CHAPTER 6:

IMPACT OF WATER CONSUMPTION AND REVIEW OF INTEGRATED WATER MANAGEMENT
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6. IMPACT ASSESSMENT OF WATER CONSUMPTION AND REVIEW OF INTEGRATED WATER MANAGEMENT

This chapter deals with the identification of issues and the assessment of potential impacts on local surface and groundwater resources related to the water use and wastewater discharge (domestic, process, brine and stormwater) from the proposed site during construction, operation and decommissioning of the Coega Integrated Power Project (CIPP). As such, the term “water resource” is used to refer to either a surface or groundwater body, and not the sea. Issues and impacts associated with the marine environment are addressed in Chapter 7.

This chapter is based on the specialist study by Philip de Souza and Grant Mackintosh (CSIR).

6.1 Approach to the Water Consumption and Review of Integrated Water Management study

6.1.1 Terms of Reference

The Water Consumption and Review of Integrated Water Management Study investigates water use and the management of liquid waste generated on-site by the project. The study included an assessment of available water sources, pre-treatment requirements and liquid wastewater characterization, as well as identification of requirements for on-site management of all liquid wastes generated.

The Terms of Reference require that the study include the following:

Water Consumption:

- Description and quantification of water quality and quantity requirements for different uses (e.g. process water, cooling water and domestic water).
- Identification of the source of any potable or recycled water required for the project, and confirmation of availability within the region for the provision of these water requirements. In addition, any potential sources of conflict that might arise regarding water availability and supply to the proposed project must be highlighted.
- Assessment of the predicted quality of source water for the project against the design requirements for the project, with discussion of the implications thereof.
- Brief description of on-site water treatment facilities (if any).
Wastewater and stormwater

- Identification and quantification of all wastewater streams (e.g. domestic, process, brine streams and stormwater).
- Identification of potential sources of contamination, constituents of concern, their expected concentrations (if possible), and an assessment of the potential impacts thereof.
- Description of the proposed wastewater disposal approach for different wastewater streams and identification of the points of discharge for different wastewater streams.
- Discussion of the potential constraints (e.g. legislative, environmental or practical) associated with wastewater disposal.
- Description of on-site wastewater treatment facilities (if any).

In addition to the above, the following is also provided:

- A preliminary water balance.
- Identification of opportunities for improving integrated water management and promoting water conservation.

6.1.2 Information sources

The general approach used in this study was to gather relevant information and data available for the Coega IDZ and the proposed project and use this information to determine possible environmental impacts of water use, domestic wastewater discharge, process wastewater discharge, concentrated brine waste discharge and stormwater discharge from the proposed project. Information in this study is largely based on findings from the Environmental Impact Assessment (EIA) for Aluminium Pechiney for the proposed aluminium smelter within the Coega IDZ and from specific information supplied by the project proponents for the CIPP.

6.1.3 Specific assumptions and limitations

As the nature of the Environmental Screening Study is such that not all information and data ideally required was necessarily available, the Terms of Reference were not met in full. In particular, very little appropriate information was made available on the LNG terminal. The impact assessment therefore is focused predominantly on the assessment of impacts associated with the CCGT power plant. Legislation, guidelines and recommendations are, however, largely applicable to both components of the CIPP project. A more detailed analysis of the water use and wastewater aspects of the LNG terminal will be required if an EIA is carried out.
6.2 Description of water consumption and wastewater generated by the project

6.2.1 Water consumption

During the construction phase, water will be required for the preliminary earthworks, the construction of the various components of the CIPP and for construction personnel.

During operation, both process water and domestic water will be required. Process water will be required within the CCGT power plant for:

- Make-up for the heat recovery steam generators (HRSG)
- Water for gas turbine washing
- Make-up for the closed cooling water system.

Provision must also be made for water required in emergencies (e.g. fire-fighting). The following table (Table 6.1) shows the expected water use for the various stages and components of the proposed project.

<table>
<thead>
<tr>
<th>Phase and project component</th>
<th>Use</th>
<th>Volume Requirement</th>
<th>Quality Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LNG terminal</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not specified</td>
</tr>
<tr>
<td>CCGT power plant</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not specified</td>
</tr>
<tr>
<td>Operations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LNG terminal</td>
<td>Drinking water</td>
<td>Not specified</td>
<td>Not specified</td>
</tr>
<tr>
<td></td>
<td>Process water</td>
<td>Not specified</td>
<td>Not specified</td>
</tr>
<tr>
<td></td>
<td>Fire fighting water</td>
<td>Not specified</td>
<td>Not specified</td>
</tr>
<tr>
<td>CCGT power plant</td>
<td>Drinking water (maximum)</td>
<td>1.25 m³/hr (or 10 950 m³/yr)</td>
<td>Drinking-water standards</td>
</tr>
<tr>
<td></td>
<td>Process water</td>
<td>50.75 m³/hr (or 444 570 m³/yr)</td>
<td>Drinking-water from NMMM to be demineralised</td>
</tr>
<tr>
<td></td>
<td>Fire fighting water</td>
<td>Not specified</td>
<td>Not specified</td>
</tr>
</tbody>
</table>

The project’s potable water requirements are likely to supplied from the nearby Nooitgedacht Water Treatment Works. An agreement has been reached between the Coega Development Corporation (CDC) and the Nelson Mandela Metropolitan Municipality (NMMM) for the supply of potable water to the Coega IDZ.
The drinking water requirement given is the maximum demand for periods when there are maintenance contractors on site. The usual demand will be around 25% of the maximum. The fire water system for the CCGT power plant consists of a ring main and hydrant system fed from the potable water storage tanks with emergency interconnection to the demineralisation water storage tanks. No dedicated firewater tank is envisaged.

The following water quality (Table 6.2) is required for process water within the CCGT power plant and is compared to the quality of potable water to be supplied by the CDC from the Nooitgedacht Water Treatment Works. Minor differences between the Nooitgedacht Water Treatment Works water quality and that of the CDC are attributable to water quality changes due to distribution through the network.

**Table 6.2: CCGT power plant process water quality requirements in comparison to typical potable water supply composition**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Nooitgedacht Final Potable Water Quality</th>
<th>CDC</th>
<th>CCGT process water quality requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH</td>
<td>Min 8</td>
<td>Max 8.3</td>
<td>Ave. 8.3</td>
</tr>
<tr>
<td>Electrical Conductivity (mS/m)</td>
<td>96</td>
<td>122</td>
<td>109</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>0.10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Total hardness (as CaCO₃) (mg/L)</td>
<td>172</td>
<td>233</td>
<td>184</td>
</tr>
<tr>
<td>Alkainity (as CaCO₃) (mg/L)</td>
<td>219</td>
<td>263</td>
<td></td>
</tr>
<tr>
<td>Sulphate (as SO₄) (mg/L)</td>
<td>80</td>
<td>110</td>
<td>&lt; 0.002</td>
</tr>
<tr>
<td>Chloride (mg/L)</td>
<td>115</td>
<td>170</td>
<td>98</td>
</tr>
<tr>
<td>Iron (mg/L)</td>
<td>0.01</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>Manganese (mg/L)</td>
<td>0.003</td>
<td>0.025</td>
<td></td>
</tr>
<tr>
<td>COD (mg/L)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Sodium (mg/L)</td>
<td></td>
<td>0</td>
<td>&lt; 0.002</td>
</tr>
<tr>
<td>Potassium (mg/L)</td>
<td></td>
<td>0</td>
<td>&lt; 0.002</td>
</tr>
<tr>
<td>Calcium (mg/L)</td>
<td></td>
<td>0</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Fluoride (mg/L)</td>
<td></td>
<td>0</td>
<td>&lt; 0.002</td>
</tr>
<tr>
<td>Silicic acid (SiO₂) (mg/L)</td>
<td></td>
<td>0</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Total Organic Carbon (TOC) (µg/L)</td>
<td></td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Comparison of the potable water quality requirements of the CCGT power plant and the water quality supplied by the CDC indicates that the water quality to be supplied to the plant is moderately hard. Although a certain degree of calcium hardness may inhibit corrosion by forming a thin protective layer on the metal surface, hard waters can prove problematic in both the domestic and industrial water systems (e.g. causing excessive scale deposits on heat exchange surfaces and pipelines, resulting in reduced heat exchange efficiency). To avoid such problems, and in order to meet the water quality requirements, the potable water will be demineralised to achieve the necessary water quality standards required by the CCGT power plant.
Potable water from the CDC will be stored in two tanks (two days supply) at the CCGT power plant where after it will be pumped to the demineralization plant.

The exact demineralization treatment process train employed will depend on the quality of potable water supplied by the NMMM to the CDC, and the exact water quality requirements for the CIIP. By way of example, a demineralization plant based on ion exchange technology will contain organic scavengers (e.g. activated carbon) and ion exchange (cation and anion) units. Selection of the optimum treatment chain will require further investigation and does not form part of the scope of this study.

Treated water from the demineralization plant will be stored in two further tanks (two days supply). The demineralized water will then be pumped from the storage tanks to the various areas requiring water.

6.2.2 Wastewater and stormwater

Liquid wastewater generated will include:

- Domestic wastewater (construction, operations and decommissioning phases)
- Process wastewater (operations phase)
- Concentrated brine wastes and sludge (operations phase)
- Contaminated stormwater and other runoff (construction, operations and decommissioning).

