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APPLICATION FOR INTEGRATED ENVIRONMENTAL AUTHORISATION AND WASTE MANAGEMENT LICENCE IN TERMS OF THE:

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998) AS AMENDED AND THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS 2010; AND

NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008 (ACT 59 OF 2008) AND GOVERNMENT NOTICE 718 OF 2009

FINAL ENVIRONMENTAL MANAGEMENT PROGRAMME

Division Presenting
A&IRM Environmental Division

OCTOBER 2014

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Title:	Environmental Management Programme for the Co-Disposal of Ash and Gypsum at the Kusile Power Station
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Project Name:	Kusile Coal Fired Power Station
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Approved for Sebata Institute by:

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Environmental Assessment Practitioner

Date: 2014/10/27

APPLICATION FOR AN INTEGRATED ENVIRONMENTAL AUTHORISATION AND WASTE MANAGEMENT LICENCE FOR THE CO-DISPOSAL OF ASH AND GYPSUM AT THE KUSILE POWER STATION

ENVIRONMENTAL MANAGEMENT PROGRAMMES (EMPr)

(Ref. No. 14/12/16/3/3/3/51)

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LIST OF ABBREVIATION

ADDD	Ash/gypsum co-disposal facility Dirty Dam
BAR	Basic Assessment Report
C	Contractor
CEO	Contractor Environmental Officer (Dedicated person)
CM	Contract Manager (Eskom)
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Environmental Monitoring Committee
EMPr	Environmental Management Programme
GN	Government Notice
IHAS	Invertebrate Habitat Assessment System
PES	Present Ecological Status
PM	Project Manager
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
SANBI	South African National Biodiversity Institute
SASS5	South African Scoring System, Version 5
SES	Standard Environmental Specification
SDD	Station Dirty Dam
WMP	Wetlands Management Plan
WMS	Wetlands Management Strategy
WUL	Water Use Licence

LIST OF UNITS

Ha	hectares
mamsl	metres above mean sea level
%	percentage

1. INTRODUCTION

1.1 BACKGROUND

In 2006 Eskom Holdings initiated an Environmental Impact Assessment (EIA), undertaken by Ninham Shand (Pty) Ltd, for the construction of a 4 800 MW Kusile Coal-Fired Power Station and associated infrastructure in the Witbank area. The Department of Environmental Affairs (DEA) issued an Environmental Authorisation (EA) in June 2007 (Ref: 12/12/20/807) (Please refer to **Appendix A** for a copy of the EA), which was appealed and a revised EA was issued in March 2008 under the ECA.

At the time of the EIA, Eskom's intention was to dispose of ash only at the ash disposal facility and initiated an investigation to determine existing potential opportunities in the market which would result in the use of gypsum that would be produced as a result of the Flue Gas Desulphurisation (FGD) process. Although the possibility of gypsum being generated through the FGD process and the commercial value related to it was discussed in the final EIA Report, the disposal of gypsum on the ash/gypsum co-disposal facility was not included and is therefore not authorised.

Since gypsum is considered to be a hazardous waste (classified as a medium hazardous waste), a Waste Management Licence (WML) must be applied for to co-dispose ash and gypsum as a listed activity 9, Category B of GN718 and the construction of the facility (Ash/gypsum co-disposal facility, the Ash/gypsum co-disposal facility Dirty Water Dam (ADDD), the Station Dirty Water Dam (SDD) and the station dirty dam settling tanks (SDD ST)) will trigger activity 11, Category B of GN 718.

In addition to the hazardous waste that will be disposed of at Kusile, general waste including rock spoils (the concrete rock spoil and K3 spoils) produced during construction will also be temporarily stored on site.

The construction of the ADDD within a wetland will trigger activities 11 and 18 of GN R544. **Table 1-1** and **Table 1-2** give a summary of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) and National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEMWA) activities that will be triggered as a result of the various waste activities at Kusile.

Table 1-1: Summary of NEMA Listed Activities being applied for

Number and date of the relevant notice:	Activity No (s) (in terms of the relevant or notice) :	Description of each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice):
Government Gazette R544 2 August 2010	**11**	The construction of the Ash/gypsum co-disposal facility Dirty Water Dam (ADDD) and settling dams within a wetland.
	18	Removing soil located in a wetland for the construction of a waste management facility and depositing ash/gypsum waste material exceeding 5 m^3 into the wetland for storage purposes using a waste management facility.

Table 1-2: Summary of NEMWA Listed Activities being applied for

No. & Date Of The Relevant Notice:	Activity Numbers (As Listed In The Waste Management Activity List) :	Description of Listed Activity
Government Notice 718 of 3 July 2009	**Category A 3 (1)**	The temporary storage of silty soils and degradable rock which is not suitable for use as general backfill within the project (classified as general waste) at the K 3 spoil stockpile that has the capacity to store in excess of 100 m^3.
		The temporary storage of construction waste (mainly concrete, unusable soil, rebar and unwanted material, classified as general waste) at the Concrete spoil stockpile that has the capacity to store in excess of 100 $m^{3.}$
Government	**Category B (9)**	The co-disposal and storage of ash and gypsum which has been classified as a moderate hazardous waste to land.

