PROPOSED PEDESTRIAN BRIDGES IN WARD 5 OF SENQU LOCAL MUNICIPALITY

DEDEAT Reference:

AQUATIC IMPACT ASSESSMENT

Prepared for:
Senqu Local Municipality

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REVISIONS TRACKING TABLE

<table>
<thead>
<tr>
<th>Name</th>
<th>Responsibility</th>
<th>Signature</th>
<th>Date</th>
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<tbody>
<tr>
<td>Caitlin Smith</td>
<td>Lead Author</td>
<td></td>
<td>May 2016</td>
</tr>
<tr>
<td>Dr Cherie-Lynn Mack</td>
<td>Reviewer</td>
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<td>May 2016</td>
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1 INTRODUCTION

1.1 Project description

The Senqu Local Municipality (LM) is proposing to construct two pedestrian bridges over the Nduma River and the Mabele River (non-perennial rivers) which are located between the Blom and Nothanda rural settlements in the Eastern Cape Province (Figure 1.1).

Bridge 1 will be constructed approximately 180 m from the informal houses situated within the Blom rural village and Bridge 2 will be constructed approximately 150 m from the rural village of Nothanda. The villages are located within the Senqu Local Municipality (Joe Gqabi District Municipality) within the Eastern Cape and are approximately 200 m from the South Africa-Lesotho border.

The construction of the proposed pedestrian bridges will take place near the current untarred road which connects the two rural settlements. Flooding experienced in the areas has resulted in the damage of the existing low-level causeways. The pedestrian bridges are intended to provide a safe river crossing for the residents of the villages who would otherwise be cut-off from each other during heavy rainfall events.

Senqu LM has appointed EOH Coastal and Environmental Services (EOH CES) to conduct the Aquatic Impact Assessment for submission to the Department of Water and Sanitation (DWS).

Figure 1.1: Location of the proposed bridge sites within the Senqu Local Municipality.
1.2 Objectives and Terms of Reference

The objectives of the aquatic assessment were to:

- Provide a general description of the status of the water resources of the area (in particular the affected tributaries of the Telle River) according to published literature.
- Provide a general description of the natural aquatic environment in the vicinity of the proposed new bridge structures.
- Identify potential impacts of the proposed construction on the aquatic environment.

1.3 Approach

The study site and surrounding areas were assessed using a two-phased approach. Firstly, a desktop assessment of the site was conducted in terms of current biodiversity programmes and plans.

Further to the above, a site visit was conducted in May 2016. The site visit served to inform potential impacts of the proposed project and how significantly it would impact on the surrounding aquatic environment.

The study area for this report is 200 m surrounding each bridge site (east and west of the bridge sites and north and south of the bridge sites).

1.4 Assumptions and Limitations

This report is based on currently available information and, as a result, the following limitations and assumptions are implicit:

- The report is based on limited project information provided by the client.
- Descriptions of the natural environments are based on limited fieldwork and available literature.
2 RELEVANT LEGISLATION

The following legislation is relevant when considering aquatic impacts identified during the Planning and Design, Construction and Operation Phase of the proposed bridges.

Table 2.1: Environmental legislation considered in the preparation of the Aquatic Report for the construction of the pedestrian bridges over tributaries of the Telle River.

<table>
<thead>
<tr>
<th>Title of Environmental legislation, policy or guideline</th>
<th>Implications for the proposed bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constitution Act (108 of 1996)</td>
<td>Obligation to ensure that the proposed development will not result in pollution and ecological degradation; and Obligation to ensure that the proposed development is ecologically sustainable, while demonstrating economic and social development.</td>
</tr>
<tr>
<td>National Environmental Management Act (NEMA) (107 of 1998)</td>
<td>The developer must apply NEMA principles, the fair decision-making and conflict management procedures that are provided for in NEMA. The developer must apply the principles of Integrated Environmental Management and consider, investigate and assess the potential impact of existing and planned activities on the environment, socio-economic conditions and the cultural heritage.</td>
</tr>
<tr>
<td>National Environment Management: Biodiversity Act (10 of 2004)</td>
<td>The proposed development must conserve endangered ecosystems and protect and promote biodiversity; Must assess the impacts of the proposed development on endangered ecosystems; No protected species may be removed or damaged without a permit; The proposed site must be cleared of alien vegetation using appropriate means.</td>
</tr>
<tr>
<td>National Water Act (36 of 1998)</td>
<td>Provides details of measures intended to ensure the comprehensive protection of all water resources, including the water reserve and water quality.</td>
</tr>
</tbody>
</table>
3 ASSESSMENT METHODOLOGY

3.1 Aquatic Assessment

The aim of this assessment is to identify the aquatic importance of the tributaries of the Telle River (as well as the Telle River itself) and to evaluate the sensitivity of the rivers.

The following literature was consulted for the desktop assessment of the rivers:

- The Eastern Cape Biodiversity Conservation Plan (2007)
- The National Freshwater Ecosystems Protected Areas Programme (2011)
- Department of Water and Sanitation Desktop Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) Model (2014).
- Department of Water Affairs and Forestry: Level 2 River Ecoregional Classification System for South Africa, Lesotho and Swaziland (2007).

A site visit was also conducted on 4 May 2016 in order to obtain photographic evidence of the current state of the rivers at the proposed crossing sites.

3.2 Impact assessment

3.2.1 Impact rating methodology

To ensure a direct comparison between various specialist studies, a standard rating scale has been defined and will be used to assess and quantify the identified impacts. This is necessary since impacts have a number of parameters that need to be assessed. Five factors need to be considered when assessing the significance of impacts, namely:

- Relationship of the impact to temporal scales - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
- Relationship of the impact to spatial scales - the spatial scale defines the physical extent of the impact.
- The severity of the impact - the severity/beneficial scale is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party.