**Domestic wastewater**

During operation of the CCGT power plant, approximately 1.25 m$^3$/hr (or 10 950 m$^3$/yr) of domestic wastewater will be produced. This is based on the assumption that the domestic wastewater volume is equivalent to the domestic water use requirement and that there are no losses in the system. No figures for domestic wastewater generated for either the construction phase or decommissioning phase of the project have been provided. The typical composition of untreated domestic wastewater is shown in Table 6.3 (Metcalf and Eddy, 1991).
Table 6.3: Typical composition of untreated domestic wastewater

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total solids (mg/L)</td>
<td>720</td>
</tr>
<tr>
<td>Settleable solids (mg/L)</td>
<td>10</td>
</tr>
<tr>
<td>Biochemical oxygen demand (BOD) (mg/L)</td>
<td>220</td>
</tr>
<tr>
<td>Total organic carbon (TOC) (mg/L)</td>
<td>160</td>
</tr>
<tr>
<td>Chemical oxygen demand (COD) (mg/L)</td>
<td>500</td>
</tr>
<tr>
<td>Total nitrogen (mg/L)</td>
<td>40</td>
</tr>
<tr>
<td>Total phosphorous (mg/L)</td>
<td>8</td>
</tr>
<tr>
<td>Chlorides (mg/L)</td>
<td>50</td>
</tr>
<tr>
<td>Sulphate (mg/L)</td>
<td>30</td>
</tr>
<tr>
<td>Alkalinity as CaCO₃ (mg/L)</td>
<td>100</td>
</tr>
<tr>
<td>Grease (mg/L)</td>
<td>100</td>
</tr>
<tr>
<td>Total coliform (no./100 mL)</td>
<td>10⁷ – 10⁸</td>
</tr>
<tr>
<td>Volatile organic compounds (VOC’s) (µg/L)</td>
<td>100 – 400</td>
</tr>
</tbody>
</table>

It is proposed that domestic wastewater generated will be discharged into the municipal sewer network for treatment at the municipal wastewater treatment plant at Fishwater Flats.

**Process wastewater**

Sources of process wastewater include:
- Boiler blowdown
- Turbine and HRSG floor waste
- Transformer bund sumps
- Waste from laboratory and other sources
- HRSG chemical cleaning wastewater
- Gas turbine compressor wash water.

The amount of process wastewater generated has been estimated to be 43.15 m³/hr (or 377 994 m³/year). This process wastewater will be treated in an on-site wastewater treatment plant.

The wastewater treatment plant will be sized to handle the wastewater generated by chemical cleaning of one HRSG unit. Wastewater is transferred to the wastewater pit where the wastewater is agitated using compressed air. The water is then transferred to the mixing pit, where the pH is adjusted for optimum coagulation. A suitable coagulant and flocculant aid is then added to the wastewater. The water is then transferred to a clarifier where sedimentation occurs. Clear clarified water is filtered and then pumped to the neutralization pit. Here the pH is again adjusted before final discharge. The wastewater can be returned to the wastewater pit if it does not meet specified effluent requirements. The expected treated process wastewater quality for the CCGT power plant (as provided by Eskom, 2003), is presented in Table 6.4 below.

---

1 This water will in all probability be of better quality than most waters and can be used in the hierarchy of re-cycling and re-use (Heine Hoffman, Strategic Water Planning, Eskom, pers comm, Memorandum dated 8 January 2004).
Table 6.4: Predicted treated CCGT power plant process wastewater quality

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treated Wastewater Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6 – 9</td>
</tr>
<tr>
<td>Total suspended solids (mg/L)</td>
<td>50</td>
</tr>
<tr>
<td>Oil and grease (mg/L)</td>
<td>10</td>
</tr>
<tr>
<td>Free chlorine residual (mg/L)</td>
<td>0.2</td>
</tr>
<tr>
<td>Chromium (total) (mg/L)</td>
<td>0.5</td>
</tr>
<tr>
<td>Copper (mg/L)</td>
<td>0.5</td>
</tr>
<tr>
<td>Iron (mg/L)</td>
<td>1.0</td>
</tr>
<tr>
<td>Zinc (mg/L)</td>
<td>1.0</td>
</tr>
<tr>
<td>Temperature increase (Degree Celcius)</td>
<td>3</td>
</tr>
</tbody>
</table>

At present, very little is known with regards to points of discharge of the treated CCGT power plant process wastewater. Although it has been proposed that treated process wastewater from the project will be discharged to the Coega IDZ process water supply system, it is not yet known whether this infrastructure will be in place. In addition, management and points of discharge for brine and stormwater are not known.

In addition to the above, wastewater is generated from floor and plant washing. It is anticipated that this water could contain significant contaminant loads. Implementation of appropriate management practises will ensure that low volumes of effluent are generated from floor and plant washing.

Eskom has a zero liquid effluent discharge policy, which will be applied to the CIPP (Heine Hoffman, Strategic Water Planning, Eskom, pers comm, Memorandum dated 8 January 2004). The design requirements in order to implement this policy for the CIPP still need to be investigated.

**Concentrated brine and sludge wastes**

An unfortunate by-product of water and wastewater treatment is the creation of additional concentrated waste streams, which need to be handled in an environmentally acceptable and responsible manner. Considering the likely water and wastewater treatment processes, the following waste streams could be expected:

- Regeneration brine from cation-anion ion exchange systems (brine from water demineralization has been estimated to be 6.61 m³/hr)
- Sludge from clarification processes (quantity unknown)
- Washwater from filter backwashing (quantity unknown).

The concentrated neutralized brine from the demineralisation regeneration process will be treated on-site along with the other process wastewater. Sludge from clarification processes is likely to be comprised of suspended matter together with calcium carbonate and...
magnesium hydroxide (possibly with low concentrations of metal hydroxides). De-watered sludge with this composition could be used as cover in the rehabilitation of domestic waste sites.

**Stormwater**

Stormwater will be collected in a “clean” drains system and discharged along with the treated process wastewater.

The possibility exists for treating first flush stormwater in the water treatment system and discharging the balance directly to the IDZ process water system.

Thus at this stage it is envisaged that all water discharge from the CIPP besides sewerage shall be via the Coega IDZ process water system (Alva Shortt, Eskom, pers. comm., 1 December 2003).

### 6.2.3 Preliminary water balance for the CCGT power plant

A preliminary water balance showing quantities of water inputs to different processes within the CIPP and quantities of wastewater generated by different processes is summarized in Figure 6.1.
6.3 Description of the local water environment and service infrastructure

6.3.1 Surface water environment

The Coega River is a relatively small sand-bed ephemeral river in the Coega IDZ and is the most significant surface water feature associated with the proposed project. The Coega River is diverted into a trapezoidal earth channel about 3.3 km upstream of the river mouth. A commercial saltworks is located within the flood plain of the Coega River downstream of the N2 highway bridge. During flood events, floodwaters will overtop the south-western bank of the channel and spread over the total area of the saltworks. Part of the eastern fringes of these saltworks will be lost to infrastructural requirements if the IDZ is further developed. In general, rivers are classified using a system that assigns a particular class to a river based on its present ecological state. The following table (Table 6.5) provides an overview of river classification guidelines used to determine the ecological state of the Coega River.

<table>
<thead>
<tr>
<th>Present ecological state</th>
<th>Description of perceived conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Within desired range</strong></td>
<td></td>
</tr>
<tr>
<td><strong>A</strong></td>
<td>Unmodified, or approximates natural condition; the natural abiotic template should not be modified. The characteristics of the resource should be determined by unmodified natural disturbance regimes. There should be no human induced risks to the abiotic and biotic maintenance of the resource. The supply capacity of the resource will not be used.</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>Largely natural with few modifications; only a small risk of modifying the natural abiotic template and exceeding the resource based should be allowed. Although the risk to the well-being and survival of especially intolerant biota (depending on the nature of the disturbance) at a very limited number of localities may be slightly higher than expected under natural conditions, the resilience and adaptability of biota must not be compromised. The impact of acute disturbances must be totally mitigated by the presence of sufficient refuge areas.</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>Moderately modified; a moderate risk of modifying the abiotic template and exceeding the resource base may be allowed. Risks to the well-being and survival of intolerant biota (depending on the nature of the disturbance) may generally be increased with some reduction of resilience and adaptability at a small number of localities. However, the impact of local and acute disturbances must at least partly be mitigated by the presence of sufficient refuge areas.</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>Largely modified; large risk of modifying the abiotic template and exceeding the resource base may be allowed. Risk to the well-being and survival of intolerant biota depending on (the nature of the disturbance) may be allowed to generally increase substantially with resulting low abundance and frequency of occurrence, and a reduction of resilience and adaptability at a large number of localities. However, the associated increase in the abundance of tolerant species must not be allowed to assume pest proportions. The impact of local and acute disturbances must at least to some extent be mitigated by refuge areas.</td>
</tr>
<tr>
<td><strong>Outside desired range</strong></td>
<td></td>
</tr>
<tr>
<td><strong>E</strong></td>
<td>Seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.</td>
</tr>
<tr>
<td><strong>F</strong></td>
<td>Critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.</td>
</tr>
</tbody>
</table>
Using the above river classification guidelines, the Coega River management class was determined (Gibb, 1999). In this assessment, the river was divided into four reaches:

- **Reach 1:** This region is in the upper reaches of the catchment. The river and the direct surroundings are not pristine, but also not in a serious degraded or disturbed state.
- **Reach 2:** Middle reaches of the catchment. In this reach, the riverbed appears more disturbed than in the upper reaches, but is still not badly degraded.
- **Reach 3:** Incorporates the top reaches of the Coega IDZ. The influence of human activities is more evident in the area than in the upper or middle reaches.
- **Reach 4:** Area to the south-east of the N2 highway (i.e. downstream) and includes the river and the estuary. The saltworks is included in this reach.

From the study, the class indices shown in Table 6.6 were assigned to the various reaches.

### Table 6.6: Overall class index for the different reaches of the Coega River

<table>
<thead>
<tr>
<th>Reach</th>
<th>Overall class index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C</td>
</tr>
<tr>
<td>2</td>
<td>C</td>
</tr>
<tr>
<td>3</td>
<td>D</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
</tr>
</tbody>
</table>

Considering the proposed location of the CIPP, the reach that could possibly be affected by wastewater discharges from the site is Reach 4. From the above table it is clear that the present ecological state of the Coega River in this reach is already critically modified and environmentally degraded.

