, the magnitude of impact could be reduced if access is maintained. The sensitivity of any new sites or assets identified may increase or decrease depending on the information gained as the site or asset is assessed. If sensitivity increases this will lead to the investigation of further mitigation to reduce the magnitude of impacts. As mitigation measures will not be known until sites are identified, a range of significance scores has been included in Appendix E2 and Table 8.20-1.

Impact: Damage or disturbance of Category 3 intangible cultural heritage

The cultural heritage management plan will include measures that contribute to the management of this impact.
The cultural heritage management plan will include details of all cultural heritage features identified before and during construction to inform cultural heritage management measures that may be required during project operation.

Although pre-mitigation impacts are likely to be not significant, the application of the above measures should further reduce any residual impacts by reaching agreement with local communities on ways to avoid or manage effects such that access or enjoyment of the ICH is not affected.

**Location-Specific Mitigation Measures**

No specific measures are currently required for project operations as no location specific impacts have been identified for this phase.

### 8.20.4 Residual Impacts and Significance Summary

This section summarises the residual impacts on cultural heritage after mitigation measures have been implemented.

Table 8.20-1 summarises the potential generic cultural heritage impacts, proposed mitigation measures and the determination of significance of the residual impacts after mitigation. Table 8.20-2 summarises location-specific impacts.

#### 8.20.4.1 Generic and Location-Specific Impacts

With the implementation of the planned mitigation measures, no significant residual generic or location-specific impacts to all tangible or intangible cultural heritage are predicted.

#### 8.20.4.2 Ecosystem Services

Various features, both tangible and intangible, in the AOI provide cultural ecosystem services (CES), see Section 6.4.3.16. These CES are highly inter-related and cannot be easily separated. Their value lies in providing communities and individuals with a sense of self and their role in the world. This gives intangible features meaning that is no less important than finding food or undertaking other everyday occupations such as farming or craftwork.

The impacts from construction and operation, including the human right to practice traditional cultural heritage and beliefs, have been fully addressed and integrated in the mitigation measures (Section 8.20.3). By engaging the local communities in the process of identifying and mitigating impacts to specific practices or beliefs, impacts to the CES will be managed with local community awareness. It is not anticipated that there will be significant effects on CES, including human rights.
### Table 8.20-1  Tangible and Intangible Cultural Heritage – Generic Impacts

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>High Stakeholder Concern</th>
<th>Management Plan(s)</th>
<th>Residual Impact</th>
<th>M</th>
<th>D</th>
<th>E</th>
<th>S</th>
<th>SS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disturbance or loss of cultural heritage</td>
<td>Increased knowledge of tangible and intangible cultural heritage. Employment of people to survey and investigate cultural heritage affected by the project.</td>
<td>C</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td>Disturbance or loss of cultural heritage</td>
<td>Damage, disturbance or disruption of access of unknown Category 1 or Category 2 tangible cultural heritage, such as evidence of previous settlement and graves.</td>
<td>C</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>1–3 1–5 1–2 2–8</td>
<td>5–18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbance or loss of cultural heritage</td>
<td>Damage, disturbance or disruption of access of unknown Category 3 intangible cultural heritage, such as meeting places, sacred natural sites, rivers or ceremonial ways, traditional dance, rituals, traditional healing and syncretism)</td>
<td>C</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Disturbance or loss of cultural heritage</td>
<td>Damage or disturbance of Category 1 and 2 tangible cultural heritage</td>
<td>O</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>1–3 1–5 1–2 2–8</td>
<td>5–18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbance or loss of cultural heritage</td>
<td>Damage or disturbance of Category 3 intangible cultural heritage</td>
<td>O</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

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### Table 8.20-2  Tangible and Intangible Cultural Heritage – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location (KP)</th>
<th>Aspect</th>
<th>VEC</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>Location (in Footprint (F) or in AOI but not in Footprint (AOI))</th>
<th>High Stakeholder Concern</th>
<th>Mitigation Measures</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>325.3</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT068: Major mound Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI TBC</td>
<td>Cultural heritage management plan</td>
<td>1 2 1 2 6</td>
<td></td>
</tr>
<tr>
<td>325.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT069: Remains of mud walls, evidence of recently abandoned houses Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI TBC</td>
<td>Cultural heritage management plan</td>
<td>1 2 1 2 6</td>
<td></td>
</tr>
<tr>
<td>325.6</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT074: Remains of mud walls, evidence of recently abandoned houses Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI TBC</td>
<td>Cultural heritage management plan</td>
<td>1 2 1 2 6</td>
<td></td>
</tr>
<tr>
<td>325.7</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT085: Major mound Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI TBC</td>
<td>Cultural heritage management plan</td>
<td>1 2 1 2 6</td>
<td></td>
</tr>
</tbody>
</table>

32 Sites that are within the project footprint or the AOI are included in this table. Some Category 3 sites are included but most of the examples of this category need to be defined during pre-construction survey and assessment.

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<th>Mitigation Measures</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>357.6</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT347: surface potsherds, Shahitogi Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 1 4 12</td>
</tr>
<tr>
<td>357.8</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT086: Two tombs Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>1 1 2 8 12</td>
</tr>
<tr>
<td>405.9</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH348: Grave at Kigagati Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>2 1 2 8 13</td>
</tr>
<tr>
<td>423.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH350: Surface potsherds, Bikokwa Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 1 4 12</td>
</tr>
<tr>
<td>492.8</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT088: Cultural mound with ashes within a farmland Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 1 2 10</td>
</tr>
</tbody>
</table>

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<th>High Stakeholder Concern</th>
<th>Mitigation Measures</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>506.4</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT310: Surface lithics, Kasozibakaya Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 1 4 12</td>
</tr>
<tr>
<td>520.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT194: One potsherd Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 1 2 10</td>
</tr>
<tr>
<td>527.8</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT195: Nine lithic materials Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 2 2 11</td>
</tr>
<tr>
<td>528.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT090: Cultural mound Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>1 2 1 2 6</td>
</tr>
<tr>
<td>549</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT091: Ethnographic objects; contemporary ceramics with decoration Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>1 2 1 4 8</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Location (KP)</th>
<th>Aspect</th>
<th>VEC</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>Location (in Footprint (F) or in AOI but not in Footprint (AOI))</th>
<th>High Stakeholder Concern</th>
<th>Mitigation Measures</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>551.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT092: Cultural mound with many diagnostic ceramics Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 2 4 13</td>
</tr>
<tr>
<td>552.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT093: Scatters of ceramics about 400 m². Late Stone Age materials. Number of diagnostic decorated ceramics. Area of archaeological potential Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 1 6 14</td>
</tr>
<tr>
<td>557.8</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT197: Grave Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>2 1 1 8 12</td>
</tr>
<tr>
<td>557.8</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT198: Grave Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>2 1 1 8 12</td>
</tr>
<tr>
<td>557.9</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT200: Six potsherds Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 2 2 11</td>
</tr>
</tbody>
</table>

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### Table 8.20-2  Tangible and Intangible Cultural Heritage – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location (KP)</th>
<th>Aspect</th>
<th>VEC</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>Location (in Footprint (F) or in AOI but not in Footprint (AOI))(^{32})</th>
<th>High Stakeholder Concern</th>
<th>Mitigation Measures</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>566.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT256: Mwingilo-Ibambula ritual site Category 3 intangible cultural heritage</td>
<td>Damage or disturbance of traditional beliefs or practices</td>
<td>C</td>
<td>F</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>– – – – –</td>
</tr>
<tr>
<td>608.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT205: Four potsherds Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 1 2 10</td>
</tr>
<tr>
<td>611.3</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH314: Surface potsherds, Lubeho Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 1 4 12</td>
</tr>
</tbody>
</table>