The severity of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it. The word 'mitigation' means not just 'compensation', but also the ideas of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.

- The likelihood of the impact occurring - the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.
Each criterion is ranked with scores assigned as presented in Table 3-2 to determine the overall significance of an activity. The criterion is then considered in two categories, viz. effect of the activity and the likelihood of the impact. The total scores recorded for the effect and likelihood are then read off the matrix presented in Table 3-3, to determine the overall significance of the impact. The overall significance is either negative or positive.

The significance scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of a social nature need to reflect the values of the affected society.

**Cumulative Impacts**
Cumulative impacts affect the significance ranking of an impact because the impact is taken in consideration of both onsite and offsite sources. For example, pollution making its way into a river from a development may be within acceptable national standards. Activities in the surrounding area may also create pollution which does not exceed these standards. However, if both onsite and offsite activities take place simultaneously, the total pollution level may exceed the standards. For this reason it is important to consider impacts in terms of their cumulative nature.

**Seasonality**
Although seasonality is not considered in the ranking of the significance, it may influence the evaluation during various times of year. As seasonality will only influence certain impacts, it will only be considered for these, with management measures being imposed accordingly (i.e. dust suppression measures being implemented during the dry season).

**Table 3.2. Significance Rating Table.**

<table>
<thead>
<tr>
<th>Temporal Scale (The duration of the impact)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Short term</td>
<td>Less than 5 years (many construction phase impacts are of a short duration).</td>
</tr>
<tr>
<td>Medium term</td>
<td>Between 5 and 20 years.</td>
</tr>
<tr>
<td>Long term</td>
<td>Between 20 and 40 years (from a human perspective almost permanent).</td>
</tr>
<tr>
<td>Permanent</td>
<td>Over 40 years or resulting in a permanent and lasting change that will always be there.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spatial Scale (The area in which any impact will have an affect)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td>Impacts affect an individual.</td>
</tr>
<tr>
<td>Localised</td>
<td>Impacts affect a small area of a few hectares in extent. Often only a portion of the project area.</td>
</tr>
<tr>
<td>Project Level</td>
<td>Impacts affect the entire project area.</td>
</tr>
<tr>
<td>Surrounding Areas</td>
<td>Impacts that affect the area surrounding the development</td>
</tr>
<tr>
<td>Municipal</td>
<td>Impacts affect either the Local Municipality, or any towns within them.</td>
</tr>
<tr>
<td>Regional</td>
<td>Impacts affect the wider District Municipality or the province as a whole.</td>
</tr>
<tr>
<td>National</td>
<td>Impacts affect the entire country.</td>
</tr>
</tbody>
</table>
### Table 3.3 Impact Severity Rating.

<table>
<thead>
<tr>
<th>Impact severity</th>
<th>Very severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example the permanent loss of land.</td>
<td>A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.</td>
</tr>
<tr>
<td>Severe</td>
<td>Beneficial</td>
</tr>
<tr>
<td>Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.</td>
<td>A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.</td>
</tr>
<tr>
<td>Moderately severe</td>
<td>Moderately beneficial</td>
</tr>
<tr>
<td>Medium to long term impacts on the affected system(s) or party(ies), which could be mitigated. For example constructing the sewage treatment facility where there was vegetation with a low conservation value.</td>
<td>A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.</td>
</tr>
<tr>
<td>Slight</td>
<td>Slightly beneficial</td>
</tr>
<tr>
<td>Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.</td>
<td>A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.</td>
</tr>
<tr>
<td>No effect</td>
<td>Don’t know/Can’t know</td>
</tr>
<tr>
<td>The system(s) or party(ies) is not affected by the proposed development.</td>
<td>In certain cases it may not be possible to determine the severity of an impact.</td>
</tr>
</tbody>
</table>

### Table 3.4 Overall Significance Rating.

<table>
<thead>
<tr>
<th>Overall Significance</th>
<th>(The combination of all the above criteria as an overall significance)</th>
</tr>
</thead>
</table>

International/Global | Impacts affect other countries or have a global influence.
Will definitely occur | Impacts will definitely occur.

**Degree of Confidence or Certainty**
(The confidence with which one has predicted the significance of an impact)

- **Definite**: More than 90% sure of a particular fact. Should have substantial supportive data.
- **Probable**: Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
- **Possible**: Only over 40% sure of a particular fact, or of the likelihood of an impact occurring.
- **Unsure**: Less than 40% sure of a particular fact, or of the likelihood of an impact occurring.
### VERY HIGH NEGATIVE | VERY BENEFICIAL
---|---
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects.

**Example:** The loss of a species would be viewed by informed society as being of VERY HIGH significance.

**Example:** The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.

### HIGH NEGATIVE | BENEFICIAL
---|---
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light.

**Example:** The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated.

**Example:** The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.

### MODERATE NEGATIVE | SOME BENEFITS
---|---
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial.

**Example:** The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.

### LOW NEGATIVE | FEW BENEFITS
---|---
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect.

**Example:** The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels.

**Example:** The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.

### NO SIGNIFICANCE
There are no primary or secondary effects at all that are important to scientists or the public.

**Example:** A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.

### DON’T KNOW
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information.

**Example:** The effect of a particular development on people’s psychological perspective of the environment.
4 DESCRIPTION OF THE BIOPHYSICAL ENVIRONMENT

4.1 Desktop Investigation

Published literature on the ecology of the area was referenced in order to describe the study site in the context of the region and the Eastern Cape Province. The following documents/plans are referenced:

- The Eastern Cape Biodiversity Conservation Plan (2007)
- The National Freshwater Ecosystems Protected Areas Programme (2011)
- Department of Water and Sanitation Desktop Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) Model (2014).
- Department of Water Affairs and Forestry: Level 2 River Ecoregional Classification System for South Africa, Lesotho and Swaziland (2007).