Linked to the above, and in order for the CDC to monitor the environmental performance by industries in the future, an independent surface water quality monitoring system has been established in the Coega IDZ. SRK Consulting carry out this monitoring service for the CDC. At present, water quality is monitored at six locations along the Coega River (upstream, intermediate and downstream of the IDZ) as indicated in Figure 6.2. Water quality parameters assessed include: pH, Electrical Conductivity, Temperature, Total Dissolved Solids, major ions, nitrates, bacteria and heavy metals (Cadmium, Chromium, Copper, Mercury, Manganese, Lead and Zinc). In terms of the location of the proposed CIPP, the closest surface water quality monitoring point is that labelled as SW-DS (downstream of the Coega IDZ). Key points from surface water quality monitoring conducted by SRK Consulting for the period 2002 – 2003 are discussed below (SRK, 2003):

- **Physical parameters**
  The pH and electrical conductivity of the surface water is dependant on the flow rate, season and distance from the sea. The pH of the Coega River is neutral to slightly alkaline, while the electrical conductivity varied from 222 mS/m to a maximum of 8 630 mS/m (similar to seawater) at the point SW-DS.
**Major ion chemistry**

The water of the Coega River is characterized by a Na/Cl signature. The highest values of Na (11 234 mg/L) and Cl (23 292 mg/L) were measured in the sample closest to the coast (SW-DS) after a significant rainfall period in May 2002.

**Trace metals**

Concentrations of zinc and chromium at all sampling points are below DWAF General Limits, whilst the lead concentration is below the SABS 241-2001 Class I (Acceptable) Limit. The iron concentration is below the SABS 241-2001 Class II (Maximum Allowable) Limit.

**Bacteriological indicators**

Both *E. Coli* bacteria (direct indicator of faecal pollution) and heterotrophic plate count (general indicator of bacteriological water quality) were measured in the Coega River. The *E. Coli* count varied from < 10 to 400 counts/100 mL (i.e. generally exceeding SABS 241-2001 Class II (Maximum Allowable) Limit), whilst the heterotrophic plate count varied between 141 to 3 100 counts/100 mL (i.e. within SABS 241-2001 Class II (Maximum Allowable) Limit).
Figure 6.2: Location of existing CDC surface water and groundwater monitoring sites within the Coega IDZ
6.3.2 Groundwater environment

From review of the proposed location of the CIPP it appears as though the site is underlain by Britskraal shale and/or Tra-Tra Shale (these formations are part of the Bokkeveld shale). The shales found are expected to act as an aquitard on site (i.e. rainfall infiltration is limited), with no aquifer potential. Use of groundwater for potable water use is therefore not currently considered as a viable alternative to surface water (i.e. the area is currently largely reliant on surface water sources for potable water requirements). Nevertheless, groundwater impacts on- and off-site should be considered with respect to:

- The current role groundwater may play in the natural environment (and its current degree of modification from pristine conditions)
- Shallow groundwater on the site may act as a pathway to receiving environments or users down gradient of the site.

It is expected that groundwater gradients will mirror the topography (following surface water drainage direction) and it is therefore expected that any groundwater flow from the site would be approximately towards the marine environment. The only evident potential receptors for groundwater impacts are therefore the marine environment. These environments may rely on groundwater inputs to control salinity or provide nutrients or trace elements.

The previous sections have highlighted the status of both surface- and groundwater in the Coega IDZ, and indicate that the surface water quality is not ideal/pristine and that no potential for use of groundwater for drinking-water or process water purposes exists.

6.3.3 Water supply infrastructure

The NMMM will supply water to the boundary of the IDZ. Thereafter, the CDC will be responsible for distribution to the various industries throughout the IDZ.

It is envisioned by the CDC that in the future the bulk of the process water for the Coega IDZ required would be obtained from reclaimed water supplied from the Fishwater Flat Reclamation Works near the Swartkops River mouth. The facilities for reclaiming treated wastewater do not presently exist, but are planned (depending on future demand). It is envisaged that proposed water re-use facilities with a capacity of 60 ML/day will be constructed. These facilities will need to be able to produce acceptable quality water for local industry.

6.3.4 Wastewater and stormwater infrastructure

Domestic wastewater

An agreement has been reached between the CDC and the NMMM for the disposal and treatment of domestic wastewater from the Coega IDZ. Domestic wastewater from industries
in the IDZ will be transported in the CDC sewer network to the boundary of the IDZ. Thereafter, domestic wastewater will enter the NMMM sewer network for treatment at the municipal wastewater treatment plant at Fishwater Flats.

**Process wastewater**

It has been indicated by the project proponents (Shell, Eskom and iGas) that treated process wastewater will be diverted to the proposed IDZ process water supply system and water re-use facilities at the Fishwater Flat Reclamation Works. A dual reticulation network has been designed so that, when there is sufficient demand for industrial process water, the treatment works can be upgraded and water can be supplied in bulk to industry (Peter Inman, CDC, *pers comm.*, November 2003). It is envisaged that the proposed IDZ re-use water treatment plant will have a capacity of 2 500 m$^3$/hr (60 ML/day). Infrastructural requirements include additional treatment facilities, a pump station, a rising main and a service reservoir. The facilities will need to produce a water of an acceptable quality to industry.

**Concentrated brine and sludge wastes**

At present, details of intended brine disposal and management infrastructure is not known. It is anticipated that environmental best practises will be followed.

**Stormwater**

At this stage no details with regards to the design and operation of the stormwater system for the site have been proposed. It is anticipated that environmental best practises will be followed.

**6.4 Identification of applicable policies, legislation, guidelines or standards**

Water use is controlled by the National Water Act (Act 36 of 1998), which protects all water resources countrywide (both surface waters and groundwaters). The enforcing authority is the Department of Water Affairs and Forestry (DWAF). The National Water Act identifies the following as uses of water relevant to the Coega Integrated Power Project:

- Taking water from a water resource;
- Storing water on-site;
- Discharging waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit;
- Disposing of waste in a manner, which may be detrimental on the water resource.
6.4.1 Registration of water use

It is the statutory obligation for all water users to register for their water use. There are strict penalties prescribed in the Act (National Water Act, 1998) for those who do not comply. Water users who must register include those who use water for inter alia:

- Industrial use
- Irrigation
- Discharges of waste or water containing waste.

However, if the aforementioned water use is part of the services provided by a water services provider (e.g. Water Board or local municipality), the individual water users need not register. In this case, the water services provider will need to register the water use with DWAF.

6.4.2 Water use licensing/authorisation

A person may only use water (National Water Act 1998):

- Without a licence if:
  - that water use is permissible under Schedule 1 of the Act (Schedule 1 is detailed in the National Water Act and provides insight into permissible use of water for domestic, emergency, recreational and discharge purposes)
  - that water use is permissible as a continuation of an existing water use; or
  - that water use is permissible in terms of a general authorisation issued under section 39 of the Act

- If the water use is authorised by a licence under the Act (as described below)
- If the responsible authority has dispensed with a licence requirement.

**General Authorisation issued under Section 39 of the National Water Act**

Licenses are not required (Section 22) where the use is permissible under a General Authorisation, or where a responsible authority has waived the need for a licence (because it is satisfied that the purpose of the Act will be served by an authorisation under any other law). The authorisation permitted replaces the need for a water user to apply for a licence in terms of the National Water Act if the water use is within the limits and conditions set out in the authorisation. The intention of the General Authorisation is to allow water use of small or insignificant impacts on a water resource to take place without a licence.

The Director-General of DWAF has issued General Authorisation in respect of four water uses, where need for a licence is not required if the water use is within specified limits and conditions:

- Taking of water from a water resource and storage of water.
Engaging in a controlled activity, identified as such in section 37(1), namely irrigation of any land with waste or water containing waste generated through any industrial activity or by waterworks.

Discharging of waste or water containing waste into a water resource through a pipe, canal, sewer, or other conduit or discharging water from an industrial or power generation process.

Disposing of waste in a manner that may detrimentally impact on a water resource.

Considering the above, the following points are of importance to the project:

a) **Taking of water from a water resource and storage of water**

If more than 50 m$^3$ of surface water or 10 m$^3$ of groundwater is abstracted on any given day, or if more than 10 000 m$^3$ of water is stored on-site, the water use must be registered with DWAF before commencement thereof.

Based on the above requirements, the following should be noted:

- Potable water use by the CCGT has been estimated to be 1248 m$^3$/day (52 m$^3$/hr). It is envisaged that this water will be supplied to the Coega IDZ and the Port of Ngqura by the local Water Services Authority (Nelson Mandela Metropolitan Municipality) who would be responsible for registration of the water use. No groundwater use is envisaged at this stage.

- It is envisaged that a two days supply of potable water will be stored on the CCGT power plant site in two tanks, each of volume 1 599 m$^3$. Two tanks for storage of two days supply of demineralised water will also be required (each of volume 1 599 m$^3$). The fire fighting water tank at the LNG terminal is expected to store between 1 000 m$^3$ and 2 000 m$^3$. It would appear as though the total proposed amount of stored water at the LNG terminal and CCGT power plant will be within the limit of 10 000 m$^3$. If this is the case, water storage would not need to be registered.

b) **Engaging in a controlled activity, identified as such in section 37(1), namely irrigation of any land with waste or water containing waste generated through any industrial activity or by waterworks.**

This schedule is designed to encourage water reuse and could be applicable to the CIPP.

- Up to 500 m$^3$ of domestic or biodegradable industrial wastewater may be irrigated on any given day provided the Electrical Conductivity (EC) is less than or equal to 200 mS/m, the pH is 6 – 9, the Chemical Oxygen Demand (COD) is less than or equal to 400 mg/L after the removal of algae, faecal coliforms are less than or equal to 100 000 per 10 mL and the Sodium Adsorption Ratio (SAR) is less than or equal to 5 for biodegradable industrial wastewater.