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<tr>
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<th>Mitigation Measures</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>616.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT094: Three tombs; according to Mstafaka Saliboko, these belong to the Mpangabure family Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>1 1 1 8 11</td>
</tr>
<tr>
<td>621.4</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT209: One lithic-like tool Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>CUH01, CUH02, CUH03</td>
<td>2 5 2 2 11</td>
</tr>
<tr>
<td>633</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT210: Four potsherds Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 2 2 11</td>
</tr>
<tr>
<td>658.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT211: Two decorated potsherds Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 2 2 11</td>
</tr>
</tbody>
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<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>658.6</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT264: Family members agreed that grave can be relocated, if affected. Liaison is required with the family at an appropriate time in advance of construction. Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>1 1 2 8 12</td>
</tr>
<tr>
<td>658.6</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT315: Malindi Ritual site with Mahari grave Category 2 tangible cultural heritage with strong intangible element and Category 3 intangible cultural heritage</td>
<td>Damage or disturbance of traditional beliefs or practices</td>
<td>C</td>
<td>F</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>3 4 3 8 18</td>
</tr>
<tr>
<td>658.6</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT265: Ritual tree with grave. Villagers use the tree for ritual performances. According to the village leadership, both can be relocated and liaison is required with the village leadership at an appropriate time in advance of construction Category 3 intangible cultural heritage</td>
<td>Damage or disturbance of traditional beliefs or practices</td>
<td>C</td>
<td>F</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>– – – – –</td>
</tr>
</tbody>
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<th>Mitigation Measures</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>664.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT252: Nyahanga graveyard site</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>1 1 2 8 12</td>
</tr>
<tr>
<td>667.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT251: Mhungula graveyard site</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
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<tr>
<td>683.6</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH316: Surface potsherds, Bumbiti</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>CUH01, CUH02, CUH03</td>
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<tr>
<td>699.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT096: Daub that signifies an abandoned settlement</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 1 2 10</td>
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<td>699.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT097: Cultural mound</td>
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<tbody>
<tr>
<td>699.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT095: Recorded iron ore but no evidence of iron smelting nearby Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 2 4 13</td>
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<tr>
<td>703.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT266: Three stone tools; three potsherds Category 1 tangible cultural heritage</td>
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<td>C</td>
<td>F</td>
<td>TBC</td>
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<tr>
<td>705.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT267: One potsherd Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
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<td>F</td>
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<tr>
<td>728.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH317: Grave at Sagida Category 2 tangible cultural heritage with intangible element</td>
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<td>F</td>
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<td>CUH01, CUH02, CUH03</td>
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<td>742.4</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT268: Three potsherds Category 1 tangible cultural heritage</td>
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<tbody>
<tr>
<td>773.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT269: Two potsherds; stone tool Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
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<tr>
<td>803.4</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT249: Pottery Site 2 Category 1 tangible cultural heritage</td>
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<td>AOI</td>
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<tr>
<td>805.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT250: Pottery Site 3 Category 1 tangible cultural heritage</td>
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<tr>
<td>822.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT270: Four lithic materials Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
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<td>F</td>
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<td>2 3 1 4 10</td>
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<tr>
<td>873.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT271: Grave of a child Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
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<tbody>
<tr>
<td>873.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT272: Two decorated potsherds. Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>1 2 1 4 8</td>
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<tr>
<td>877</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT061: Ntwiga 3. Information from members of the ESIA team indicate that the site is 40 km away from here. There is no local knowledge of the site but site retained in the database of sites until position confirmed Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>TBC</td>
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<td>1 3 1 2 7</td>
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<tr>
<td>878.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT102: Cultural mounds Category 1 tangible cultural heritage</td>
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<td>AOI</td>
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<tr>
<td>882.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT123: Scatter of ceramics Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
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<td>Cultural heritage management plan</td>
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<tbody>
<tr>
<td>882.9</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT273: Four graves. When Lunuwa well dries, the elders of Mukulu conduct rituals on top of these old graves. They slaughter black sheep on the grave and eat its meat without salt. They take the manure of the sheep to Lunuwa well and spread it in the well. Thereafter, the well will fill with water. Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>Y</td>
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<td>2 2 1 8 13</td>
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<tr>
<td>883.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT274: Stone microlith, late Stone Age Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
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<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 2 1 6 11</td>
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<tr>
<td>899.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT275; One potsherd to stone tools Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
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<td>2 5 2 2 11</td>
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<tr>
<td>899.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT276: Two graves Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
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<tbody>
<tr>
<td>931.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT277: Two graves Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
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</tr>
<tr>
<td>931.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT278: Two graves at PS6 Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>2 1 1 8 12</td>
</tr>
<tr>
<td>931.3</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT279: Amburiya clan bury people in this area. More than seven graves. This area is still used for burials Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>2 1 1 8 12</td>
</tr>
<tr>
<td>932.8</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT125: Four grinding stones, six pestles and materials of later Stone Age Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
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<tbody>
<tr>
<td>932.9</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT280: Six graves. Sometimes the Igauri villagers conduct rituals on the graves whenever there are socio-cultural problems. Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C AOI</td>
<td>Y</td>
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<tr>
<td>933.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT281: Three potsherds and one grinding stone Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C F TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 2 2 11</td>
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</tr>
<tr>
<td>937.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT282: Four graves: Leti Nyuha, Change Nyuha, Mbula Nyuha and Mwinga Nyuha; all buried 1936. Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C AOI</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>1 1 2 8 12</td>
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</tr>
<tr>
<td>938.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT238: Ifombou Mosque southwest of KP938 Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C AOI</td>
<td>Y</td>
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<tbody>
<tr>
<td>938.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH320: Graveyard, Ifombou II Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C F</td>
<td>TBC</td>
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<tr>
<td>938.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH321: Graveyard, Ifombou I Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C F</td>
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<tr>
<td>938.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT283: Three Graves: Sita Nkunguli Msagha, Tandu Msaghu Nyuha and Muna Wawa Nyuha; all buried before 1936. Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C F</td>
<td>Y</td>
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<tr>
<td>938.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH322: Graveyard, Ifombou III Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C F</td>
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</tr>
<tr>
<td>938.3</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT284: Five potsherds Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
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<tr>
<td>938.3</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT285: Old grave of Ihafwa Muna Kingi. The only mark is a tree called Moghiankuya in the Nyaturu language Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
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</tr>
<tr>
<td>943.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH323: STP78 Pottery, Mrama Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
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<tr>
<td>943.3</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT286: Three historic potsherds Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
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<tr>
<td>943.4</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT287: 10 graves belonging to the Wanyamninga clan Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
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<tr>
<td>943.4</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT288: Old grave belonging to Makiya Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
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<tbody>
<tr>
<td>954.4</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT289: Four historic potsherds Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
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<tr>
<td>954.4</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT290: Two graves: Juma Hango (1995) and Said Hango Ghambuja (1995) Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
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<td>Y</td>
<td>Cultural heritage management plan</td>
<td>2 1 1 8 12</td>
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<tr>
<td>954.6</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT291: One grave believed to be very old Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>Y</td>
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<tr>
<td>956.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT176: Recorded rock art; diagnostic ceramics probably dating to the Iron Age Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>TBC</td>
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<td>957.8</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT292: Grave of Marove Sangwa, buried 1968 Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
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<tbody>
<tr>
<td>957.8</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT293: Three potsherds</td>
<td>Damage or disturbance of feature</td>
<td>C F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 1 2 10</td>
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<tr>
<td>959.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT295: Three graves: Shabani Gufa (2000), Mwanjuma Gufa (1998) and Hawa Shabani Gufa (1996)</td>
<td>Damage or disturbance of feature</td>
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<td>Y</td>
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<tr>
<td>961.9</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT047: Fifteen potsherds</td>
<td>Damage or disturbance of feature</td>
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<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 2 2 11</td>
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</tr>
<tr>
<td>962.7</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT053: Mrama tree. Under the Mrama tree, the elders of the Nyankindi clan normally conduct rituals when they need rainfall. They slaughter a black sheep, eat its meat without salt and burn the bones. Category 3 intangible cultural heritage</td>
<td>Damage or disturbance of traditional beliefs or practices</td>
<td>C F</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
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<tr>
<td>964.3</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT296: Seven historic potsherds on the surface Category 1 tangible cultural heritage</td>
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<td>971.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT183: Daub and limited cultural mounds, 19th-century settlement that was probably abandoned during villagisation Category 1 tangible cultural heritage</td>
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<td>C</td>
<td>F</td>
<td>TBC</td>
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<tr>
<td>974.6</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT297: One diagnostic pottery sherd Category 1 tangible cultural heritage</td>
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<tr>
<td>997.3</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT298; Worshipping tree (tiita) for local people. Villagers normally pray when rain is needed. Category 3 intangible cultural heritage</td>
<td>Damage or disturbance of traditional beliefs or practices</td>
<td>C</td>
<td>F</td>
<td>Y</td>
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33 Planned policy of grouping population into villages