The bridge sites are located within quaternary catchment D18K (primary catchment D) and falls within Water Management Area (WMA) 6 (Figure 4.1 below).

Figure 4.1: Quaternary catchment locality.

The two bridge sites cross non-perennial tributaries of the Telle River. Bridge 1 crosses the Mabele River and bridge 2 crosses the Nduma River (Figure 4.2).
4.1.1 The National Spatial Biodiversity Assessment (2004)

The National Spatial Biodiversity Assessment of 2004 is a framework document within which fine-scale conservation planning in identified priority areas should occur. The NSBA integrates terrestrial, river, marine, estuarine and wetland ecosystems using available spatial data, relevant conservation planning software and a series of expert and stakeholder workshops. It is important to note that the NSBA was conducted at a national scale (1:250 000), and thus can only provide a general context for biodiversity assessments at a local level.

An important tool used in the NSBA is conservation status. Conservation status aims at identifying threatened ecosystems, and is based on the classification scheme developed by the IUCN to categorise species. Of the 120 rivers in South Africa that have been classified using this categorisation, 44 % are critically endangered, 27 % are endangered, 11 % are vulnerable and 18 % are least threatened. The Telle River is listed as Critically endangered (Figure 4.3).

Critically endangered ecosystems have lost so much of their original natural habitat that ecosystem functioning has broken down and species associated with the ecosystem have been lost or are likely to be lost.
4.1.2 National Freshwater Ecosystem Priority Areas (NFEPA), 2011

The National Freshwater Ecosystem Priority Areas (NFEPA) project provides strategic spatial priorities for conserving South Africa’s freshwater ecosystems and supports sustainable use of water resources. These priority areas are called Freshwater Ecosystem Priority Areas, or ‘FEPAs’.

FEPAs were identified based on:

- Representation of ecosystem types and flagship free-flowing rivers
- Maintenance of water supply areas in areas with high water yield
- Identification of connected ecosystems
- Representation of threatened and near-threatened fish species and associated migration corridors
- Preferential identification of FEPAs that overlapped with:
  - Any free-flowing river
  - Priority estuaries identified in the National Biodiversity Assessment 2011
  - Existing protected areas and focus areas for protected area expansion identified in the National Protected Area Expansion Strategy.

The Telle River has been classified as FEPA code 0 which is a river that has **not been classified** (Figure 4.4).

No NFEPA wetlands were identified within 500 of the bridge sites.
Figure 4.4. Freshwater Ecosystem Priority Area status of the Telle River (NFEPA, 2011).

The table below indicates the Present Ecological State (PES) classification of the closest river reach to the bridge sites assessed by the DWS as part of the Desktop PESEIS (2014), as well as the Ecological Importance (EI) and Sensitivity and Socio-economic Importance (SI) of the river reach.

The PES of the Telle River is classified as “B”, i.e. Largely Natural. The mean EI class is classified as moderate and the ES class is classified as high.
Table 4.1 Present Ecological State, Ecological Importance and Sensitivity of the closest river reach to the bridge sites.

<table>
<thead>
<tr>
<th>SELECT SQ REACH</th>
<th>SQR NAME</th>
<th>LENGTH km</th>
<th>STREAM ORDER</th>
<th>PES ASSESSED BY XPERTS? (IF TRUE=&quot;Y&quot;)</th>
<th>REASONS NOT ASSESSED</th>
<th>PES CATEGORY DESCRIPTION</th>
<th>PES CATEGORY BASED ON MEDIAN OF METRICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>D18K-05359</td>
<td>Telle</td>
<td>11.53</td>
<td>2</td>
<td>Y</td>
<td></td>
<td>LARGELY NATURAL</td>
<td>B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MEAN EI CLASS</th>
<th>MEAN ES CLASS</th>
<th>DEFAULT ECOLOGICAL CATEGORY (EC)</th>
<th>RECOMMENDED ECOLOGICAL CATEGORY (REC)</th>
<th>PRESENT ECOLOGICAL STATE</th>
<th>ECOLOGICAL IMPORTANCE</th>
<th>ECOLOGICAL SENSITIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODERATE</td>
<td>HIGH</td>
<td>B</td>
<td>0</td>
<td>INSTREAM HABITAT CONTINUITY MOD</td>
<td>FISH SPP/SQ</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RIP/WETLAND ZONE CONTINUITY MOD</td>
<td>FISH: AVERAGE CONFIDENCE</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>POTENTIAL INSTREAM HABITAT MOD ACT.</td>
<td>FISH REPRESENTIVITY PER SECONDARY: CLASS</td>
<td>MODERATE</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>RIPARIAN-WETLAND ZONE MOD</td>
<td>FISH REPRESENTIVITY PER SECONDARY: CLASS</td>
<td>MODERATE</td>
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<td></td>
<td>POTENTIAL FLOW MOD ACT.</td>
<td>FISH RARITY PER SECONDARY: CLASS</td>
<td>VERY HIGH</td>
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<td></td>
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<td>POTENTIAL PHYSICO-CHEMICAL MOD ACTIVITIES</td>
<td>ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING</td>
<td>LOW</td>
</tr>
<tr>
<td>Rating</td>
<td>Habitat Size (Length) Class</td>
<td>Distribution Class</td>
<td>Description</td>
<td></td>
<td></td>
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<td>--------------------</td>
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<td></td>
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</tr>
<tr>
<td>HIGH</td>
<td>VERY LOW</td>
<td>HIGH</td>
<td>RIPARIAN-WETLAND VEG INTOLERANCE TO WATER LEVEL CHANGES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOW</td>
<td>INSTREAM MIGRATION LINK CLASS</td>
<td>VERY HIGH</td>
<td>RIPARIAN-WETLAND ZONE MIGRATION LINK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RIPARIAN-WETLAND ZONE HABITAT INTEGRITY CLASS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>INSTREAM HABITAT INTEGRITY CLASS</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.1.3 Eastern Cape Biodiversity Conservation Plan (ECBCP)

The ECBCP is a first attempt at detailed, low-level conservation mapping for land-use planning purposes. Specifically, the aims of ECBCP were to map critical biodiversity areas through a systematic conservation planning process. The current biodiversity plan includes the mapping of priority aquatic features, land-use pressures, critical biodiversity areas and develops guidelines for land and resource-use planning and decision-making.