- Up to 50 m$^3$ of domestic or biodegradable industrial wastewater may be irrigated on any given day provided the Electrical Conductivity (EC) is less than or equal to 200 mS/m, the pH is 6 – 9, the Chemical Oxygen Demand (COD) is less than or equal to 5000 mg/L after the removal of algae, the faecal coliforms are less than or equal to 100 000 per 100 mL and the Sodium Adsorption Ratio (SAR) is less than or equal to 5 for biodegradable industrial wastewater.
A registration must be submitted to DWAF before commencement of irrigation if more than 10 cubic metres of wastewater are irrigated on any given day.

Wastewater irrigation is only permitted if the irrigation takes place above the 100 year flood line, or alternatively, more than 100 meters from the edge of a water resource or a borehole which is utilised for drinking water or stock watering; and on land that is not or does not overlie a Major Aquifer.

Based on the above the following should be noted:
- Domestic wastewater is likely to be discharged to the municipal sewer network
- Irrigation with treated wastewater could be viewed as a water re-use option (provided required water quality standards are maintained), however, the sites offer limited irrigation potential.

c) Discharging of waste or water containing waste into a water resource through a pipe, canal, sewer, or other conduit or discharging water from an industrial or power generation process

This schedule provides information regarding discharge of wastewater into a water resource. (in this case, the Coega River). Wastewater limit values applicable to discharge of wastewater into a water resource are shown in Table 6.7.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>General Limit</th>
<th>Special Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faecal coliforms (per 100 mL)</td>
<td>1000</td>
<td>0</td>
</tr>
<tr>
<td>Chemical Oxygen Demand (mg/L) (after removal of algae)</td>
<td>75</td>
<td>30</td>
</tr>
<tr>
<td>PH</td>
<td>5.5 – 9.5</td>
<td>5.5 – 7.5</td>
</tr>
<tr>
<td>Ammonia as N (mg/L)</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Nitrate/Nitrite as N (mg/L)</td>
<td>15</td>
<td>1.5</td>
</tr>
<tr>
<td>Chlorine as free chlorine (mg/l)</td>
<td>0.25</td>
<td>0</td>
</tr>
<tr>
<td>Suspended solids (mg/L)</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>Electrical conductivity (mS/m)</td>
<td>70 mS/m above intake to a max. of 150 mS/m</td>
<td>50 mS/m above intake to a max. of 100 mS/m</td>
</tr>
<tr>
<td>Ortho-phosphate as phosphorous (mg/L)</td>
<td>10</td>
<td>1 (median) and 2.5 (max.)</td>
</tr>
<tr>
<td>Fluoride (mg/L)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Soap, oil or grease (mg/L)</td>
<td>2.5</td>
<td>0</td>
</tr>
<tr>
<td>Arsenic (dissolved) (mg/l)</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>Cadmium (dissolved) (mg/L)</td>
<td>0.005</td>
<td>0.001</td>
</tr>
<tr>
<td>Chromium VI (dissolved) (mg/L)</td>
<td>0.05</td>
<td>0.02</td>
</tr>
<tr>
<td>Copper (dissolved) (mg/L)</td>
<td>0.01</td>
<td>0.002</td>
</tr>
<tr>
<td>Cyanide (dissolved) (mg/L)</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>Iron (dissolved) (mg/L)</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Lead (dissolved) (mg/L)</td>
<td>0.01</td>
<td>0.006</td>
</tr>
<tr>
<td>Manganese (dissolved) (mg/L)</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Mercury and its compounds (mg/l)</td>
<td>0.005</td>
<td>0.001</td>
</tr>
<tr>
<td>Selenium (dissolved) (mg/L)</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Zinc (dissolved) (mg/L)</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Boron (mg/L)</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>
Under the general authorisation, the proposed CIPP would be allowed to:

- Discharge up to 2000 m$^3$ of wastewater on any given day into a water resource that is **not** a listed water resource provided the:
  - Discharge complies with the General Limit Values as set out above.
  - The discharge does not alter the natural ambient water temperature of the receiving water resource by more than 3 ºC.
  - The discharge is not a Complex Industrial Wastewater.

- Discharge up to 2000 m$^3$ of wastewater on any given day into a listed water resource provided the:
  - Discharge complies with the Special Limit Values as set out above.
  - The discharge does not alter the natural ambient water temperature of the receiving water resource by more than 2 ºC.
  - The discharge is not a Complex Industrial Wastewater.

- Discharge stormwater runoff from the premises, not containing waste or wastewater emanating from industrial activities and premises, into a water resource.

Based on the above requirements, the following should be noted:

- The Coega River is not a listed water resource, and therefore General Limit Values are applicable.
- Process wastewater from the proposed project is not considered a Complex Industrial Wastewater.
- As general on-site activities (emission deposition on site, vehicle oil and other spillages, etc) are likely to result in contamination of stormwater runoff from the site, discharge of this stormwater could potentially not fall under the General Authorisation. If this is the case, stormwater would be regarded as a wastewater and will need to be dealt with in an environmentally appropriate manner. If it can be demonstrated that a very low risk of stormwater contamination from emission deposition and spillages exists, reclassification of the stormwater could be considered. Stormwater will then be allowed to be discharged off-site without any further treatment.

**d) Disposing of waste in a manner that may detrimentally impact on a water resource.**

*This schedule provides information with regards to storage and disposal of wastewaters*

- Up to 5 000 m$^3$ of domestic and/or biodegradable industrial wastewater can be stored on-site for reuse purposes.
- Up to 10 000 m$^3$ of domestic and/or biodegradable industrial wastewater can be stored on-site for disposal purposes (or up to 50 000 m$^3$ can be stored on-site if a wastewater pond system exists).
- Up to 1 000 m$^3$ of domestic and/or biodegradable industrial wastewater can be disposed on-site on any given day into a wastewater pond system or into an evaporation pond system for disposal purposes.
A registration for water use must be submitted to DWAF before commencement of storage if more than 1,000 m$^3$ is stored for disposal or more than 500 m$^3$ is stored for reuse.

Wastewater storage dams and wastewater disposal sites must be located outside of a watercourse; above the 100 year flood line, or alternatively, more than 100 meters from the edge of a water resource or a borehole which is utilised for drinking water or stock watering; and on land that is not or does not overlie a Major Aquifer.

Based on the above requirements, the following should be noted:

- It is anticipated that domestic wastewater will be discharged to the municipal sewer network.
- Evaporation ponds may be required for disposal of concentrated brine (from demineralisation). Concentrated brine is estimated to be 6.61 m$^3$/hr or 158.64 m$^3$/day.
- Depending on the size of the evaporation ponds, registration may be required.
- Groundwater is not used on the proposed site nor does the proposed site overlie a major aquifer.

### 6.4.3 Other applicable water quality guidelines

In addition to satisfaction of the water quality requirements specified under the General Authorisation, the following guidelines describe the receiving water quality of any water body to which water or wastewater may be discharged to.

- South African Water Quality Guidelines – Aquatic Ecosystems
- South African Marine Water Quality Guidelines.

**South African Water Quality Guidelines – aquatic ecosystems**

These guidelines are used by DWAF as a decision support tool for management and protection of freshwater aquatic ecosystems. The different water quality criteria and objectives provided in the guidelines are typically used in the following ways:

- **Target Water Quality Range (TWQR)** is a management objective that is used to specify the desired or ideal concentration range and/or receiving water quality requirements for a particular constituent in the water resource.

- **The Chronic Effect Value (CEV)** is a thresholds/criterion that is used, in certain special cases where the TWQR is exceeded. The setting of water quality requirements or objectives at the CEV protects aquatic ecosystems from acute toxicity effects.

- **The Acute Effect Value (AEV)** is a criterion used to identify those cases requiring urgent management attention because the aquatic environment is threatened by parameters exceeding specified thresholds, even if the situation persists only for a brief period. The
AEV may also be used to identify those cases in need of urgent mitigatory action. However, the AEV should not be used for setting water quality requirements for aquatic ecosystems.

Table 6.8 below shows the guidelines applicable to the site to ensure protection of aquatic ecosystems. In the case of the CIPP, these guidelines would apply to the Coega River if water or wastewater discharges were directed to the river.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Target Water Quality Range (TWQR)</th>
<th>Chronic Effect Value (CEV)</th>
<th>Acute Effect Value (AEV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH</td>
<td>pH values should not be allowed to vary by &gt; 0.5 of a pH unit, or by &gt; 5% (use more conservative estimate)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total Suspended solids (SS) (mg/L)</td>
<td>Any increase in TSS concentrations must be limited to &lt; 10% of the background TSS concentrations at a specific site and time</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Soap, oil or grease (mg/L)</td>
<td>No guidelines</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Free chlorine residual (mg/L)</td>
<td>&lt; 0.2</td>
<td>0.35</td>
<td>5</td>
</tr>
<tr>
<td>Chromium (VI) (µg/L)</td>
<td>&lt; 7</td>
<td>14</td>
<td>200</td>
</tr>
<tr>
<td>Copper (mg/L) (assuming soft waters)</td>
<td>&lt; 0.3</td>
<td>0.53</td>
<td>1.6</td>
</tr>
<tr>
<td>Iron (mg/L)</td>
<td>The iron concentration should not be allowed to vary by more than 10% of the background dissolved iron concentration for a particular site or case, at a specific time</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Zinc (dissolved) (mg/L)</td>
<td>&lt; 0.002</td>
<td>0.0036</td>
<td>0.036</td>
</tr>
</tbody>
</table>

Considering the above criteria, the following limitations should be noted:

- The criteria address the water column only, which forms but one compartment of aquatic ecosystems;
- The criteria ignore interactions between constituents which could result in additive, synergistic or antagonistic effects;
- The criteria do not fully account for environmental partitioning under various chemical and physical water conditions, which may induce change in the bio-availability of a constituent;
- The procedure for deriving criteria makes use of data from a limited number of species, often determined by their ease of laboratory culturing; and
- The criteria often rely on single-species dose-response data, rather than multi-species or community response data.
For these reasons, assessment of potentially adverse secondary effects should be referred to a specialist in aquatic ecology. In addition, where criteria are to be modified for a specific site or region, DWAF will obtain expert inputs.