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<tr>
<td>997.4</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT299: Three ritual trees for rainmaking and other social activities. Category 3 intangible cultural heritage</td>
<td>Damage or disturbance of traditional beliefs or practices</td>
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<tr>
<td>1007.3</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH324: STP64 lithic tool, Masusu Category 1 tangible cultural heritage</td>
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<td>1030.4</td>
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<td>CHT301: Grave Category 2 tangible cultural heritage with strong intangible element</td>
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<td>F</td>
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<td>1036.6</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT302: Furnace walls, slags, tuyeres, pottery and charcoal. Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
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<td>1039.8</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT263: Five Christian graves southwest of pipeline</td>
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<tr>
<td>1064.6</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH325: Family graveyard, Cheku B Category 1 tangible cultural heritage with intangible element</td>
<td>Damage or disturbance of feature</td>
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<td>F</td>
<td>TBC</td>
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<tr>
<td>1075</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH326: Surface potsherds, Salala Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
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<td>AOI</td>
<td>TBC</td>
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<tr>
<td>1115.8</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT304: Kulaki Early Iron Age pottery site Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
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<td>1161.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT303: Kalikala Early Iron Age pottery site Category 1 tangible cultural heritage</td>
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<td>F</td>
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<tr>
<td>1205.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT228: Amei historic pottery site northwest to KP1205.1 Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI TBC</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>M ( \overline{5} ) D E S S</td>
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<tr>
<td>1208.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT227: Olpulu site Category 3 intangible cultural heritage</td>
<td>Damage or disturbance of traditional beliefs or practices</td>
<td>C</td>
<td>F Y</td>
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<tr>
<td>1229.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH327: surface lithic materials, Loolera Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F TBC</td>
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<td>1235.3</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH328: STP30 potsherds, Loolera Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
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<td>F TBC</td>
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<tr>
<td>1246</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH329: STP29 lithics and surface potsherds, Ngiligili Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
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<td>1285.2</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CH330: STP25 lithics Stone Age stratified site, Komukota Category 1 tangible cultural heritage</td>
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<td>C F</td>
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<td>1292.3</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT331: STP23 lithics and potsherds, Kikwembe Category 1 tangible cultural heritage</td>
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<td>1300.1</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT332: STP24 lithic materials, Matembo Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C F</td>
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<td>1303.8</td>
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<td>CHT114: Kwamadule graveyard Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
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<td>1310</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT115: Ruins Category 1 tangible cultural heritage Structure</td>
<td>Damage or disturbance of feature</td>
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<td>1310.4</td>
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<td>CHT333: Surface potsherds, Misima</td>
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<td>CHT117: Settlement</td>
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<td>CHT334: Said Daudi, 12-year-old grave</td>
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<td>CHT335: Sonyoro Kalau, 5-year-old grave</td>
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<td>1329.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT337: STP18 potsherd and lithic materials, Nkale</td>
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<td>CHT118: Enclosure Category 1 tangible cultural heritage Structure</td>
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<td>CHT120: Sinden Kwamwenkubi traditional forest Category 3 intangible cultural heritage</td>
<td>Damage or disturbance of traditional beliefs or practices</td>
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<td>CHT338: STP15 potsherds, Sindeni Category 1 tangible cultural heritage</td>
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</tr>
<tr>
<td>1365.6</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT127: Chang’ombe Sir Juma graves Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>2 1 2 8 13</td>
</tr>
</tbody>
</table>

**NOTES:** C = construction; O = operation; C&O = construction and operation; B = beneficial impact; M = magnitude of impact; D = duration of impact; E = extent of impact; S = sensitivity; SS = significance score; Y = stakeholder concern; – = no stakeholder concern was recorded. TBC = to be confirmed. See Section 5 for the methodology used to calculate the significance score and Appendix D for the tables used to rank magnitude and sensitivity. – A qualitative determination of impact significance for Category 3 has been undertaken and recorded in Section 8.20.3 and 8.20.4.
### Table 8.20-2  Tangible and Intangible Cultural Heritage – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location (KP)</th>
<th>Aspect</th>
<th>VEC</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>Location (in Footprint (F) or in AOI but not in Footprint (AOI))</th>
<th>High Stakeholder Concern</th>
<th>Mitigation Measures</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1378.4</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT340: STP12 daub and surface potsherds, Mamboleo Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 5 1 4 12</td>
</tr>
<tr>
<td>1395</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT145: Kibanda Pottery Site 2 Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>1 5 1 2 9</td>
</tr>
<tr>
<td>1401.85</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT159: Sembwana Dawa graves Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>2 1 2 8 13</td>
</tr>
<tr>
<td>1402</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT160: Seif Lupatu graves Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>1 1 2 8 12</td>
</tr>
<tr>
<td>1407.9</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT258: Colonial railway Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>1 5 1 2 9</td>
</tr>
</tbody>
</table>

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<tr>
<th>Location (KP)</th>
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<th>VEC</th>
<th>Potential Impact</th>
<th>Phase</th>
<th>Location (in Footprint (F) or in AOI but not in Footprint (AOI))</th>
<th>High Stakeholder Concern</th>
<th>Mitigation Measures</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1408.5</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT345: surface potsherds, Mkanyageni GP4 Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>0 0 0 4 4</td>
</tr>
<tr>
<td>1409.7</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT259: Colonial railway siding Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>F</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>1 5 1 2 9</td>
</tr>
<tr>
<td>1436</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT207: Helani/Ndaoya Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>2 1 1 6 10</td>
</tr>
<tr>
<td>1436.7</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT185: Spread of ceramics over 20 m² area Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>1 2 1 2 6</td>
</tr>
<tr>
<td>1437.9</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT037: Graves from one family Category 2 tangible cultural heritage with strong intangible element</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>2 1 1 8 12</td>
</tr>
</tbody>
</table>

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### Table 8.20-2  Tangible and Intangible Cultural Heritage – Location-Specific Impacts

<table>
<thead>
<tr>
<th>Location (KP)</th>
<th>Aspect</th>
<th>VEC</th>
<th>Potential Impact describe</th>
<th>Phase</th>
<th>Location (in Footprint (F) or in AOI but not in Footprint (AOI))32</th>
<th>High Stakerholder Concern</th>
<th>Mitigation Measures</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1441</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT212: Chongoleani spiritual site Category 3 intangible cultural heritage</td>
<td>Damage or disturbance of traditional beliefs or practices</td>
<td>C</td>
<td>AOI</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>– – – – –</td>
</tr>
<tr>
<td>1442</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT213: Chongoleani archaeology Category 1 tangible cultural heritage</td>
<td>Damage or disturbance of feature</td>
<td>C</td>
<td>AOI</td>
<td>TBC</td>
<td>Cultural heritage management plan</td>
<td>2 2 1 2 7</td>
</tr>
<tr>
<td>1442</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT214: Chongoleani spiritual site Category 3 intangible cultural heritage</td>
<td>Damage or disturbance of traditional beliefs or practices</td>
<td>C</td>
<td>AOI</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>– – – – –</td>
</tr>
<tr>
<td>MST</td>
<td>Disturbance or loss of cultural heritage</td>
<td>CHT187: Spread of ceramics and a shrine under the baobab tree Category 3 intangible cultural heritage</td>
<td>Damage or disturbance of traditional beliefs or practices</td>
<td>C</td>
<td>AOI</td>
<td>Y</td>
<td>Cultural heritage management plan</td>
<td>– – – – –</td>
</tr>
</tbody>
</table>

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8.20.5 Transboundary Project Impacts
There are no transboundary impacts on TCH or ICH.

8.20.6 Cumulative Impacts
No cumulative impacts have been identified at the time of writing.

8.20.6.1 Transboundary Cumulative Impacts
There are no transboundary cumulative impacts.

8.21 Summary of Ecosystem Services Impacts

8.21.1 Ecosystem Service Impacts
Impacts on ecosystem services and mitigation measures have been considered in the assessments of the VECs that provide ecosystem services. Table 8.21-1 summarises references to ecosystem services documented in the VEC assessments.

Table 8.21-1 Ecosystem Service References

<table>
<thead>
<tr>
<th>Ecosystem Service*</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Provisioning Services</strong></td>
<td></td>
</tr>
<tr>
<td>Crops</td>
<td>8.5 Soil, 8.6 Surface Water, 8.7 Groundwater, 8.13 Land-Based Livelihoods</td>
</tr>
<tr>
<td>Livestock</td>
<td>8.6 Surface Water, 8.7 Groundwater, 8.13 Land-Based Livelihoods</td>
</tr>
<tr>
<td>Capture fisheries</td>
<td>8.2 Biodiversity Habitats, 8.6 Surface Water, 8.14 River-, Lake- and Marine-Based Livelihoods</td>
</tr>
<tr>
<td>Aquaculture</td>
<td>8.14 River-, Lake- and Marine-Based Livelihoods</td>
</tr>
<tr>
<td>Wild foods</td>
<td>8.2 Biodiversity Habitats, 8.3 Biodiversity Flora and Fauna, 8.4 Protected Areas, 8.13 Land-Based Livelihoods, 8.18 Community Health</td>
</tr>
<tr>
<td>Live trade in animals</td>
<td>8.2 Biodiversity Habitats, 8.3 Biodiversity Flora and Fauna,</td>
</tr>
<tr>
<td>Timber and wood products</td>
<td>8.2 Biodiversity Habitats, 8.3 Biodiversity Flora and Fauna, 8.4 Biodiversity Protected Areas, 8.13 Land-Based Livelihoods</td>
</tr>
<tr>
<td>Fibres and nonwood products</td>
<td>8.2 Biodiversity Habitats, 8.3 Biodiversity Flora and Fauna, 8.4 Biodiversity Protected Areas, 8.13 Land-Based Livelihoods</td>
</tr>
<tr>
<td>Aggregates</td>
<td>8.5 Soil, 8.13 Land-Based Livelihoods</td>
</tr>
<tr>
<td>Biomass fuel</td>
<td>8.2 Biodiversity Habitats, 8.3 Biodiversity Flora and Fauna, 8.4 Biodiversity Protected Areas, 8.13 Land-Based Livelihoods</td>
</tr>
<tr>
<td>Freshwater</td>
<td>8.6 Surface Water, 8.7 Groundwater</td>
</tr>
<tr>
<td>Medicinal plants</td>
<td>8.2 Biodiversity Habitats, 8.3 Biodiversity Flora, 8.4 Protected Areas</td>
</tr>
</tbody>
</table>
### Table 8.21-1  Ecosystem Service References