The main outputs of the ECBCP are “critical biodiversity areas” or CBAs, which are allocated the following management categories:

1. CBA 1 = Maintain in a natural state
2. CBA 2 = Maintain in a near-natural state

The ECBCP maps CBAs based on extensive biological data and input from key stakeholders. Although ECBCP is mapped at a finer scale than the National Spatial Biodiversity Assessment (Driver et al., 2005) it is still, for the large part, inaccurate and “course”. Therefore it is imperative that the status of the environment, for any proposed development MUST first be verified before the management recommendations associated with the ECBCP are considered (Berliner and Desmet, 2007). It is also important to note that in absence of any other biodiversity plan, the ECBCP has been adopted by the Provincial Department of Economic Development and Environmental Affairs (DEDEAT) as a strategic biodiversity plan for the Eastern Cape.

As with terrestrial CBAs, aquatic CBAs are grouped into Biodiversity Land Management Classes (BLMCs). The ECBCP recommends limits (thresholds) to the total amount of land transformation that should be allowed in an ABLMC 1 and 2, if biodiversity is to be conserved. The goal is to maintain sufficiently large intact and well-connected habitat patches in each sub-quaternary catchment.

<table>
<thead>
<tr>
<th>ABLMC</th>
<th>CBA Code</th>
<th>Description of CBAs</th>
<th>ABLMC Threshold</th>
<th>Transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABLMC 1</td>
<td>CBA1</td>
<td>Critically important river sub-catchments; Priority primary catchments for E1 estuaries</td>
<td>Less than 10 % of total area of sub-quaternary catchment</td>
<td></td>
</tr>
<tr>
<td>ABLMC 2a</td>
<td>CBA2</td>
<td>Important sub-catchments, Primary catchment management areas for E2 estuaries</td>
<td>Less than 15 % of total area of sub-quaternary catchment</td>
<td></td>
</tr>
<tr>
<td>ABLMC 2b</td>
<td>CBA3</td>
<td>Catchments of free flowing rivers important for fish migration</td>
<td>Less than 20 % of total area of sub-quaternary catchment</td>
<td></td>
</tr>
</tbody>
</table>

The tributary that Bridge 1 crosses (Mabele River) is located in an Aquatic CBA 2 area. Bridge 2 (Nduma River) is located in a CBA 1 area (Figure 4.5).
4.1.4 Ecoregion

South Africa is a geologically, geomorphologically, climatically and ecologically complex country, and this has resulted in a diverse range of ecosystems, including rivers. River ecoregional classification or typing allows the grouping of rivers according to similarities based on a top-down nested hierarchy. The principle of river typing is that rivers grouped together at a particular level of the typing hierarchy will be more similar to one another than rivers in other groups. Ecological regions are regions within which there is relative similarity in the mosaic of ecosystems and ecosystem components (biotic and abiotic, aquatic and terrestrial).

According to the Department of Water Affairs and Forestry (2007) Level 2 River Ecoregional Classification System, the study area falls within Ecoregion 15: Eastern Escarpment Mountains.

This Ecoregion has the following characteristics:

- The vegetation consists of a range of grassland types with Afro Mountain and Alti Mountain Grassland being the defining types.
- Several major South African rivers have their sources in this region, e.g. Orange, Caledon, Wilge, Thukela, Buffalo, Mooi, Mzimkulu, Mzimvubu, Mgeni and Mkomazi.
- Mean annual precipitation: Moderate to very high.
- Drainage density: Medium.
- Stream frequency: Medium high.
- Slopes <5%: Generally <20%.
- Median annual simulated runoff: Moderate to very high.
- Mean annual temperature: Very low to moderate.
Table 4.2. Main attributes of the Eastern Escarpment Mountains 15.02 Ecoregion (Department of Water Affairs and Forestry Resource Quality Services, 2007).

<table>
<thead>
<tr>
<th>Main Attributes</th>
<th>Eastern Escarpment Mountains 15.02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain Morphology: Broad division</td>
<td>Closed Hills, Mountains; moderate and high relief</td>
</tr>
<tr>
<td>Terrain Morphology</td>
<td>High Mountains, <strong>Low Mountains</strong></td>
</tr>
<tr>
<td>Vegetation types (dominant types in bold) (Primary)</td>
<td><strong>Afro Mountain Grassland, Moist Cold Highveld Grassland</strong></td>
</tr>
<tr>
<td>Altitude (m a.m.s.l.)</td>
<td>1200 - 2900</td>
</tr>
<tr>
<td>MAP (mm)</td>
<td>500 - 700</td>
</tr>
<tr>
<td>Coefficient of variation (% of annual precipitation)</td>
<td>25 - 35</td>
</tr>
<tr>
<td>Rainfall concentration index</td>
<td>45 - 55</td>
</tr>
<tr>
<td>Rainfall seasonality</td>
<td><strong>Mid Summer, Late Summer</strong></td>
</tr>
<tr>
<td>Mean annual temp (°C)</td>
<td>&lt;8 - 14</td>
</tr>
<tr>
<td>Mean daily max temp (°C) February</td>
<td>18 - 24</td>
</tr>
<tr>
<td>Mean daily max temp (°C) July</td>
<td>&lt;10 - 16</td>
</tr>
<tr>
<td>Mean daily min temp (°C) February</td>
<td>&lt;6 - 12</td>
</tr>
<tr>
<td>Mean daily min temp (°C) July</td>
<td>8 - &gt;10</td>
</tr>
<tr>
<td>Median annual simulated runoff (mm) for quaternary catchment</td>
<td>810 - 1120</td>
</tr>
</tbody>
</table>
4.2 Site survey