**South African Marine Water Quality Guidelines**

If process wastewater, concentrated brine wastes and contaminated stormwater are discharged from the site to the sea, the necessary Marine Discharge Guidelines will be applicable. The impact of process wastewater and contaminated stormwater discharges on the marine environment forms the focus of Chapter 7 "Water Discharges to the Marine Environment".

### 6.4.4 Pollution mitigation

Under Chapter 3 of the National Water Act (Act 36 of 1998) (Section 19) any person who owns, controls, occupies or uses land is deemed responsible for taking measures to prevent pollution of water resources. If these measures are not taken, the responsible authority may do whatever is necessary to prevent the pollution or remedy its effects and to recover all reasonable costs from the responsible person. Non-compliance with this provision constitutes a criminal offence. The measures referred to may include measures to:

- Cease, modify or control any act or process causing the pollution;
- Comply with any prescribed waste standard or management practice;
- Contain or prevent the movement of pollutants;
- Eliminate any source of the pollution;
- Remedy the effects of the pollution; and
- Remedy the effects of any disturbance to the bed and banks of a watercourse.

### 6.4.5 Other regulatory considerations

**The Water Services Act (Act 108 of 1997)**

This Act regulates rights of access to basic water supply and sanitation necessary to secure sufficient water and environment not harmful to human health or well-being. In the case of the abstraction of water for industrial purposes or the disposal of process wastewater the provisions of section 7 of this Act must be met. In particular:

- Industrial water must be sourced from the distribution system of the water services provider nominated by the water services authority having jurisdiction in the area in question (unless approval is granted by the Water Services Authority not to do so).
- Wastewater produced by the industry must be disposed in a manner approved by the water services provider nominated by the water services authority having jurisdiction in the area in question.
CDC By-laws relating to the discharge of wastewaters

Any by-Laws generated will be administered by the CDC and will regulate the quality and quantity of wastewater discharged (to aquatic systems, municipal sewers, etc). The By-Laws will prohibit the discharge of specified substances and allow the CDC to impose strict conditions of compliance.

International Finance Corporation Liquid Effluent Guidelines

The International Finance Corporation (IFC) Environmental, Health and Safety Guidelines for Gas Terminal Systems specify that liquid effluents (process wastewater, domestic sewage and contaminated stormwater) should be treated to meet the following specified limits before being discharged to surface waters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH</td>
<td>6 to 9</td>
</tr>
<tr>
<td>Total Suspended solids (SS) (mg/L)</td>
<td>50</td>
</tr>
<tr>
<td>BOD$_5$ (mg/L)</td>
<td>50</td>
</tr>
<tr>
<td>Oil and grease (mg/L)</td>
<td>10</td>
</tr>
<tr>
<td>Cyanide, free (mg/L)</td>
<td>0.1</td>
</tr>
<tr>
<td>Cyanide, total (mg/L)</td>
<td>1.0</td>
</tr>
<tr>
<td>Heavy metals, total (mg/L)</td>
<td>10</td>
</tr>
</tbody>
</table>

In addition to the above, the following guidelines are also noted by the IFC:

- Project proponents must confirm with the local authority that the municipal treatment system has the capacity to adequately treat the project’s liquid effluents.
- Project proponents should recycle or reclaim materials where possible.
- If recycling or reclamation is not practical, wastes must be disposed of in an environmentally acceptable manner and in compliance with local laws and regulations.
- Sludges and brines from raw water, process wastewater and domestic sewage treatment systems must be disposed of in a manner to prevent the contamination of soil, groundwater and surface waters.
- Storage and liquid impoundment areas should be designed with secondary containment to prevent spills from contaminating soil, groundwater and surface waters.
World Bank Liquid Effluent Guidelines

The World Bank Pollution Prevention and Abatement Handbook specifies Thermal Power Guidelines for New Plants. These guidelines specify that liquid effluents should meet the following specified limits on a daily basis without dilution (Table 6.10):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH</td>
<td>6 to 9</td>
</tr>
<tr>
<td>Total Suspended solids (SS) (mg/L)</td>
<td>50</td>
</tr>
<tr>
<td>Oil and grease (mg/L)</td>
<td>10</td>
</tr>
<tr>
<td>Total residual chlorine (mg/L)</td>
<td>0.2</td>
</tr>
<tr>
<td>Chromium, total (mg/L)</td>
<td>0.5</td>
</tr>
<tr>
<td>Copper (mg/L)</td>
<td>0.5</td>
</tr>
<tr>
<td>Iron (mg/L)</td>
<td>1.0</td>
</tr>
<tr>
<td>Zinc (mg/L)</td>
<td>1.0</td>
</tr>
<tr>
<td>Temperature increase (degree C)</td>
<td>&lt; 3</td>
</tr>
</tbody>
</table>

In addition to the above, the following guidelines are also noted by the World Bank:

- The pH and temperature of the wastewater discharges should be monitored continuously.
- Levels of suspended solids, oil and grease, and residual chlorine should be measured daily.
- Heavy metals and other pollutants in wastewater discharges should be measured monthly if treatment is provided.

6.5 Description of key water related issues

6.5.1 Construction phase

During the construction phase, water will be required for the preliminary earthworks, the construction of the various components of the Coega Integrated Power Project and for domestic purposes.

During the construction phase, pollution of ground and surface water resources can result from release, accidental or otherwise, of contaminated runoff from construction sites and discharge of construction water contaminated by, for example, chemicals, oils, fuels, sewage, solid waste and litter. Nevertheless, during construction increased turbidity and downstream sedimentation (arising from erosion from construction areas) is likely to be the main water quality concern. During construction, adequate sanitation facilities (e.g. portable toilets) will be required.

The abovementioned issues are presented in Table 6.11.
6.5.2 Operations phase

During the operations phase, the water usage for the CCGT power plant is approximately 52 m$^3$/hr or 455 520 m$^3$/year (including both process and domestic water requirements). Key issues related to water utilization and management are the availability of water, the optimisation of on-site water use and the prevention of pollution arising from wastewater discharges.

During the operations phase, the four main liquid discharges from the CCGT power plant site will be domestic wastewater, process wastewater (blowdown), brine from potable water demineralisation and stormwater, in particular the “first flush” of stormwater (i.e. the first rainfall run-off after a dry period which usually carries a higher concentration of potential pollutants). A key issue related to water discharges from the site is the risk of pollutants reaching any environmentally sensitive areas.

The above issues are presented in Table 6.12.

6.5.3 Decommissioning phase

 During the decommissioning phase, only problems related to containment and discharge of contaminated stormwater and other runoff from decommissioning procedures are envisaged.

The above issues are presented in Table 6.13.
### Table 6.11: Construction phase issues associated with water consumption and wastewater management

<table>
<thead>
<tr>
<th>Issue/concern identified</th>
<th>Potential Source of Impact</th>
<th>Potential Impact</th>
<th>Risk Situation under which impact occurs</th>
</tr>
</thead>
</table>
| Will water used during the construction phase have a significant impact on water required by NMMM for normal service delivery? | ▪ Water used for construction (earthworks, cement concrete production, etc) and for domestic purposes  
  ▪ Conditions may be such that all present and future water demands in the NMMM area cannot be met (normal weather conditions)  
  ▪ Drought conditions can have a significant impact on water availability | ▪ The negative impact of water use by project contributing to local water supply infrastructure being exceeded  
  ▪ The negative impact of water use by project contributing to the sustainable yield of water resources being exceeded. | ▪ Impact would occur if the present spare capacity of Nooitgedacht Water Treatment Works is completely utilised by new industry and future community needs cannot be met.  
  ▪ Impact would occur if the water reserve is not sufficient to meet demands of consumers (public and industry) and ensure protection of the environment (e.g. drought conditions exist which result in an inability to meet all water demands) |
| Will wastewater (stormwater and other runoff, domestic) generated during the construction phase negatively impact on the local environment (e.g. surface water, groundwater & marine)? | ▪ Release of contaminated stormwater and discharge of other runoff contaminated by, for example, chemicals, oils, fuels, sewage, solid waste & litter.  
  ▪ Increased turbidity and downstream sedimentation (arising from erosion from construction areas)  
  ▪ Release of untreated domestic sewage into the surrounding environment | ▪ Depending on the nature of the contaminants, the release of contaminated stormwater and other runoff can negatively impact the surrounding environment. (NOTE: Any wastewater discharges from the site must meet with required legislative requirements)  
  ▪ The release of untreated domestic sewage could have an impact on environmental and community health | ▪ Impact would occur if: structures to contain and treat contaminated wastewaters are not in place;  
  ▪ Stormwater containment structures overflow;  
  ▪ Contaminated wastewaters are discharged in an inappropriate manner; or  
  ▪ On-site sanitation services are not as required or sanitation practices are not followed by personnel. |
Table 6.12: Operations phase issues associated with water consumption and wastewater management