<table>
<thead>
<tr>
<th>Ecosystem Service*</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regulating Services</strong></td>
<td></td>
</tr>
<tr>
<td>Local air quality regulation</td>
<td>8.2 Biodiversity Habitats, 8.4 Biodiversity Protected Areas</td>
</tr>
<tr>
<td>Global climate regulation</td>
<td>8.2 Biodiversity Habitats, 8.4 Biodiversity Protected Areas</td>
</tr>
<tr>
<td>Local climate regulation</td>
<td>8.2 Biodiversity Habitats, 8.4 Biodiversity Protected Areas</td>
</tr>
<tr>
<td>Water regulation</td>
<td>8.2 Biodiversity Habitats, 8.4 Biodiversity Protected Areas, 8.6 Surface Water, 8.7 Groundwater</td>
</tr>
<tr>
<td>Erosion regulation</td>
<td>8.2 Biodiversity Habitats, 8.4 Biodiversity Protected Areas, 8.5 Soil, 8.6 Surface Water</td>
</tr>
<tr>
<td>Waste assimilation</td>
<td>8.2 Biodiversity Habitats, 8.4 Biodiversity Protected Areas, 8.6 Surface Water</td>
</tr>
<tr>
<td>Soil quality regulation</td>
<td>8.2 Biodiversity Habitats, 8.4 Biodiversity Protected Areas, 8.5 Soil, 8.6 Surface Water</td>
</tr>
<tr>
<td><strong>Cultural Services</strong></td>
<td></td>
</tr>
<tr>
<td>Recreation and ecotourism</td>
<td>8.2 Biodiversity Habitats, 8.3 Biodiversity Species, 8.4 Protected Areas</td>
</tr>
<tr>
<td>Aesthetics, landscapes</td>
<td>8.2 Biodiversity Habitats, 8.4 Biodiversity Protected Areas, 8.5 Landscape</td>
</tr>
<tr>
<td>Sense of place / self</td>
<td>8.2 Biodiversity Habitats, 8.4 Biodiversity Protected Areas, 8.11 Cultural Heritage</td>
</tr>
<tr>
<td>Spiritual, sacred and religious values</td>
<td>8.2 Biodiversity Habitats, 8.4 Biodiversity Protected Areas, 8.11 Cultural Heritage</td>
</tr>
<tr>
<td>Ethical and biodiversity non-use values</td>
<td>8.2 Biodiversity Habitats, 8.3 Biodiversity Flora and Fauna, 8.4 Biodiversity Protected Areas</td>
</tr>
<tr>
<td><strong>Supporting Services</strong></td>
<td></td>
</tr>
<tr>
<td>Habitats and species support</td>
<td>8.2 Biodiversity Habitats, 8.4 Biodiversity Protected Areas, 8.6 Surface Water, 8.7 Groundwater</td>
</tr>
</tbody>
</table>


All potentially significant ecosystem services related impacts are addressed by the VEC impact assessments and associated mitigation measures set out in the sections listed in Table 8.21-1, the ESMP (Appendix J) and Appendix E4.

When additional surveys are planned, it is recommended that associated ecosystem service aspects are considered in their design and implementation.
### 8.21.2 Ecosystem Service Dependencies

IFC PS 6 includes specific requirements for assessing ecosystem services dependencies\(^{34}\) and documenting associated proposed resource use efficiency measures, as summarised for the project in Table 8.21-2.

#### Table 8.21-2 Ecosystem Service Dependencies

<table>
<thead>
<tr>
<th>Ecosystem Service</th>
<th>Dependency Description</th>
<th>Resource Use Efficiency Measure(^ {35})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Water use for hydrostatic testing, dust suppression and camp use as follows: Construction camps – potable water 200 m(^3)/day at maximum occupancy (up to 1000 people). Construction activities – 100–200 m(^3)/day. Hydrostatic testing – 16,000 m(^3) per test section required. Coating facility requirements – 160 m(^3)/day (90 m(^3)/day for the camp and 70 m(^3)/day for operations).</td>
<td>• Water conservation initiatives and opportunities to reuse water, e.g., for dust suppression or concrete, will be identified, assessed for impacts on the environment and human health and those deemed suitable will be implemented. • Re-use water between sections for hydrostatic testing to reduce volumes needed (see Section 2.4.4.2) • The grey water stream will be separated from black water (e.g., sewage), treated and either reused (e.g., for toilet flushing, dust suppression) or discharged, in accordance with the environment project standards and national environmental guidance and regulations. All wastewater discharges will comply with permit conditions and the project environmental standards. • Water meters will be installed to measure the quantities of water supplied and wastewater discharged at the camps and detailed records will be kept of quantities of water reused and the purposes for which water is reused as part of the water management plan and the data used for monitoring water usage and project reporting requirements.</td>
</tr>
<tr>
<td>Energy</td>
<td>Energy use for operation of equipment and vehicles. The primary source of fuel for the pumping station generators will be the export crude oil, with diesel back-up.</td>
<td>• Electrical equipment of a size that is appropriate for the functions to be performed will be selected with a view to maximising energy efficiency. Electrical equipment will be turned off when not in use.</td>
</tr>
<tr>
<td>Aggregates</td>
<td>Used for various construction activities, requiring an estimated: 170,000 m(^3) gravel, 200,000 m(^3) sand, 17,000 m(^3) cement, murram (quantities will be identified during construction).</td>
<td>• All excavated materials will be screened and reused where possible to reduce the need for newly quarried aggregates.</td>
</tr>
</tbody>
</table>

---

\(^{34}\) An ecosystem dependency occurs where the EACOP project depends on the ecosystem service.

\(^{35}\) Reference is to either a proposed mitigation measure in Appendix E4 or mitigation included in the project description, Section 2.
Table 8.21-2 Ecosystem Service Dependencies

<table>
<thead>
<tr>
<th>Ecosystem Service</th>
<th>Dependency Description</th>
<th>Resource Use Efficiency Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber</td>
<td>Used for various construction activities.</td>
<td>• If timber is cleared (e.g., as part of right-of-way clearance), it will be reused for construction activities as far as possible. Release of any and all chemically treated waste timber will be made on a case-by-case basis.</td>
</tr>
<tr>
<td>Food</td>
<td>Food required for feeding personnel</td>
<td>• Provision of food to workers will be planned to cater for workforce requirements and therefore minimise food waste as far as possible.</td>
</tr>
</tbody>
</table>

8.22 Climate

This section includes:

- an assessment of the potential impacts on the global climate of the EACOP project, comprising:
  - a description of the use of global warming potential (GWP) as the basis for comparing emissions of different greenhouse gases (GHG)
  - an evaluation of the carbon intensity (emissions per unit of energy exported) of direct\textsuperscript{36} project operations phase GHG emissions
  - a description of the project’s main direct and indirect\textsuperscript{37} GHG emissions during construction and commissioning
  - a description of the project’s main direct GHG emissions during the operations phase
  - a comparison of direct project operational phase GHG emissions to total national emissions and Tanzanian reduction commitments, as described in Section 6.4.4
  - a description of indirect emissions during the operations phase
  - description of the key mitigation measures used to reduce GHG emissions
- an assessment of the effects of climate change trends on the project and how these have been considered in project design and implementation.

8.22.1 Key Sensitivities and Considerations

Section 6.4.4 describes the climate baseline and key considerations.

The key considerations include:

- The global climate has undergone unprecedented change\textsuperscript{38} and continuing change is predicted by climate scientists. Tanzania’s climate has changed and further change is predicted.

---

\textsuperscript{36} Direct emissions are from sources owned or controlled by the project.

\textsuperscript{37} Indirect emissions are a consequence of the project but are from sources not owned or controlled by the project.

\textsuperscript{38} “Since the 1950s, many of the observed changes are unprecedented over decades to millennia” (IPCC 2014).
Tanzania is vulnerable to increased climate variability and climate change. For example, the severity and frequency of extreme events such as droughts and floods are projected to increase.