4.2.1 Site description

- The Tele, Mabele and Nduma Rivers contained sparse riparian vegetation along their beds and banks.
- The riparian vegetation zones were surrounded by the semi-degraded Senqu Montane Shrubland.
- Plants observed included *Juncus kraussii*, *Gomphostigma virgatum*, *Vernonia capensis* and *Leucosideris sercea*.
- *Bobartia orientlis* plants are dominant.
- The vegetation type also contained a large number of alien plants including *Oenthoera rosea* and *Acacia saligna*.
- The rivers generally appeared to be in a good condition.
- A bit of erosion was evident on the banks of the rivers, especially where local people currently cross the banks through the rivers.

Below is a photo sequence showing the affected rivers and surrounding aquatic environment:
View downstream of the Mabele River.

View upstream of the Nduma River (bridge 2 crosses this river).
Aquatic Impact Assessment

EOH Coastal & Environmental Services

19 Senqu Pedestrian Bridge

**View downstream of the Nduma River.**

**View upstream of Telle River.**
View downstream of Telle River.

*Juncus kraussii*
<table>
<thead>
<tr>
<th>Image 1</th>
<th>Image 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Datura stramonium" /></td>
<td><img src="image2.png" alt="Xanthium spinosum" /></td>
</tr>
</tbody>
</table>

**Datura stramonium (alien vegetation)**

**Xanthium spinosum (alien vegetation)**
Gomphostigma virgatum

Leucosided sercea
4.3 Site sensitivity

A sensitivity map (Figure 4.6 below) was developed based on desktop and site information gathered, and was classified into areas of high and low sensitivity.

High Sensitivity

- Telle River with 32 m river buffer.

Moderate Sensitivity

- Nduma and Mabele River with 32 m buffer.

Low Sensitivity

- All areas outside the rivers within the study area.

Authorisation must be obtained from DWS prior to any construction taking place within the required buffers as indicated below:

- 32 m from all watercourses

Figure 4.6. Sensitivity map of the study area.
5 IMPACT ASSESSMENT

Impacts were identified during the Planning and Design, Construction and Operation Phase of the proposed pedestrian bridges and are described below. These included the consideration of direct, indirect and cumulative impacts that may occur.

Table 5.1 below is a summary of the issues identified and their applicability to each phase of construction.

Table 5.1 Issues identified for the proposed Senqu Pedestrian Bridges.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Applicability to each phase</th>
<th>Planning and Design</th>
<th>Construction</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legal and policy compliance</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Non-compliance with the laws and policies of South Africa as they pertain to the aquatic environment.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scheduling of construction</td>
<td>YES</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Inappropriate construction scheduling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes to fluvial geomorphology</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>• Incorrect design of bridge pilings or culverts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Insufficient planning for erosion prevention along the banks of the river</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stormwater management</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>Inappropriate routing of stormwater.</td>
</tr>
<tr>
<td></td>
<td>Inappropriate stormwater design</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Quality</td>
<td>N/A</td>
<td>YES</td>
<td>YES</td>
<td>Inappropriate routing of stormwater.</td>
</tr>
<tr>
<td></td>
<td>• Accidental contamination of wet concrete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Accidental chemical spills in the vicinity of the rivers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riparian vegetation</td>
<td>N/A</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Indiscriminate removal of riparian vegetation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrology</td>
<td>N/A</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Coffer dams may permanently change the flow dynamics in the rivers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invasion of alien species</td>
<td>N/A</td>
<td>YES</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Removal of existing natural vegetation resulting in invasion by alien species.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Table 5.2: Impacts and mitigation measures for the Planning and Design Phase of the proposed pedestrian bridges.**

<table>
<thead>
<tr>
<th>ISSUE</th>
<th>DESCRIPTION OF IMPACT</th>
<th>NATURE OF IMPACT</th>
<th>SPATIAL SCALE (EXTENT)</th>
<th>TEMPORAL SCALE (DURATION)</th>
<th>CERTAINTY SCALE (LIKELIHOOD)</th>
<th>SEVERITY / BENEFICIAL SCALE</th>
<th>SIGNIFICANCE PRE-MITIGATION</th>
<th>MITIGATION MEASURES</th>
<th>SIGNIFICANCE POST-MITIGATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legal and policy compliance</td>
<td>During the planning and design phase non-compliance with the laws and policies of South Africa as they pertain to the aquatic environment could lead to damage to the aquatic environment, unnecessary delays in construction activities, and potentially criminal cases, based on the severity of the non-compliance, being brought against the proponent and his/her contractors.</td>
<td>DIRECT</td>
<td>Localised</td>
<td>Short term</td>
<td>Probable</td>
<td>Moderately severe</td>
<td>MODERATE NEGATIVE</td>
<td>• All legal matters pertaining to permitting must be completed prior to any construction activity. In particular, all necessary Water Use Licences must be in order.</td>
<td>LOW NEGATIVE</td>
</tr>
<tr>
<td>Scheduling of construction</td>
<td>During the planning and design phase inappropriate construction scheduling that does not take into account the seasonal requirements of the aquatic environment, e.g. allowing for unimpeded flood events, could lead to short-term (and potentially long-term) impacts on the aquatic environment such as excessive sediment mobilization, etc.</td>
<td>INDIRECT</td>
<td>Study area</td>
<td>Medium term</td>
<td>Possible</td>
<td>Moderately severe</td>
<td>MODERATE NEGATIVE</td>
<td>• Wherever possible, construction activities should be undertaken during the driest part of the year to minimize downstream sedimentation due to excavation, etc. • When not possible, suitable stream diversion structures must be used to ensure the river is not negatively impacted by construction activity.</td>
<td>LOW NEGATIVE</td>
</tr>
<tr>
<td>Changes to fluvial geomorphology</td>
<td>During the planning and design phase incorrect design of bridge pilings or culverts may result in scouring of the river bed in areas immediately surrounding the pilings or culverts.</td>
<td>DIRECT</td>
<td>Localised</td>
<td>Long term</td>
<td>Possible</td>
<td>Moderately severe</td>
<td>MODERATE NEGATIVE</td>
<td>• Scour countermeasures must be incorporated into the design of the bridges.</td>
<td>LOW NEGATIVE</td>
</tr>
<tr>
<td></td>
<td>During the planning and design phase insufficient planning for erosion prevention along the banks of the rivers alongside the bridge structures will result in erosion that may eventually impair the safety of the structures.</td>
<td>DIRECT</td>
<td>Localised and downstream</td>
<td>Long term</td>
<td>Possible</td>
<td>Moderately severe</td>
<td>MODERATE NEGATIVE</td>
<td>• Adequate bank stabilisation measures must be incorporated into the design of the bridges.</td>
<td>LOW NEGATIVE</td>
</tr>
</tbody>
</table>
**Aquatic Impact Assessment**