<table>
<thead>
<tr>
<th>Issue/concern identified</th>
<th>Potential source of impact</th>
<th>Potential impact</th>
<th>Risk situation under which impact occurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Will water used during the operations phase have a significant impact on water required</td>
<td>- Water used for construction (earthworks, cement concrete production, etc) and for domestic purposes&lt;br&gt;  - Conditions may be such that all present and future water demands in the NMMM area cannot be met (normal weather conditions)&lt;br&gt;  - Drought conditions can have a significant impact on water availability</td>
<td>- The negative impact of water use by project contributing to local water supply infrastructure being exceeded&lt;br&gt;  - The negative impact of water use by project contributing to the sustainable yield of water resources being exceeded.</td>
<td>- Impact would occur if the present spare capacity of Nooitgedacht Water Treatment Works is completely utilised by new industry and future community needs cannot be met.&lt;br&gt;  - Impact would occur if the water reserve is not sufficient to meet demands of consumers (public and industry) and ensure protection of the environment (e.g. drought conditions exist which result in an inability to meet all water demands)</td>
</tr>
<tr>
<td>by NMMM for normal service delivery?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will domestic sewage negatively impact the local environment (surface water, groundwater</td>
<td>- Release of untreated domestic sewage into the surrounding environment</td>
<td>- The release of untreated domestic sewage could have an impact on environmental and community health</td>
<td>- Impact would occur if on-site sanitation services are not as required or if sanitation practices are not followed by personnel</td>
</tr>
<tr>
<td>and marine)?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Could untreated process wastewater be discharged into the local environment (surface</td>
<td>- Release of untreated process wastewater into the surrounding environment (e.g. accident)</td>
<td>- Depending on the nature of the contaminants, the release of untreated process wastewater can negatively impact the surrounding environment. (NOTE: Any wastewater discharges from the site must meet with legislation requirements)</td>
<td>- Impact would occur if untreated process wastewaters are discharged in an inappropriate manner</td>
</tr>
<tr>
<td>water, groundwater, marine)?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issue/concern identified</td>
<td>Potential source of impact</td>
<td>Potential impact</td>
<td>Risk situation under which impact occurs</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Will treated process wastewater negatively impact the local environment (surface water,  | Release of treated process wastewater effluent into the surrounding environment           | • Depending on the nature of the contaminants, the release of treated process wastewater that does not satisfy required legislative quality requirements can negatively impact the surrounding environment. | • Impact would occur if treated wastewater does not meet required specifications and is still discharged to the environment  
• Impact would occur if wastewater treatment plant fails and untreated or poorly treated process wastewaters are discharged in an inappropriate manner |
| groundwater, marine)?                                                                   |                                                                                           |                                                                                                           |                                                                                                          |
|                                                                                       |                                                                                           |                                                                                                           |                                                                                                          |
| Will brine and other concentrated wastes have a negative impact on the local environment | Release of brine and other concentrated wastes into the surrounding environment            | • The release of brine and other concentrated wastes can negatively impact the surrounding environment.     | • Impact would occur if brine and other concentrated wastes are discharged in an inappropriate manner      |
| (surface water, groundwater, marine)?                                                   |                                                                                           |                                                                                                           |                                                                                                          |
|                                                                                       |                                                                                           |                                                                                                           |                                                                                                          |
| Will contaminated stormwater have a negative impact on the local environment (surface    | Release of contaminated stormwater into the surrounding environment                        | • Depending on the nature of the contaminants, the release of contaminated stormwater and other runoff from the site can negatively impact the surrounding environment. (NOTE: Any contaminated stormwater discharges from the site must meet with legislation requirements) | • Impact would occur if structures to contain stormwater are not in place  
• Impact would occur if stormwater containment structures overflow |
| water, groundwater, marine)?                                                           |                                                                                           |                                                                                                           |                                                                                                          |
### Table 6.13: Decommissioning phase issues associated with water consumption and wastewater management

<table>
<thead>
<tr>
<th>Issue</th>
<th>Potential source of impact</th>
<th>Potential impact</th>
<th>Risk situation under which impact occurs</th>
</tr>
</thead>
</table>
| Will stormwater and other runoff generated during the decommissioning phase negatively impact the local environment? | ▪ Discharge of contaminated stormwater and other runoff from the site  
▪ Increased turbidity and downstream sedimentation (arising from erosion)                                                                 | ▪ Depending on the nature of the contaminants, the release of contaminated stormwater and other runoff can negatively impact the surrounding environment | ▪ Impact would occur if structures to contain stormwater are not in place  
▪ Impact would occur if stormwater containment structures overflow                                                                                                                                 |

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Final Report, February 2004 - Confidential  
page 6-28
6.6 Scenarios to be considered in the Environmental Screening Study

Although concern exists over the availability of water in the area, the issue is currently being disputed (van der Berg, 2003). Ninham Shand believes that the water availability in the area is currently in balance but that augmentation will be required in the short-term. A recent report by BKS provides conflicting information and states that augmentation will be required in approximately 8 years time. Considering the above, and until a consensus has been reached between experts, water shortages caused by drought will not be included as an impact assessment scenario.

6.7 Project alternatives

The specialist has identified alternatives for:
- Process wastewater;
- Concentrated brine waste; and
- Stormwater.

**Process wastewater**

With regards to treated process wastewater disposal, the following alternatives exist:
- Discharge to the Coega IDZ process water supply system (i.e. Fishwater Flats Water Reclamation Works system), (as proposed by Eskom)
- Discharge to the surface water environment (Coega River)
- Discharge to the marine environment east of the breakwater (Indian Ocean)
- Discharge to the Port of Ngqura
- Further treatment and re-use by the project (with the aim of zero liquid discharge).

Process wastewater can be discharged to the first four alternatives via an earth or natural channel, an engineered (lined) canal or a pipeline. Each of these alternatives will have their own environmental impact (construction of transport vessel, leakage of liquid waste into the surrounding environment, etc). The future EIA for the CIPP should include an assessment of reasonable alternatives and identification of the Best Practicable Environmental Option (BPEO).

**Concentrated brine and sludge wastes**

With regards to concentrated brine waste management and disposal, the following options are available:
- Regulated discharge to the marine environment
- Regulated discharge to surface waters
- Subsurface injection/deep well injection (storage of brine in underground reservoirs)
- Discharge to municipal sewers
- Disposal via evaporation ponds
- Concentration of brine via evaporator/concentrator/crystallization treatment steps.

With regards to sludge waste management, disposal of sludge at an appropriate landfill or waste disposal site must be considered.

**Stormwater**

As per treated process wastewater disposal, the following stormwater disposal alternatives exist:

- Discharge to the Coega IDZ process water supply system (i.e. Fishwater Flats Water Reclamation Works system)
- Discharge to the surface water environment (Coega River)
- Discharge to the marine environment east of the breakwater (Indian Ocean)
- Discharge to the Port of Ngqura
- Further treatment and re-use by the project
- Stormwater can be discharged to the first four alternatives via an earth or natural channel, an engineered (lined) canal or a pipeline.

**6.8 Impact assessment**

**6.8.1 Construction phase**

The impacts for the construction phase are presented in Table 6.15.

**6.8.2 Operations phase**

**Water use**

The Nootgedacht Water Treatment Works has a capacity of 2 917 m³/hr 70 ML per day and the current output is an average of 1 750 m³/hr (i.e. Nootgedacht Water Treatment Works has spare capacity of approximately 1 167 m³/hr). Estimated water use for the CCGT Power Plant is 52 m³/hr, which is approximately 4.4 % of the spare capacity of the Nootgedacht Water Treatment Works

Despite the spare capacity of the treatment works, concern over the availability of water in the area exists. At present, there is a difference in opinion with regards to water availability for the area (E. van der Berg, Ninham Shand, *pers comm.*, 2003). Ninham Shand believe that the water availability in the area is currently in balance (i.e. supply equals demand) but that augmentation will be required in the short-term (less than five years). A recent report by BKS provides conflicting information and states that augmentation will be required only in approximately eight years time. Existing surface water resources in the Port Elizabeth area are presently fully utilised, and expansion of Port Elizabeth has led to the need to augment this supply with water from the Orange River (Gariep Dam). Water from the Orange River is fed to the Fish River (high salinity), where the Fish River water is diluted, and then used for
various purposes (e.g. irrigation). Although concern exists, all indications are that the existing infrastructure and water sources of the NMMM have sufficient capacity to meet the water demands of the Coega Integrated Power Project without the planned water re-use facilities at the Fishwater Flat Reclamation Works.

**Process wastewater**

The volume of process wastewater generated by the CCGT power plant lies within DWAF’s General Authorisation maximum allowable discharge of 2000 m³/day. Licensing will therefore not be required if the water quality discharged to an aquatic ecosystem (the Coega River in this instance) meets DWAF General Limits.

The expected treated process wastewater quality of the CCGT power plant is presented in Table 6.14 below and compared to the national water quality guidelines.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treated Wastewater Quality</th>
<th>DWAF General Limit Value</th>
<th>DWAF Aquatic Ecosystems Target Water Quality Range (TWQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6 – 9</td>
<td>5.5 – 9.5</td>
<td>pH values within the receiving water should not be allowed to vary by &gt; 0.5 of a pH unit, or by &gt; 5%</td>
</tr>
<tr>
<td>Total suspended solids (mg/L)</td>
<td>50</td>
<td>25</td>
<td>Increase in receiving water quality must be limited to &lt; 10% of the background TSS</td>
</tr>
<tr>
<td>Oil and grease (mg/L)</td>
<td>10</td>
<td>2.5</td>
<td>No guidelines</td>
</tr>
<tr>
<td>Free chlorine residual (mg/L)</td>
<td>0.2</td>
<td>0.25</td>
<td>&lt; 0.2</td>
</tr>
<tr>
<td>Chromium (total) (mg/L)</td>
<td>0.5</td>
<td>0.05*</td>
<td>&lt; 0.007*</td>
</tr>
<tr>
<td>Copper (mg/L)</td>
<td>0.5</td>
<td>0.01*</td>
<td>&lt; 0.3</td>
</tr>
<tr>
<td>Iron (mg/L)</td>
<td>1.0</td>
<td>0.3*</td>
<td>Not allowed to vary by more than 10% of the background dissolved iron</td>
</tr>
<tr>
<td>Zinc (mg/L)</td>
<td>1.0</td>
<td>0.1*</td>
<td>&lt; 0.002</td>
</tr>
<tr>
<td>Temperature increase (Degree Celcius)</td>
<td>3</td>
<td>3</td>
<td>2 or not more than 10%</td>
</tr>
</tbody>
</table>

* Dissolved
# Chromium (VI)

The above table shows that although the project proponents have committed themselves to meeting World Bank Liquid Effluent Guidelines, the treated process wastewater from the CCGT power plant will still not meet DWAF General Limit requirements provided for in the General Authorisation for water use. Although it has been shown that the lower reaches of the Coega River are not pristine and have been largely modified, the treated wastewater is unlikely to meet the water quality requirements. It should be noted that it is unlikely that wastewater discharges will be directed into the Coega River, given the coastal location of the...
CIPP site and the extensive modification to the lower reaches of the Coega River caused by the salt works and the port. If the treated process wastewater is discharged to the marine environment, this will need to be investigated in more detail during the EIA process.