Global anthropogenic GHG emissions, with other anthropogenic drivers, are extremely likely to have been the dominant cause of the observed warming of the global climate since the mid-20th century.

The Tanzanian government has put in place a strategy to reduce the risks of the changing climate. The strategy includes mitigation measures (reductions in GHG emissions relative to a business-as-usual (BAU) scenario\textsuperscript{39}) and adaptation measures (reduction of the vulnerability of social and biological systems).

### 8.22.2 Project Greenhouse Gas Emissions

#### 8.22.2.1 Greenhouse Gases and Global Warming Potentials

The dominant source of GHG emissions from EACOP is combustion of crude oil during operation of the generators and, possibly later in the project, bulk heaters at the pumping stations and the marine storage terminal (MST). The principal GHG emitted will be carbon dioxide (CO\textsubscript{2}). There will be small emissions of methane (CH\textsubscript{4}) and nitrous oxide (N\textsubscript{2}O), see Table 8.22-1. Emissions of other GHGs considered in the Kyoto Protocol from EACOP-related activities will be negligible.

It is standard practice to convert GHGs to a common unit, so that their relative effects can be expressed on a common basis. Each GHG has a GWP, which accounts for the total contribution to global warming from the emission of one mass unit of that gas relative to one mass unit of the reference gas, CO\textsubscript{2}, which is assigned a value of 1. Based on a GHG’s GWP, its carbon dioxide equivalent (CO\textsubscript{2}e) can be calculated\textsuperscript{40}. The GWPs used for CO\textsubscript{2}, CH\textsubscript{4} and N\textsubscript{2}O and their contribution to a total GHG emission factor for crude oil combustion are shown in Table 8.22-1. GHGs have different GWPs depending on the ‘time horizon’ considered, as they have different lifetimes in the atmosphere. This assessment uses GWPs over a 100-year horizon, as primarily used by the US EPA (2018a, Internet site).

<table>
<thead>
<tr>
<th>GHG</th>
<th>Emission Factor (kg GHG/kg fuel)\textsuperscript{1}</th>
<th>GWP\textsuperscript{2}</th>
<th>Emission Factor (kg CO\textsubscript{2}e/kg fuel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO\textsubscript{2}</td>
<td>3.13</td>
<td>1</td>
<td>3.13</td>
</tr>
<tr>
<td>CH\textsubscript{4}</td>
<td>1.25 \times 10^{-4}</td>
<td>34</td>
<td>4.24 \times 10^{-3}</td>
</tr>
<tr>
<td>N\textsubscript{2}O</td>
<td>2.43 \times 10^{-5}</td>
<td>298</td>
<td>7.26 \times 10^{-3}</td>
</tr>
</tbody>
</table>

\textsuperscript{39} The BAU scenario is GCAP’s (2011) estimate of future emissions in line with planned development as set out in the Vision 2025 (Ministry of Finance and Planning 2000, Internet site), and based on population forecasts from the United Nations.

\textsuperscript{40} For example, methane has a global warming potential of 34, which means that 1 kg of methane has the same impact on climate change as 34 kg of carbon dioxide and thus 1 kg of methane is 34 kg of carbon dioxide equivalent.
Table 8.22-1  Greenhouse Gas Emission Factors for Crude Oil Combustion

<table>
<thead>
<tr>
<th>GHG</th>
<th>Emission Factor (kg GHG/kg fuel)¹</th>
<th>GWP²</th>
<th>Emission Factor (kg CO₂e/kg fuel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total CO₂e</td>
<td>--</td>
<td>--</td>
<td>3.14</td>
</tr>
</tbody>
</table>

NOTES: ¹EPA (2018b, Internet site), converted to mass basis using fuel density of 868 kg/m³ (EACOP crude blend E1)
²Myhre et al. (2013)

Table 8.22-1 shows that CO₂ comprises 99.6% of the GHG emissions from crude oil combustion. The data are similar for the combustion of gas oil, which will be the main fuel used in the construction phase of the project and as backup fuel in the operations phase.

8.22.2.2 Carbon Intensity

Carbon intensity (CI) is a measure of the rate of GHG emissions relative to the intensity of a specific activity, or an industrial production process. The EACOP project transports an (primarily) energy product to market, so the most appropriate CI metric is GHG emissions per unit of energy exported, in units of grams of CO₂ equivalent per megajoule (gCO₂e/MJ).

Based on the pipeline hydraulic profile and the emissions created to pump and heat the oil, EACOP’s progressive total CI in Tanzania is shown in Figure 8.22-1.

![Figure 8.22-1](image)

Figure 8.22-1  Progressive Total Carbon Intensity During Project Life

The CI begins high as the year 1 flow rate is quite low at 90 kbpd as production ramps up. The CI rapidly decreases as high flow rates do not require the pipeline to be heated. When the flow rate reduces, pumping power demand is ultimately more
than replaced by heating demand and the annual emissions are increased while the export rate is reduced, resulting in a higher annual CI and a gradual increase in the progressive total CI. Over the project life, the predicted average CI of all exported oil is 1.3 gCO₂e/MJ.

8.22.2.3 Direct Emissions – Construction and Commissioning Phases

For the purposes of this assessment, all in-country construction phase emissions are considered, including:

- equipment used during construction of the main camp and pipe yards (MCPY), coating facility, pipeline and aboveground installations (AGIs)
- road vehicles and transport by rail to move pipe, equipment, materials, fuel and the workforce
- generators at MCPYs and the coating facility
- compressors for hydrotest drying
- net emissions created under the umbrella definition of land use, land use change and forestry activities.\(^{41}\)

The GHG emissions from these sources have not been quantified as their contribution is minor relative to operational emissions over the life of the project.

8.22.2.4 Indirect Emissions – Construction and Commissioning Phases

The main types of indirect emissions in the construction and commissioning phases will be:

- the extraction, production and outsourced transport of purchased materials and fuels
- travel of the workforce to and from work.

The GHG emissions from these sources have not been quantified, as they are minor relative to the operational emissions over the life of the project.

8.22.2.5 Direct Emissions – Operation Phase

The largest source of direct GHG emissions during the operational phase will be the crude oil-fired generators at PS3, PS5 and the MST, the direct-fired heater at the MST and, later in the project, the bulk heaters at pumping stations.

The power and heat demands vary over the project life. Greater pumping power is required during high flow rates of oil and less pumping power, but greater heat demand, during periods with lower flow rates to maintain the pipeline at the minimum operating temperature.

Table 8.22-2 presents the predicted minimum and maximum annual direct emissions for the AGI sites.\(^{42}\)

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\(^{41}\) The primary effect under this category is the biological carbon stock changes caused by the project activity on the project site. This category includes carbon sinks (absorbers of carbon) as well as sources.

\(^{42}\) GHG emissions data were calculated on a year-by-year basis throughout the 25-year operational life. Each year is associated with a crude oil throughput, approximated to those values for which the engineer’s steady state
Table 8.22-2 Operational Direct Greenhouse Gas Emissions Inventory

<table>
<thead>
<tr>
<th>Site</th>
<th>Emission Source</th>
<th>Operational GHG Emissions (kilotonne CO₂e)</th>
<th>Minimum Annual</th>
<th>Maximum Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS3</td>
<td>Power generation</td>
<td>30</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bulk heating</td>
<td>0</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>PS4</td>
<td>Bulk heating</td>
<td>0</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>PS5</td>
<td>Power generation</td>
<td>31</td>
<td>91</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bulk heating</td>
<td>0</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>PS6</td>
<td>Bulk heating</td>
<td>0</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>MST</td>
<td>Power generation</td>
<td>35</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Direct-fired heating</td>
<td>3</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>Power generation</td>
<td>121(^1)</td>
<td>237(^1)</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>Bulk and MST heating</td>
<td>9(^1)</td>
<td>79(^1)</td>
<td></td>
</tr>
<tr>
<td>Total – Tanzania</td>
<td></td>
<td>201(^1)</td>
<td>282(^1)</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** \(^1\)The maximum and minimum years for each site and for the different emission sources do not coincide, so the totals are not the sums of the rows above

Other minor direct emission sources during the operational phase will include:
- diesel-fired combustion plant at the AGIs, e.g., firewater pumps and standby generators
- road vehicles for the movement of people and equipment for operations and maintenance, and supplies to the manned AGIs.

The GHG emissions from these sources have not been quantified, as they are negligible relative to the operational emissions over the life of the project.