<table>
<thead>
<tr>
<th>Stormwater management</th>
<th>DIRECT</th>
<th>Localised</th>
<th>Long-term</th>
<th>Possible</th>
<th>Severe</th>
<th>HIGH NEGATIVE</th>
<th>MODERATE NEGATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>During the planning and design phase the inappropriate design of stormwater structures may result in increased levels of erosion, sedimentation and pollution of the watercourses.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Appropriate stormwater structures must be designed to minimise erosion and sedimentation of watercourses.</td>
</tr>
</tbody>
</table>
Table 5.3: Impacts and mitigation measures for the Construction Phase of the proposed pedestrian bridges.

<table>
<thead>
<tr>
<th>ISSUE</th>
<th>IMPACT</th>
<th>NATURE OF IMPACT</th>
<th>SPATIAL SCALE (EXTENT)</th>
<th>TEMPORAL SCALE (DURATION)</th>
<th>CERTAINTY SCALE (LIKELIHOOD)</th>
<th>SEVERITY/ BENEFICIAL SCALE</th>
<th>SIGNIFICANCE PRE-MITIGATION</th>
<th>MITIGATION MEASURES</th>
<th>SIGNIFICANCE POST-MITIGATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduling of construction</td>
<td>During the construction phase, inappropriate construction scheduling that does not take into account the seasonal requirements of the aquatic environment, e.g. allowing for unimpeded flood events, could lead to short-term (and potentially long-term) impacts on the aquatic environment such as excessive sediment mobilization, etc.</td>
<td>INDIRECT</td>
<td>Study area</td>
<td>Medium term</td>
<td>Possible</td>
<td>Moderately severe</td>
<td>MODERATE NEGATIVE</td>
<td>• Wherever possible, construction activities should be undertaken during the driest part of the year to minimize downstream sedimentation due to excavation, etc. • When not possible, suitable stream diversion structures must be used to ensure the river is not negatively impacted by construction activity.</td>
<td>LOW NEGATIVE</td>
</tr>
<tr>
<td>Water Quality</td>
<td>During the construction phase, accidental contamination of wet concrete (highly alkaline) in the river could result in flash kills of macro-invertebrates and fish species in the vicinity (see appendix A).</td>
<td>DIRECT CUMULATIVE</td>
<td>Localised</td>
<td>Short-term</td>
<td>Possible</td>
<td>Moderately severe</td>
<td>MODERATE NEGATIVE</td>
<td>• During the construction phase no concrete mixing must take place within 32 m of the river banks. • A serviced fire extinguisher (to neutralise pH levels if a spill occurs) must be available on site in the event that wet concrete is accidentally spilled into the rivers. • The mitigation measures in Appendix A must be used in conjunction with this report.</td>
<td>LOW NEGATIVE</td>
</tr>
<tr>
<td></td>
<td>During the construction phase, accidental chemical spills in the vicinity of the rivers will result in water pollution, adversely affecting the aquatic</td>
<td>DIRECT</td>
<td>Localised</td>
<td>Short-term</td>
<td>Possible</td>
<td>Moderately severe</td>
<td>MODERATE NEGATIVE</td>
<td>• During the construction phase no machinery must be parked overnight within 50 m of the rivers. • All stationary machinery must be</td>
<td>LOW NEGATIVE</td>
</tr>
<tr>
<td>EOH Coastal &amp; Environmental Services</td>
<td>28</td>
<td>Senqu Pedestrian Bridge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Aquatic Impact Assessment**

<table>
<thead>
<tr>
<th>Stormwater management</th>
<th>Direct</th>
<th>Localised, study area and downstream</th>
<th>Long-term</th>
<th>Probable</th>
<th>Moderately severe</th>
<th>Moderate negative</th>
<th>Flood attenuation and storm water management plans must be drawn up by a qualified engineer and DWS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riparian vegetation</td>
<td>Direct</td>
<td>Localised</td>
<td>Medium-term</td>
<td>Possible</td>
<td>Moderately severe</td>
<td>Moderate negative</td>
<td>During the construction phase removal of riparian vegetation should take place under the supervision of the ECO.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Removal of the alien invasive vegetation should be prioritised.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Banks should be artificially stabilized as soon as possible if significant riparian vegetation is removed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Only existing access roads to the bridge sites must be used. Vehicles and machinery should not encroach into areas outside/surrounding the bridge sites as far as is possible.</td>
</tr>
<tr>
<td>Hydrology</td>
<td>Direct cumulative</td>
<td>Localised and downstream</td>
<td>Medium-term</td>
<td>Possible</td>
<td>Severe</td>
<td>High negative</td>
<td>During the construction phase coffer dams must not be left in place for longer than 30 days.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>All work within the river should be completed during the dry season, when flows are at their lowest.</td>
</tr>
</tbody>
</table>
sedimentation. Both of these changes can impact negatively on the health of the aquatic ecosystem.