Concentrated brine waste

A specialist opinion is provided in the possible alternatives for the disposal of brine waste, based on information provided by the project proponents:

- **Regulated discharge to the marine environment**
  Generally the most economical method of brine disposal. However, concentrated waste can affect marine ecology, and appropriate studies will be required to assess possible environmental impacts.

- **Regulated discharge to surface waters**
  Direct discharge into surface watercourses is not usually recommended as the concentrated waste can affect aquatic ecology.

- **Subsurface injection/deep well injection (storage of brine in underground reservoirs)**
  High construction and operating costs (and the potential for serious operational problems – high risk) usually cause sub-surface and deep-well injection to be the last processes considered for brine “disposal”.

- **Discharge to municipal sewers**
  Although conventional wastewater treatment processes do not remove dissolved minerals from water, dilution of the brine by domestic sewage, could neutralise the brine. Brine, however, can interfere with wastewater settling, inhibit biological processes and aggravate plant equipment and piping corrosion.

- **Disposal via evaporation ponds**
  Generally used if evaporation rates are high, precipitation is minimal, and land costs are low. In most localities, precautions must be taken to ensure that brine ponds do not overflow or leak into the groundwater (e.g. inclusion of an appropriate lining). Considering the large difference between the average precipitation rate (614 mm/year) and the average evaporation rate (1750 mm/year) in the Port Elizabeth area, evaporation ponds appear feasible for ultimate brine disposal.

- **Concentration of brine via evaporator, concentrator or crystallization treatment steps**
  The brine stream is further concentrated, whilst the recovered water can be recycled for re-use. This treatment process generally results in a very small final
brine stream or a crystallised product. High capital and operating/maintenance costs can be expected for this brine disposal method.

**Stormwater**

Stormwater contamination generally arises from:

- Accidental or other spillages of materials, oils, chemicals and litter
- Accidental discharge of process wastewater into the stormwater system
- Deposition (“fallout”) onto the site from atmospheric emissions in the Coega IDZ (including the CIPP as well as other industries).

At this stage, no details with regards to specific parameters of concern or likely concentrations in the stormwater are available. The following points are, however, noted:

- The bulk of the emissions from the proposed project will be gaseous, with very limited particulate emissions. As such, the potential to contaminate stormwater from particulates is therefore negligible (Greg Scott, CSIR, *pers comm.*, November 2003).
- Potential stormwater contamination from atmospheric deposition of pollutants emitted by neighbouring industries should be taken into account. Based on the EIA undertaken for the proposed Coega Aluminium Smelter (CSIR, 2002; Zunckel *et al.*, 2002), the predicted fluoride deposition (for three fluoride emission scenarios) indicates, as may be expected, maximum deposition at the smelter site. In all cases the deposition rates decrease very quickly with increasing distance from the site and within 2 to 3 km they are less than 1 g/m². Therefore, deposition of fluoride at the LNG terminal and CCGT power plant are expected to be negligible and have little/no effect on stormwater quality.
- The potential for stormwater contamination as a result of deposition of particulate pollutants from other neighbouring industries (e.g. in the Markman Industrial Area) are currently unknown, however, the distance between these emission sources and the project is considered to be great enough for these potential pollutants to not be of major concern.

Based on the above, it is clear that through careful on-site management, stormwater contamination could be largely minimised. It is expected that grease/oil (e.g. from vehicles and general equipment maintenance) and suspended matter/turbidity (e.g. from dust and litter) are the main stormwater quality parameters of concern.

The impacts for the operations phase are presented in Table 6.16.

**6.8.3 Decommissioning Phase**

The impacts for the decommissioning phase are presented in Table 6.17.
### Table 6.15: Potential construction phase impacts associated with water consumption and wastewater management

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Status</th>
<th>Significance</th>
<th>Degree of confidence</th>
<th>Potential fatal flaw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact of water use by the CIPP exceeding the treatment and/or supply capacity of the regional &amp; local water infrastructure.</td>
<td>Negative</td>
<td>Low</td>
<td>Medium</td>
<td>No Provided that: good general management practices are followed; proper sanitation facilities are in place for removal of domestic wastewater; and wastewater discharges from site meet legislated requirements.</td>
</tr>
<tr>
<td>Impact of water use by the CIPP exceeding the sustainable yield of water resources</td>
<td></td>
<td></td>
<td></td>
<td>No With proper water utilisation and conservation practises, negative impacts associated with increased water use by the project will be largely negated</td>
</tr>
<tr>
<td>Impact of the release from the CIPP site of stormwater (which could potentially be contaminated), other wastewater discharges and untreated domestic effluent on the receiving environment (including surface water, groundwater &amp; marine) and community health.</td>
<td>Negative</td>
<td>Low</td>
<td>Medium</td>
<td>No Provided that: good general management practices are followed; proper sanitation facilities are in place for removal of domestic wastewater; and wastewater discharges from site meet legislated requirements.</td>
</tr>
</tbody>
</table>
### Table 6.16: Potential operations phase impacts associated with water consumption and wastewater management

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Status</th>
<th>Significance</th>
<th>Degree of confidence</th>
<th>Potential fatal flaw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact of water use by the CIPP exceeding the treatment and/or supply capacity of the regional &amp; local water infrastructure.</td>
<td>Negative</td>
<td>Medium Due to the long term nature of the operation phase, a higher likelihood exists that water use by the project will affect the regional water supply/demand</td>
<td>Medium At present, there is a dispute/difference in opinion with regards to water availability for the area. Ninham Shand believe that the water availability in the area is currently in balance but that augmentation will be required in the short-term. A recent report by BKS provides conflicting information and states that augmentation will be required in approximately 8 years time.</td>
<td>No With proper water utilisation, implementation of water conservation practices and introduction of wastewater treatment and re-use practices, negative impacts associated with increased water use by the project can be largely negated.</td>
</tr>
<tr>
<td>Impact of water use by the CIPP exceeding the sustainable yield of water resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact of the release of <strong>untreated domestic effluent</strong> into the surrounding environment</td>
<td>Negative</td>
<td>Low The existing municipal sewerage network and Fishwater Flats Reclamation Works will be used for treatment of domestic wastewater (sufficient spare exists capacity to meet needs).</td>
<td>High The project proponents have stated that domestic wastewater will be discharged into the Coega IDZ sewerage network</td>
<td>No</td>
</tr>
<tr>
<td>Depending on the nature of the contaminants, the impact of accidental release of <strong>untreated process wastewater</strong> on the surrounding environment (eg. surface water, groundwater &amp; marine).</td>
<td>Negative</td>
<td>High Noting that this impact would only occur in the case of an accident (eg. breakdown of treatment plant) or if management systems fail.</td>
<td>Medium Quality of untreated wastewater is not available at this stage (but expected to be worse than treated wastewater). Information on management systems and control measures is not available.</td>
<td>Yes But can be avoided provided that: proper control measures are in place to prevent discharge of untreated wastewater to the environment; and wastewater discharges from the site meet legislated requirements.</td>
</tr>
</tbody>
</table>
### Potential impact

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Status</th>
<th>Significance</th>
<th>Degree of confidence</th>
<th>Potential fatal flaw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depending on the nature of the contaminants, the impact of the release of treated process wastewater that does not satisfy legislated quality requirements on surrounding environment (eg. surface water, groundwater &amp; marine). (Note: The potential impact of process water discharge on the marine environment is not assessed in this chapter and should be addressed in the EIA.)</td>
<td>Negative</td>
<td>High</td>
<td>High</td>
<td>Yes, If IDZ process water system is not in place by the time of start-up of the CIPP, and discharge is sent to the Coega River. Need to ensure that proper control measures are in place so that water quality meets the requirements for re-treatment via the IDZ process water system. An alternative would be on-site tertiary/advanced treatment for direct wastewater re-use.</td>
</tr>
<tr>
<td>Impact of accidental release of brine wastes on the surrounding environment (eg. surface water, groundwater &amp; marine).</td>
<td>Negative</td>
<td>High</td>
<td>Medium</td>
<td>Yes</td>
</tr>
<tr>
<td>Depending on the nature of the contaminants, the impact of the release of contaminated stormwater and other runoff from the site on the surrounding environment (eg. surface water, groundwater or marine)</td>
<td>Negative</td>
<td>Medium</td>
<td>Medium</td>
<td>No</td>
</tr>
</tbody>
</table>

**Note:** The potential impact of process water discharge on the marine environment is not assessed in this chapter and should be addressed in the EIA.
6.8.4 Decommissioning phase

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Status</th>
<th>Significance</th>
<th>Degree of confidence</th>
<th>Potential fatal flaw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depending on the nature of the contaminants, the impact of the release of</td>
<td>Negative</td>
<td>Low</td>
<td>Medium</td>
<td>No Provided that good management practices are followed; and that wastewater discharges from the site meet legislated requirements.</td>
</tr>
<tr>
<td>contaminated stormwater and other runoff on the surrounding environment (eg.</td>
<td></td>
<td>Due to the limited extent of the impact, short-term nature of construction</td>
<td>Provided that good management practices are followed on-site during the decommissioning period.</td>
<td></td>
</tr>
<tr>
<td>surface water, groundwater &amp; marine).</td>
<td></td>
<td>phase, and expected composition of contaminated stormwater and other runoff</td>
<td>The exact nature of practices to be employed on site, and the control thereof, is unknown.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>produced. Proper sanitation facilities must be in place for removal of</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>domestic wastewater.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.9 Specification of environmental thresholds

No additional thresholds are identified over and above those identified in section 6.4.