**National Emissions Context**

As described in Section 6.4.4, the BAU emissions scenario predicts Tanzania’s GHG emissions will rise gradually from 102 MtCO₂e in 2016 to 138–153 MtCO₂e\(^{43}\) in 2030. However, the government of Tanzania intends to reduce emissions by 10–20% of the BAU scenario by 2030, according to its Intended Nationally Determined Contribution (INDC) report (Climate Watch 2018, Internet site). A 10% reduction would reduce emissions to 124–138 MtCO₂e, a 20% reduction would reduce emissions to 110–122 MtCO₂e.

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43 Mt = megatonne, or one million tonnes, kt = 1000 kilotonnes
The project’s direct emissions of 201–282 ktCO₂e/a in Tanzania represent:

- 0.17–0.25% of Tanzania’s 2020 BAU emissions (2020 is when the INDC emission reduction measures are predicted to begin to take effect)
- 0.18–0.26% of 2030 emissions under the 20% INDC emission reduction scenario
- 0.15–0.21% of 2030 emissions under the 10% INDC emission reduction scenario.

The contribution of EACOP to national emissions will not affect Tanzania’s ability to meet its emission reduction target published as part of the UNFCCC’s Paris Agreement.

### 8.22.2.6 Indirect Emissions – Operation Phase

The main sources of indirect GHG emissions during the operational phase will be:

- end use of the products derived from the crude oil
- other parts of the chain that ultimately gets the products to end users:
  - upstream extraction and processing
  - EACOP feeder pipelines
  - shipping crude oil from the MST to refineries abroad
  - refining
  - distribution of refined products
  - indirect sources.\(^{44}\)

The types of indirect emissions listed in Section 8.22.2.4 may also occur in the operational phase.

### 8.22.3 Effect of Climate Change

The impacts associated with climate change for a region are hard to predict and its specific effects on the EACOP project cannot be determined. However, climate trends (see Section 6.4.4) predict an increase in the severity and frequency of extreme events such as droughts, storms and floods, an increase in rainfall and temperature and an increase in sea level. These events and trends may affect EACOP in varying degrees.

Climate change timescales are considered too short to have an effect on the construction phase. Effects are therefore limited to the operational phase and may include:

- floods and storms:
  - erosion at watercourses which could affect pipeline integrity
  - soil erosion on the RoW
  - increased risk of landslides
  - flooding of AGIs

---

\(^{44}\) Here, indirect means indirect to the entire fuel chain, i.e., removed by a further level relative to the emission sources that are indirect to EACOP. The category includes induced land development and co-product production.
• sea level rise and storm events:
  o sea-level rise and coastal erosion, potentially affecting the MST and load-out facility.

8.22.4 Mitigation Measures

8.22.4.1 Greenhouse Gas Emissions

  Design
  Most of the decisions and measures that substantially affect greenhouse gas emissions are the conceptual alternatives described in Section 3.

  The configuration of the main pumps at the pumping stations has been optimised, with efficiency as a key consideration. This optimisation has led to larger pumps being specified, with an efficiency benefit that will save an estimated 5 ktCO₂e/a in Tanzania over the years of plateau flow rate, this emission being avoided at PS3 and PS5 owing to less power demand on the generators there. Further study in detailed engineering will examine the performance over the varying flow rate during the project’s life. Detailed engineering will also select the pump models, an evaluation process during which efficiency will be a key factor.

  At the standalone block valve stations, solar power is the base case power source. For the estimated load of 31 kWh/day at each of 49 stations in Tanzania, this use of renewable energy will save around 371 tCO₂e/a compared with generating that power from oil-fired generators.

  Operation
  Monitoring and management arrangements during operation (see Section 2.4.5.6) will address climate change effects.

8.22.5 Cumulative Impacts

  The climate VEC has a global AOI and in effect, every source of GHG emissions is a source of cumulative impact and ultimately a contributor to the same impact (climate change) on the same VEC. Project contributions to national GHG emissions are described in Section 8.22.2 and project mitigation measures in Section 8.22.4.

8.22.6 Conclusions

  The following are the key conclusions related to the EACOP project’s impact on climate:

  • Direct operational emissions in Tanzania will range between 201–282 ktCO₂e/a throughout the 25-year life, which represents around 0.2–0.3% of Tanzania’s total GHG emissions in 2030. The contribution of EACOP to national emissions will not affect Tanzania’s ability to meet its emission reduction target published as part of the Paris Agreement.

45 Number of pumps and total capacity relative to maximum demand.
• Construction phase direct and indirect emissions have not been quantified, as they are minor relative to the operational emissions over the life of the project.

The following key conclusion is related to climate change adaptation:
• Project design, construction and operation have taken into account events and trends that may be related to climate change.

8.23 Pipeline and AGI Decommissioning

When pipeline oil shipping volumes diminish to the point that it becomes inefficient to transport oil via the pipeline, the pipeline will be decommissioned based on Tanzanian regulations and standards and international standards and protocols. The decommissioning process will be based on the following principles:
• engagement with stakeholders at local, regional and district levels to determine potential use of all redundant equipment and structures
• project structures to be removed from land that is no longer required for operations
• environmental due diligence to ensure that no substance-affected soil is managed
• land to be reinstated to a capability similar to that which existed before pipeline construction.

A decommissioning plan, which includes a social management component that addresses the impact of decommission (loss of jobs, economic activity), will be prepared and the scope will be developed in consultation with stakeholders at that time.

The decommissioning plan will consider the available options for removal of AGIs and disposition of the pipeline, fibre optic and power cables, in situ. It will assess, where necessary, options for remediating contaminated land and propose details for revegetation of the area and post-decommission environmental and social monitoring. The impacts of options will be considered and mitigation measures proposed. Activities, aspects and associated impacts will be similar to construction including:
• soil handling leading to soil erosion and sediment release to surface water
• activities and traffic leading to noise and air emissions
• workforce leading to potential social effects.

Effects may be limited and short-term except at the MST.

8.24 Associated Facilities

As outlined in Section 2.5.1 and Appendix H, the following have been identified as AFs:
• Tilenga Project
• Kingfisher Oil Project
• concrete batch plants, borrow-pits and waste management facilities where they meet the IFC definition of associated facilities.\footnote{Associated facilities are defined in IFC Performance Standard 1, paragraph 8, as “facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.”}

Even though the Tilenga Project and Kingfisher Oil Development impacts are considered to be distant from the AOI of the EACOP in Tanzania, as per Appendix H, Section H4, and have been screened out of the CIA, their beneficial impacts and significant residual impacts have been described below. Potential associated facility impacts are categorised using the EACOP project VEC categories.\footnote{The Tilenga feeder pipeline ESIA uses the same VECs as the Uganda EACOP project. The Tilenga Project and the Kingfisher Oil Project have similar VECs but where they differ they have been allocated to the equivalent EACOP VEC.}

The locations of concrete batch plants, borrow-pits and any waste disposal sites required have yet to be defined. These will be subject to the management of change process described in Section 10.10, which includes environmental and social appraisal of the change.

\section*{8.24.1 Tilenga Project}

This section summarises the impacts from the Tilenga field and the Tilenga feeder pipeline.

The beneficial impacts from both the field and the feeder pipeline are described in Table 8.24-1. The significant residual impacts from the Tilenga field are presented in Table 8.24-2.

There are no significant residual impacts for the Tilenga feeder pipeline (TEAM 2019).
**Table 8.24-1 Beneficial Impacts of the Tilenga Project**

<table>
<thead>
<tr>
<th>Beneficial Impacts</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved road accessibility within the Tilenga Project area (direct)</td>
<td>Site preparation and enabling works</td>
</tr>
<tr>
<td>Direct and indirect employment opportunities (direct/indirect/induced)</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations, decommissioning&lt;sup&gt;48&lt;/sup&gt;</td>
</tr>
<tr>
<td>Increased demand for goods and services (direct/indirect/induced)</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations, decommissioning</td>
</tr>
<tr>
<td>Development of more educated and skilled workforce (direct/indirect)</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations</td>
</tr>
<tr>
<td>Community empowerment and increased community participation in decision making (induced)</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations</td>
</tr>
<tr>
<td>Increased revenue for government (direct)</td>
<td>Commissioning and operations</td>
</tr>
<tr>
<td>Improvement in nutritional status (indirect/induced)</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations, decommissioning</td>
</tr>
<tr>
<td>Improved health seeking behaviour (induced)</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations, decommissioning</td>
</tr>
<tr>
<td>Improved regional health planning and programme delivery (Induced)</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations, decommissioning</td>
</tr>
</tbody>
</table>

<sup>48</sup> Closure is equivalent to decommissioning.
### Table 8.24-1 Beneficial Impacts of the Tilenga Project