<table>
<thead>
<tr>
<th>Invasion of alien species</th>
<th>INDIRECT</th>
<th>Localised, study area</th>
<th>Long-term</th>
<th>Probable</th>
<th>Moderately severe</th>
<th>MODERATE NEGATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water in the rivers must be allowed to pass downstream of the construction activity. If necessary this should be achieved via a temporary diversion – this should not be in place for more than 30 days.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A Rehabilitation and Alien Management Plan must be developed and implemented during the construction phase to reduce the establishment and spread of undesirable alien plant species.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alien plants must be removed from the site through appropriate methods such as hand pulling, application of chemicals, cutting, etc.</td>
<td>LOW NEGATIVE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5.4: Impacts and mitigation measures for the Operational Phase of the proposed pedestrian bridges.

<table>
<thead>
<tr>
<th>ISSUE</th>
<th>IMPACT</th>
<th>NATURE OF IMPACT</th>
<th>SPATIAL SCALE (EXTENT)</th>
<th>TEMPORAL SCALE (DURATION)</th>
<th>CERTAINTY SCALE (LIKELIHOOD)</th>
<th>SEVERITY/ BENEFICIAL SCALE</th>
<th>SIGNIFICANCE PRE-MITIGATION</th>
<th>MITIGATION MEASURES</th>
<th>SIGNIFICANCE POST-MITIGATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes to fluvial geomorphology</td>
<td>During the operation phase, incorrect design or placement of bridge pilings or culverts may result in scouring of the river bed in areas immediately surrounding the pilings or culverts.</td>
<td>DIRECT</td>
<td>Localised</td>
<td>Long term</td>
<td>Possible</td>
<td>Moderately severe</td>
<td>MODERATE NEGATIVE</td>
<td>- Scour countermeasures must be incorporated into the design of the bridges and implemented.</td>
<td>LOW NEGATIVE</td>
</tr>
<tr>
<td></td>
<td>During the operation phase insufficient erosion prevention along the banks of the rivers alongside the bridge structures will result in erosion that may eventually impair the safety of the structures.</td>
<td>DIRECT</td>
<td>Localised and downstream</td>
<td>Long term</td>
<td>Possible</td>
<td>Moderately severe</td>
<td>MODERATE NEGATIVE</td>
<td>- Adequate bank stabilisation measures must be incorporated into the design of the bridges and implemented.</td>
<td>LOW NEGATIVE</td>
</tr>
</tbody>
</table>
| Stormwater management                      | During the operation phase inappropriate routing of stormwater will lead to stream sedimentation. | DIRECT           | Localised, study area and downstream | Long term                 | Probable                     | Moderately severe           | MODERATE NEGATIVE            | - Flood attenuation and storm water management plans must be drawn up by a qualified engineer and approved by DWS.  
- An Erosion and Sediment Management Plan must be developed and implemented to minimize the ingress of sediment-laden stormwater into the rivers. | LOW NEGATIVE                  |
6 IMPACT STATEMENT, CONCLUSION & RECOMMENDATIONS

6.1 Conclusions

Senqu LM is proposing to construct two pedestrian bridges over the tributaries of the Telle River in Ward 5 of the Senqu LM. Senqu LM has appointed EOH Coastal & Environmental Services (EOH CES) to conduct the Aquatic Impact Assessment for submission to the Department of Water and Sanitation.

An aquatic impact assessment was commissioned in order to assess the ecological importance of the aquatic environment through which the proposed bridges will be constructed. This report forms part of the Water Use Licence Application for the bridges.

A comparison of impacts in terms of the number of impacts per phase is illustrated in Table 6.1 below. HIGH pre-mitigation impacts relate to hydrology and stormwater management. The majority of the impacts can be mitigated using the recommended mitigation measures to LOW/MODERATE post-mitigation impacts.

Table 6.1: Assessment of pre- and post-mitigation impact significance.

<table>
<thead>
<tr>
<th></th>
<th>PRE-MITIGATION</th>
<th>POST-MITIGATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW</td>
<td>MOD</td>
</tr>
<tr>
<td>Planning and Design</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Construction</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Operation</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0</td>
<td>13</td>
</tr>
</tbody>
</table>

6.2 Water Use Licensing

A water use licence application is required for crossing the rivers in terms of the following triggers from the National Water Act (No. 36 of 1998):

• Sec 21 (c) - impeding or diverting the flow of water in a watercourse, and
• Sec 21 (i) - altering the bed, banks, course or characteristics of a watercourse.

The watercourse crossings must be authorised by the Department of Water and Sanitation prior to commencement of construction.

6.3 Recommendations for the proposed construction of the Senqu Pedestrian Bridges.

All the mitigation measures provided below are to be implemented in the Planning and Design, Construction and Operation Phases of the proposed bridges.

6.3.1 Planning and Design

• All legal matters pertaining to permitting must be completed prior to any construction activity. In particular, all necessary Water Use Licences must be in order.