6.10 Recommendations for project planning and design

6.10.1 Water consumption

Although increased water use has not been identified as a fatal flaw/"showstopper", it is noted that the proposed project does not recycle and reuse any of its treated process wastewater. As South Africa is a water scarce country, every effort must be made to limit/reduce water use on the site. Considering the increasing water demands in the region and the likely increase in industrial activities in the IDZ, the following design recommendations are made:

- Investigation of the potential for further treatment and re-using of treated process wastewater from the CCGT power plant and stormwater
- Introduction of appropriate water conservation measures.

Re-using treated process wastewater and stormwater

If the planned process water supply system and water re-use facilities at Fishwater Flat Reclamation Works is not implemented shortly, the potential for re-using treated process wastewater and stormwater should be investigated. Re-using treated process wastewater is in line with DWAF’s National Water Conservation and Water Demand Management Strategy, and will greatly enhance the environmental profile of this project.

Water conservation

In addition to using technology to reduce water consumption (as proposed above), the following water conservation techniques should be considered:

- **Domestic**
  
  Implement water saving devices (e.g. dual flush toilets and automatic shut-off taps).

- **Irrigation**

  Stormwater could be of a suitable quality for irrigation purposes. Ideally, landscapes should be designed to absorb rainwater runoff (stormwater) rather than having to carry it off-site in stormwater sewers. Furthermore, the following should be noted:
  
  - Proper irrigation scheduling will limit evaporation losses
  - Indigenous plants generally require less water than alien species
  - Gardens should be structured as to minimise surface run-off.


- **Cleaning**
  Cleaning methods utilised for cleaning vehicles, floors, etc should aim to minimise water use.

- **Fire fighting**
  Proper pressure management within fire water systems will limit water use.

- **Elimination of leakage**
  Regular audits of water systems should be conducted to identify possible water leakages.

- **Metering and measurement**
  Proper metering and measurement of water use and wastewater discharges will enable proper performance review and management.

- **Education and awareness**
  Awareness campaigns focussing on spillages and the effects thereof on stormwater quality and the environment should be launched in all departments. These campaigns must be aimed at all levels of the organisation (including contractors). Furthermore, water system operating personnel need to have extensive knowledge of the various water control systems, to allow for optimum operation thereof.

6.10.2 Wastewater and stormwater

**Domestic wastewater**

During the construction phase, adequate sanitation facilities (e.g. portable toilets) will be required.

During the operations phase, domestic wastewater must be discharged to the municipal sewer network.

**Process wastewater**

The treated process wastewater does not meet DWAF General Limits and therefore discharge of the treated process wastewater to the aquatic environment (e.g. Coega River) is not recommended. It is also anticipated that discharge of the treated process wastewater will also have an impact on the marine environment. Considering the above and the potential for water stress in the area, the option of disposing treated process wastewater from the CCGT power plant to the Coega IDZ process water supply system (as proposed by Eskom) for advanced treatment and re-use seems to be the alternative with the lowest environmental impact and would contribute to water conservation and re-use efforts in the area. However,
as the proposed process water supply system and water reclamation works may not yet be in place at the start of operation of the Coega Integrated Power Project, this discharge option may not be feasible in the short-term. Considering the above and the fact that South Africa is a water scarce country, the potential exists for the inclusion of a proactive water management initiative in the project. In this case the treated process wastewater (from both the LNG terminal and CCGT power plant) could undergo tertiary/advanced treatment such that it could be directly re-used as process water by the project. Water re-use will lower purchased potable water costs and be in-line with water conservation and best management practices.

It is recommended that the project proponents clarify the future availability of the CDC process water supply system and the expected water quality standards for accepting process wastewater from future tenants. Similarly the option and quality requirements for discharging treated process wastewater to the Port of Ngqura should be clarified with NPA and DEAT: Marine and Coastal Management (MCM).

With regards to sludge management and disposal, it has been proposed by the project proponents that sludge from the clarifier will be collected for disposal off-site. With regards to washwater from filter backwashing, it is recommended that the washwater be recycled to the start of the treatment process.

In summary, considering the above recommendations, that South Africa is a water scarce country, and that Eskom has a zero liquid effluent discharge policy, it is recommended that an integrated water management initiative be investigated for this project. This would aim to re-use process wastewater and stormwater as input process water within the CIPP, through tertiary/advanced treatment. The possibility of using seawater as supply water for the process water system should also be considered (Heine Hoffman, Strategic Water Planning, Eskom, pers comm, Memorandum dated 8 January 2004).

Concentrated brine wastes

Although specifics surrounding the quality of the concentrated brine wastes has not been provided by the project proponents, the following alternatives were identified as alternatives for brine discharge:

- Regulated discharge to the marine environment
- Regulated discharge to surface waters
- Subsurface injection/deep well injection (storage of brine in underground reservoirs)
- Discharge to municipal sewers
- Disposal via evaporation ponds
- Concentration of brine via evaporator/concentrator/crystallization treatment steps.
For the CCGT power plant, it has been indicated that the concentrated brine wastes will be treated on-site in the process wastewater treatment system for subsequent discharge to the IDZ process water supply system (Alva Short, Eskom. *pers comm.*, 1 December 2003). Of the alternatives presented above, it is the specialists opinion that only the following should be considered:

- Regulated discharge to the marine environment
- Discharge to municipal sewers
- Disposal via evaporation ponds
- Concentration of brine via evaporator/concentrator/crystallization treatment steps.

Considering the above, the following should be noted:

- Discharge to the marine environment can affect marine ecology, and appropriate studies will be required to assess possible environmental impacts. This discharge method will probably receive opposition from authorities.
- Dilution of the brine by domestic sewage, could neutralise the brine. This discharge method will probably receive opposition from authorities.
- Disposal via evaporation ponds is generally low risk if sufficient precautions are in place (e.g. pond has appropriate lining to prevent leakage into groundwater). Large evaporation ponds may, however, have a negative visual impact and add to the spatial requirements of the plant.
- Concentration of brine results in further concentrated brine/crystals and a recovered water that can be recycled for re-use. This brine disposal method generally has high energy requirements.

Considering the information presently available, it is not possible to identify the best of these alternatives.

**Stormwater**

It is recommended that the project proponents clarify the future availability of the CDC process water supply system and the expected water quality standards for accepting stormwater from future tenants. Similarly the option and quality requirements for discharging stormwater to the Port of Ngqura should be clarified with NPA and DEAT: Marine and Coastal Management (MCM).

The stormwater system developed will need to meet the discharge quality and quantity requirements specified by the institution responsible for receiving the stormwater (i.e. CDC, NPA and/or DEAT: MCM). The following stormwater management principles are presented to guide design and operation of the stormwater system.
Sediment Capture: Initial control of stormwater quality requires collection of sediments, oils and floating matter. A sedimentation basin will be required to separate gross particulates. Trap mechanisms will need to be installed to aid removal of oils and other floating matter.

“First Flush” Collection: A stormwater pond should be constructed to capture the “first flush” of stormwater (most heavily contaminated stormwater from the paved, roofed and sealed areas of the site). The first flush collection also acts as an important interception control for accidental spillages of chemicals/oils on site and for containment of water from fire fighting. As it has been noted that gaseous emissions will contain very little particulates, it is anticipated that the pond required will not need to capture and contain a large volume of stormwater. The pond can be sized by multiplying the total sealed collection area of the site by the level of rainfall to be collected (e.g. first hour of rainfall or first 20 mm).

Once the pond is full, all further stormwater flow during a rain event will bypass the pond (it is assumed that such water is not contaminated). Following the cessation of a rain event, water stored in the pond can be discharged as a “controlled” flow via the normal offsite network. After the pond is drained, it is subsequently maintained in an empty state in readiness for the next rain event.

The pond must be located at the lowest possible point on the site and must be lined to minimize possible impacts on groundwater. The pond must be operated at a minimum level to ensure sufficient capacity for runoff from subsequent rain events.

Spill and pollution management: In practice, this first flush principle may be compromised by poor housekeeping procedures, which can introduce an additional load of contaminants to the stormwater collection network. Strict operational housekeeping controls are therefore required to minimise these effects. It is thus recommended that plant-wide spillage audits be conducted during operations. The introduction of such audits will identify areas contributing to the elevated contaminant levels in the pond. Proper education and awareness training will encourage employees (and contractors) to minimize spillages, timeously report incidents of spillage and follow good cleaning practices. Practical management actions to reduce the risk of stormwater contamination through accidental spillages and leaks include: covering materials during transportation and storage; environmental awareness and training of personnel on site; and ensuring that workshops, material storage areas and washing areas contain bunded areas and grease traps. Emergency management procedures must be developed to deal with leaks and spills.

Considering the fact that stormwater may be of a good quality and bearing in mind that South Africa is a water scarce country, treatment and/or re-use of stormwater as process water and/or for irrigation purposes should be considered. Stormwater and
treated process wastewater could be combined and treated via a single treatment system, thus lowering treatment equipment capital costs and lowering purchased potable water costs.

Construction of stormwater and other run-off from the containment facilities must commence at the start of the construction phase. Minimisation of erosion and sedimentation (e.g. using drainage ditches and stabilization of steep slopes) during construction will reduce the amount of sediment available for entrainment in the stormwater.

6.11 Recommendations for baseline monitoring and more detailed studies

- Expected qualities for all liquid wastes (including stormwater and brine) and proposed points of discharge for all liquid wastes must be specified by the project proponents and evaluated in the EIA process.
- The quality and quantity of treated process wastewater and stormwater must be monitored and recorded during operations.

Given the location of the project on the shoreline west of the port, it is not expected that the project will have an impact on surface water. Therefore no surface water monitoring additional to what is currently carried out for the IDZ is proposed.

With regards to groundwater, it is recommended that a groundwater survey of the site be conducted. This could include drilling a limited number of shallow test boreholes that will determine if groundwater is connected to aquifers or potentially vulnerable receiving environments (such as estuaries and rivers). Depending on the above, baseline monitoring may be required and monitoring boreholes may need to be established.