<table>
<thead>
<tr>
<th>Beneficial Impacts</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ecosystem services</strong></td>
<td></td>
</tr>
<tr>
<td>Crop production may increase due to re-opening land for agriculture</td>
<td>Decommissioning</td>
</tr>
<tr>
<td>Livestock and fodder/ pastoralism – benefit of re-opening of pasture grounds</td>
<td>Decommissioning</td>
</tr>
<tr>
<td>Timber and woody biomass – limited increase in supply and shift in patterns of fuel use</td>
<td>Decommissioning</td>
</tr>
<tr>
<td>Wild foods and bushmeat – small increase in wild food availability due to recolonisation</td>
<td>Decommissioning</td>
</tr>
<tr>
<td>Fibres and ornamental resources – small increase in supply</td>
<td>Decommissioning</td>
</tr>
<tr>
<td>Improved knowledge of the region increasing scientific and knowledge values</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations, decommissioning</td>
</tr>
</tbody>
</table>
### Table 8.24-2 Significant Residual Impacts of the Tilenga Project

<table>
<thead>
<tr>
<th>Potential Residual Impact</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biodiversity: habitats of conservation importance</strong></td>
<td></td>
</tr>
<tr>
<td>Direct impacts on Forest-Savanna Mosaic (scattered to the south of the Tilenga Project area – the remnant forest patches within the overall savanna landscapes, generally outside protected forests), due to land use changes and loss of habitat and indirect impacts due to in migration (PIIM) causing land use changes and pressure on natural resources and habitats</td>
<td>Construction and pre-commissioning, commissioning and operations, decommissioning.</td>
</tr>
<tr>
<td>Indirect impact on natural habitat – Murchison Falls-Albert Delta Wetland System Ramsar site, stretching from the top of Murchison Fall to the Albert Delta, predominantly within the Murchison Falls National Park (MFNP)– due to PIIM pressures on natural resources and habitats in the region</td>
<td>Commissioning and operations, decommissioning</td>
</tr>
<tr>
<td><strong>Biodiversity: flora and fauna species of conservation importance</strong></td>
<td></td>
</tr>
<tr>
<td>Direct impacts including loss, degradation or fragmentation of species’ habitat, population changes, disturbance or barrier effects, and indirect impacts due to PIIM pressures on the natural environment, on fauna, including critical habitat qualifying species and other notable species, such as Rothchild’s giraffe, Lelwel hartebeest, elephant, lion, spotted hyena, Bohor reedbuck, Uganda kob and Denham’s bustard</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations, decommissioning</td>
</tr>
<tr>
<td><strong>Biodiversity: legally protected, internationally or nationally recognised areas</strong></td>
<td></td>
</tr>
<tr>
<td>Direct impacts on grassland habitats including direct loss of the threatened ecosystem Hyparrhenia Grass Savanna and loss of integrity of the protected forests, and indirect impacts such as PIIM pressures and indirect loss of habitat, degradation or fragmentation on MFNP and Karuma Wildlife Reserve</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations, decommissioning</td>
</tr>
<tr>
<td>Indirect impacts, such as loss of habitat due to PIIM pressures, on Bugungu Wildlife Reserve, Budongo Central Forest Reserve, Forest Reserves in Masindi Area, Bugoma Forest</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations, decommissioning</td>
</tr>
<tr>
<td><strong>Soils</strong></td>
<td></td>
</tr>
<tr>
<td>No significant impacts identified</td>
<td>–</td>
</tr>
</tbody>
</table>
### Table 8.24-2 Significant Residual Impacts of the Tilenga Project

<table>
<thead>
<tr>
<th>Potential Residual Impact</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surface water</strong></td>
<td></td>
</tr>
<tr>
<td>Impact of changed morphology of river banks and flow of the Victoria Nile River causing increased flood risk due to the construction of the Victoria Nile Ferry Crossing</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations</td>
</tr>
<tr>
<td><strong>Groundwater</strong></td>
<td></td>
</tr>
<tr>
<td>No significant impacts identified</td>
<td>–</td>
</tr>
<tr>
<td><strong>Landscape</strong></td>
<td></td>
</tr>
<tr>
<td>Impacts of construction and maintenance activities on local landscape character areas: Buliisa lowland pastoral farmland, Buliisa lowland rolling farmland, Lake Albert coastal fringe, Victoria Nile corridor and MFNP north, savanna plateau, and viewpoints: Kimoli, Buliisa (west), Kisimo, Kirama, Kabalega Wilderness Lodge, Murchison River Lodge, Nile Safari Lodge, Pakuba Safari Lodge, Paraa ferry crossing, Buligi track Delta track junction, Albert track, Kasinyi (west and east), Buligi track (Pakuba airfield)</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations</td>
</tr>
<tr>
<td><strong>Air quality</strong></td>
<td></td>
</tr>
<tr>
<td>See climate</td>
<td></td>
</tr>
<tr>
<td><strong>Acoustic environment</strong></td>
<td></td>
</tr>
<tr>
<td>Impact of site activity noise: night-time well drilling and well pad noise south of Victoria Nile, HDD drilling noise at the Victoria Nile crossing points, CPF night-time noise</td>
<td>Construction and pre-commissioning, commissioning and operations</td>
</tr>
<tr>
<td><strong>Socio-economic VECs</strong> (economy; local economy (nonland-based livelihoods); land-based livelihoods; river and lake-based livelihoods; land and property; workers’ health, safety and welfare; social infrastructure and services; community health; community safety, security and welfare)</td>
<td></td>
</tr>
<tr>
<td>Economic displacement of communities due to land acquisition (direct)</td>
<td>Site preparation and enabling works</td>
</tr>
<tr>
<td>Changes to traditional land tenure system (induced)</td>
<td>Site preparation and enabling works</td>
</tr>
<tr>
<td>Increased pressure on education facilities (indirect/induced)</td>
<td>Site preparation and enabling works</td>
</tr>
<tr>
<td>Social disarticulation and increased family and community conflict (indirect/induced)</td>
<td>Construction and pre-commissioning</td>
</tr>
</tbody>
</table>
### Table 8.24-2 Significant Residual Impacts of the Tilenga Project

<table>
<thead>
<tr>
<th>Potential Residual Impact</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes to traditional way of life leading to loss of community/sense of place (indirect/induced)</td>
<td>Construction and pre-commissioning</td>
</tr>
<tr>
<td>Increased prostitution (indirect/induced)</td>
<td>Construction and pre-commissioning</td>
</tr>
<tr>
<td>Local price inflation (induced)</td>
<td>Site preparation and enabling works</td>
</tr>
<tr>
<td>Loss of tourism revenue (indirect)</td>
<td>Construction and pre-commissioning</td>
</tr>
<tr>
<td>Increase in teenage and unwanted pregnancy (indirect)</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations</td>
</tr>
<tr>
<td>Increased prevalence of HIV/AIDS and other STIs (indirect)</td>
<td>Site preparation and enabling works, construction and pre-commissioning, commissioning and operations</td>
</tr>
<tr>
<td>Tangible and intangible cultural heritage</td>
<td></td>
</tr>
<tr>
<td>No significant impacts identified</td>
<td>–</td>
</tr>
</tbody>
</table>

**Climate**

- GHG emissions: Commissioning and operations

**Ecosystem services**

- Direct impacts including surface water runoff, disruption of fish and macroinvertebrates, and indirect impacts; overfishing and increased demand due to PIIM, and reduction in species diversity and catch size, on capture fisheries: Construction and pre-commissioning, commissioning and operations
- Direct impact on wild foods and bushmeat through increased hunting, demand and instances of commercial hunting of flagship species, improved access and increases in human-wildlife conflicts: Commissioning and operations
- Direct and indirect impacts on tourism and recreation values and wild species diversity, through disturbance to wild animals and visitors to Murchison Falls, damage to MFNP’s reputation for remoteness and wildness, and increased hunting activities due to improved access: Construction and pre-commissioning, commissioning and operations
8.24.2 Kingfisher Oil Project

This section summarises the significant residual impacts from the Kingfisher Oil Project.

The beneficial impacts are described in Table 8.24-3 and the significant residual impacts are presented in Table 8.24-4. Information received from the project infers that an impact ranked as being of low significance does not require mitigation; Table 8.24-4 therefore includes the impacts ranked with moderate and high significance.