• Wherever possible, construction activities should be undertaken during the driest part of the year to minimize downstream sedimentation due to excavation, etc.
6.3.2 Construction

- Wherever possible, construction activities should be undertaken during the driest part of the year to minimize downstream sedimentation due to excavation, etc.
- When not possible, suitable stream diversion structures must be used to ensure the river is not negatively impacted by construction activity.
- During the construction phase no concrete mixing must take place within 32 m of the river banks.
- A serviced fire extinguisher (to neutralise pH levels if a spill occurs) must be available on site in the event that wet concrete is accidentally spilled into the rivers.
- The mitigation measures in Appendix A must be used in conjunction with this report.
- During the construction phase no machinery must be parked overnight within 50 m of the rivers.
- All stationary machinery must be equipped with a drip tray to retain any oil leaks.
- Flood attenuation and storm water management plans must be drawn up by a qualified engineer and DWS.
- An Erosion and Sediment Management Plan must be developed to minimize the ingress of sediment-laden stormwater into the rivers.
- During the construction phase removal of riparian vegetation should take place under the supervision of the ECO.
- Removal of the alien invasive vegetation should be prioritised.
- Banks should be artificially stabilized as soon as possible if significant riparian vegetation is removed.
- Only existing access roads to the bridge sites must be used. Vehicles and machinery should not encroach into areas outside/surrounding the bridge sites as far as is possible.
- During the construction phase coffer dams must not be left in place for longer than 30 days.
- All work within the river should be completed during the dry season, when flows are at their lowest.
- Water in the rivers must be allowed to pass downstream of the construction activity. If necessary this should be achieved via a temporary diversion – this should not be in place for more than 30 days.
- A Rehabilitation and Alien Management Plan must be developed and implemented during the construction phase to reduce the establishment and spread of undesirable alien plant species.
- Alien plants must be removed from the site through appropriate methods such as hand pulling, application of chemicals, cutting, etc.

6.3.3 Operation

- Scour countermeasures must be incorporated into the design of the bridges and implemented.
- Adequate bank stabilisation measures must be incorporated into the design of the bridges and implemented.
- Flood attenuation and storm water management plans must be drawn up by a qualified engineer and approved by DWS.
- An Erosion and Sediment Management Plan must be developed and implemented to minimize the ingress of sediment-laden stormwater into the rivers.
6.4 Environmental statement and Opinion of the Specialist

The aquatic impacts of all aspects for the proposed Senqu Pedestrian Bridges were assessed and considered to be acceptable, provided that the mitigation measures provided in this report are implemented. All impacts are rated as MODERATE to HIGH pre-mitigation, therefore implementation of recommended mitigation measures coupled with comprehensive rehabilitation and monitoring in terms of re-vegetation and restoration is an important element of the mitigation strategy. Implementing the recommended mitigations measures will reduce impacts to MODERATE and LOW.
7 REFERENCES


National Environmental Management: Biodiversity Act (No 10 of 2004).


SANBI (bgis.sanbi.org).

Technical Report for the National Freshwater Ecosystem Priority Areas project.

Concrete Works – Information and Mitigation

Background

Concrete, cement, mortars, grouts and other Portland cement or lime-containing construction materials are basic or alkaline materials. They are highly toxic to fish and must only be used near water with extreme care.

What are acceptable pH ranges?

A pH level around 7 is typical for most watercourses, and this neutral pH is required for the survival of aquatic organisms. Should the pH rise or drop out of this range, fish and other aquatic organisms will become stressed and may die. Complete isolation of the work area is needed to ensure that pH value in the surrounding waterbody does not rise (become more alkaline) during works. The Ministry of Water, Land, and Air Protection’s British Columbia Approved Water Quality Criteria for pH sets the range for acceptable pH change with respect to fresh water aquatic life between 6.5 and 9.0. However, any increase in pH noted in conjunction with concrete works should be monitored and emergency protection measures implemented in accordance with the best practices below.

Objectives

The objective of this set of best practices is to ensure no concrete materials or leachates enter any watercourses.

Operational or Construction-related Best Practices

To ensure your works meet the requirements of applicable legislation:

Concrete Works

- Use pre-cast concrete structures whenever possible.
- As concrete leachate is alkaline and highly toxic to fish and other aquatic life, ensure that all works involving the use of concrete, cement, mortars, and other Portland cement or lime containing construction materials (concrete) will not deposit, directly or indirectly, sediments, debris, concrete, concrete fines, wash or contact water into or about any watercourse.
- Concrete materials cast in place must remain inside formed structures.
- Keep a carbon dioxide (CO2) tank with regulator, hose and gas diffuser readily available during concrete work. Use it to release carbon dioxide gas into the affected area to neutralize pH levels should a spill occur. Train workers to use the tank.
- Provide containment facilities for the wash-down water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment.
- Report immediately any spills of sediments, debris, concrete fines, wash or contact water. Implement emergency mitigation and clean-up measures immediately.
- Completely isolate all concrete work from any water within or entering into any watercourse or stormwater system.
- Monitor the pH frequently in the watercourse immediately downstream of the isolated worksite until completion of the works. Emergency measures will be implemented if downstream pH has changed more than 1.0 pH unit, measured to an accuracy of +/- 0.2 pH units from the background level, or is recorded to be below 6.0 or above 9.0 pH units.
- Prevent any water that contacts uncured or partly cured concrete during activities like exposed aggregate wash-off, wet curing, or equipment washing from directly or indirectly entering any watercourse or stormwater system.
• Maintain complete isolation of all cast-in-place concrete and grouting from fish-bearing waters for a minimum of 48 hours if ambient air temperature is above 0°C and for a minimum of 72 hours if ambient air temperature is below 0°C.

• Isolate and hold any water that contacts uncured or partly cured concrete until the pH is between 6.5 and 8.0 pH units, and the turbidity is less than 25 nephelometric turbidity units (NTU), measured to an accuracy of +/- 2 NTU.

For further information regarding the safe use of concrete materials, refer to the following websites:

**Cement and Concrete: Environmental Considerations**
http://www.buildinggreen.com/features/cem/cementconc.html

**Carbon Dioxide for Concrete Wash Water Treatment**
http://www.praxair.com/Praxair.nsf/d63afe71c771b0d785256519006c5ea1/78b5b272ccfbcdd8885256550069e32d?OpenDocument