Table 8.24-3 Beneficial Impacts of the Kingfisher Oil Project

<table>
<thead>
<tr>
<th>Beneficial Impacts</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socio-economic VECs</td>
<td></td>
</tr>
<tr>
<td>Employment opportunities for local communities</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Skills development and training for employees</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Provision of accommodation and catering facilities for contract workers</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>National and regional economic growth</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Local economic development</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Human capital development</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Increase in government revenue</td>
<td>Operation</td>
</tr>
<tr>
<td>Project acting as a persuasive and influential partner in promoting the development of a stable and diversified economy around the CPF</td>
<td>Operation</td>
</tr>
<tr>
<td>Project creating the impetus for increased government investment in district government funding</td>
<td>Operation</td>
</tr>
<tr>
<td>New well-ventilated, multi-roomed homes which will reduce the impact of respiratory diseases, in the case of relocation</td>
<td>Construction</td>
</tr>
<tr>
<td>Replacement of lost houses with modern weatherproof houses</td>
<td>Construction</td>
</tr>
<tr>
<td>Compensation from land acquisition combined with mechanisms to ensure effective livelihood restoration providing income to affected landowners along the feeder pipeline</td>
<td>Construction</td>
</tr>
<tr>
<td>Contribution of the project to the control of vector-based and noncommunicable diseases in communities around the CPF</td>
<td>Operation</td>
</tr>
<tr>
<td>Improved access provided by regional road upgrades</td>
<td>Construction and operation</td>
</tr>
</tbody>
</table>
### Table 8.24-4  Significant Residual Impacts of the Kingfisher Oil Project

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biodiversity: habitats of conservation importance</strong></td>
<td></td>
</tr>
<tr>
<td>Indirect impacts of in-migration (PIIM) pressures including changes in water quality and increased soil erosion, increased harvesting and grazing on the habitats and ecosystem integrity of Buhuka Flats around the CPF</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Indirect impacts of PIIM pressures including changes in water quality and increased soil erosion, increased harvesting and grazing on the habitats and ecosystem integrity of the escarpment vegetation corridors near the CPF</td>
<td>Operation</td>
</tr>
<tr>
<td>Impact of the jetty upgrade at the CPF on sediment transport along the shoreline of Lake Albert affecting ecosystem composition</td>
<td>Construction</td>
</tr>
<tr>
<td>Impact of habitat loss of seasonal wetland and disturbance due to the extension of well pad 1 at the CPF on ecosystem composition</td>
<td>Construction</td>
</tr>
<tr>
<td>Indirect impacts of PIIM pressures including changes in water quality and increased sedimentation and erosion on wetlands and drainage lines along the feeder pipeline</td>
<td>Construction</td>
</tr>
<tr>
<td><strong>Biodiversity: flora and fauna species of conservation importance</strong></td>
<td></td>
</tr>
<tr>
<td>Indirect impacts of PIIM pressure including habitat degradation, poaching, increased sedimentation on species of conservation concern including the mud snail (CR) along the shores of Lake Albert, grey-crowned crane (EN) on Buhuka Flats and Nahan’s francolin (CR) and Eastern chimpanzees (EN) in the Bugoma Central Forest Reserve (BCFR), due to the CPF</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Direct impact of habitat loss and degradation through sedimentation and contamination on the mud snail (CR) along the shores of Lake Albert due to the CPF</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Impacts of additional construction traffic and transmission of human diseases on the survival and reproduction of Eastern chimpanzees within the BCFR</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Impacts on ecosystem configuration due to potential barrier effects of the road for fauna species through the escarpment vegetation corridors</td>
<td>Operation</td>
</tr>
<tr>
<td>Indirect impacts of PIIM pressure due to the feeder pipeline, including pressures on natural resources, on species of conservation concern, the grey-crowned crane (EN) on Buhuka Flats</td>
<td>Construction</td>
</tr>
</tbody>
</table>
### Table 8.24-4  Significant Residual Impacts of the Kingfisher Oil Project

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiversity: legally protected, internationally or nationally recognised areas</td>
<td></td>
</tr>
<tr>
<td>Indirect impacts of PIIM pressures including encroachment on the habitats and ecosystem integrity of Bugoma Central Forest Reserve, due to the CPF and feeder pipeline</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Indirect impacts of upgrades of roads to the CPF within the Bugoma Central Forest Reserve, including collision, nuisance and harassment of wild animals</td>
<td>Construction</td>
</tr>
<tr>
<td>Soils</td>
<td></td>
</tr>
<tr>
<td>No significant impacts were identified</td>
<td></td>
</tr>
<tr>
<td>Surface water</td>
<td></td>
</tr>
<tr>
<td>Impact on water levels in Lake Albert due to the CPF abstracting water</td>
<td>Operation</td>
</tr>
<tr>
<td>Groundwater</td>
<td></td>
</tr>
<tr>
<td>No significant impacts were identified</td>
<td></td>
</tr>
<tr>
<td>Landscape</td>
<td></td>
</tr>
<tr>
<td>Impact on the visual aesthetics for local communities around the CPF (daytime and night-time)</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>No significant impacts were identified along the feeder pipeline</td>
<td></td>
</tr>
<tr>
<td>Air quality</td>
<td></td>
</tr>
<tr>
<td>No significant impacts were identified</td>
<td></td>
</tr>
<tr>
<td>Acoustic environment</td>
<td></td>
</tr>
<tr>
<td>Impact of night-time CPF construction on structures and households close to CPF</td>
<td>Construction</td>
</tr>
<tr>
<td>Impact of night-time drilling noise on structures and households around the CPF</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Impact of night-time civil construction noise on structures and households</td>
<td>Construction</td>
</tr>
</tbody>
</table>
## Table 8.24-4  Significant Residual Impacts of the Kingfisher Oil Project

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socio-economic (economy; local economy (nonland-based livelihoods); land-based livelihoods; river and lake-based livelihoods; land and property; workers’ health, safety and welfare; social infrastructure and services; community health; community safety, security and welfare)</td>
<td>Construction</td>
</tr>
<tr>
<td>Indirect impacts due to PIIM, on infrastructure and community services such as increasing demand on limited schools, health and welfare services, emergency service and water supply at the CPF</td>
<td>Construction</td>
</tr>
<tr>
<td>Impact of loss of income due to layoff of casual labour around the CPF and along the feeder pipeline</td>
<td>Construction</td>
</tr>
<tr>
<td>Impact of sexually transmitted diseases (STDs), including HIV/AIDS on employee health and safety around the CPF and along the feeder pipeline</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Impact on land property and rates around the CPF and along the feeder pipeline</td>
<td>Construction</td>
</tr>
<tr>
<td>Impact of disrupted local livelihoods due to loss of grazing land on the Buhuka Flats due to CPF construction and of land on which subsistence agriculture is practiced along the feeder pipeline</td>
<td>Construction</td>
</tr>
<tr>
<td>Impacts due to PIIM, including competition for jobs and resources increasing tensions, increased pressure on existing services such as health centres and schools, dilution of local government influence, increase in vector-related diseases, STDs, water borne diseases, food and nutrition related diseases and zoonotic diseases, and increased crime and fire risks at the communities around the CPF</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Impacts due to PIIM, including competition for jobs and resources increasing tensions, increased pressure on existing services such as health centres and schools, and dilution of local government influence</td>
<td>Construction</td>
</tr>
<tr>
<td>Impact of STDs, including HIV/AIDS, on local communities around the CPF and along the feeder pipeline</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Impacts of land loss, resulting in loss of grazing land and resettlement around the CPF</td>
<td>Construction</td>
</tr>
<tr>
<td>Impact on land and property rates from increased land speculation on the Buhuka Flats due to the CPF and feeder pipeline</td>
<td>Construction</td>
</tr>
<tr>
<td>Impact of increased property prices and rental on existing tenants around the CPF</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Impact of social fragmentation and loss of sense of place in communities around the CPF</td>
<td>Construction</td>
</tr>
<tr>
<td>Impact of unmet expectations if work seekers are unsuccessful in communities along the feeder pipeline</td>
<td>Construction</td>
</tr>
<tr>
<td>Disruption of social networks due to resettlement of communities within the CPF footprint and along the feeder pipeline</td>
<td>Construction and operation</td>
</tr>
</tbody>
</table>
### Table 8.24-4 Significant Residual Impacts of the Kingfisher Oil Project

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact of the release of hazardous materials or wastes through small spillages outside controlled areas on community safety around the CPF</td>
<td>Operation</td>
</tr>
<tr>
<td>Impact of restrictions on land use; prohibited further settlement or other built infrastructure within the buffer zone around the CPF</td>
<td>Operation</td>
</tr>
<tr>
<td>Tangible and intangible cultural heritage</td>
<td></td>
</tr>
<tr>
<td>Direct impacts (loss or damage of site) on lithic archaeological sites from the Stone Age, a location where a bangle fragment was found, and sites of undated pottery scatter around the CPF location</td>
<td>Construction</td>
</tr>
<tr>
<td>Indirect impacts on intangible cultural landscapes, ritual sites, a sacred river and a sacred tree around the CPF location</td>
<td>Construction and operation</td>
</tr>
<tr>
<td>Climate</td>
<td></td>
</tr>
<tr>
<td>No significant impacts identified around the CPF or along the feeder pipeline</td>
<td></td>
</tr>
</tbody>
</table>