Notice 718 of 3 July 2009		The disposal of the belt filter press sludge (gypsum) from the FGD process to land.
	Category B (11)	The construction of a hazardous waste facility (Ash/Gypsum co-disposal facility) and its associated dams (Ash/gypsum co-disposal facility Dirty Water Dam, Station Dirty Water Dam and Station Dirty Water Dam Settling Tank).

The March 2008 Environmental Authorisation granted Kusile Power Station permission to construct a number of waste related facilities (**DEA Ref: 12/12/20/807**) (**Appendix A**). In May 2010, Kusile Power Station was also granted a waste management licence (**DEA Ref: 12/9/11/L193/6**) (**Appendix B**) for additional waste activities. The authorised waste activities are summarised in **Table 1-3**.

Table 1-3: Summary of Authorised Waste Activities at Kusile

No.	Activity	Comments
1.	Sewage treatment works	The Sewage Treatment Works were authorised in terms of the 2008 Environmental Authorisation (**DEA Ref: 12/12/20/807**).
2.	Coal Stockyard Pollution Control Dam (PCD)	The Coal Stockyard PCD was authorised in terms of the 2008 Environmental Authorisation (**DEA Ref: 12/12/20/807**).
3.	Potable Raw Water Treatment (Brine)	The Potable Raw Water Treatment (brine) was authorised in terms of the 2008 Environmental Authorisation, which authorised water and waste water treatment facilities (**DEA Ref: 12/12/20/807**).
4.	Water Treatment Plant	The Water Treatment Plant was authorised in terms of the 2008 Environmental Authorisation, which authorised water and waste water treatment facilities (**DEA Ref: 12/12/20/807).**

No.	Activity	Comments
5.	Effluent Neutralisation Plant	The Effluent Neutralisation Plant was authorised in terms of the 2008 Environmental Authorisation, which authorised water and waste water treatment facilities (**DEA Ref: 12/12/20/807).**
6.	Holding Recycling Dams and De-gritting Sumps	The Holding Recycling Dams and De-gritting Sumps were authorised in terms of the 2008 Environmental Authorisation, which authorised water and waste water treatment facilities (**DEA Ref: 12/12/20/807**).
7.	Temporary Demineralisation Plant	The Temporary Demineralisation Plant was authorised in terms of the 2008 Environmental Authorisation, which authorised water and waste water treatment facilities (**DEA Ref: 12/12/20/807**).
8.	Radial Stacker	The Radial Stacker was authorised in terms of the 2008 Environmental Authorisation, which authorised ash disposal facility (**DEA Ref: 12/12/20/807**).
9.	Emergency Ash/gypsum co-disposal facility (EAD)	The EAD was authorised in terms of the 2008 Environmental Authorisation, which authorised ash disposal facility (**DEA Ref: 12/12/20/807**).
10.	Hazardous Waste during construction	The hazardous waste produced during construction was authorised in terms of the waste licence (**DEA Ref: 12/9/11/L193/6**).
11.	General Waste during construction	General waste produced during construction was authorised in terms of the waste licence (**DEA Ref: 12/9/11/L193/6**).

In addition to the activities in **Table 1-1** and **Table 1-2**, Eskom is also looking to consolidate all waste activities into one licence and is requesting that the Department includes the abovementioned activities (**Table 1-3**), which were applied for and authorised

prior to the promulgation of the NEMWA, in the Licence.

1.2 PURPOSE OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME

The purpose of this construction Environmental Management Programme (EMPr) is to describe the manner in which activities associated with the construction and operation of the ash/gypsum co-disposal facility and associated dams and the K3 and spoil areas, which have the potential to cause pollution or degradation of the environment, will be managed and controlled in accordance with relevant Environmental legislation and standards and practices.

This EMPr is based on the principles of the National Environmental Management Act (Act no. 107 of 1998) (NEMA). These principles include:

- To avoid, minimise, or correct pollution and degradation of the environment;
- To avoid or minimise waste and to re-use or re-cycle waste where possible;
- To apply a risk averse and cautious approach;
- To anticipate and prevent negative impacts on the environment. Where these impacts cannot be prevented, such impacts must be minimized or remedied;
- That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimized and remedied;
- Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option; and
- The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment.

The NEMA stipulates that anyone who causes pollution or degradation of the environment is responsible for preventing impacts occurring, continuing or recurring and for the costs of repair of the environment.

The overall objective of the Environmental Management Programme (EMPr) is to provide Kusile Power Station and its contractors with practical guidance for the environmentally

and socially responsible construction, operation and eventual closure of the ash/gypsum co-disposal facility and associated dams by listing relevant South African and international environmental guidelines and standards and describing the actions to be taken to achieve them. This document provides appropriate mitigation measures designed to minimise or eliminate significant adverse impacts that may result from the construction, operation and closure activities associated with the co-disposal facility and associated dams.

An EMPr is a dynamic plan that must be adapted as and when necessary. In the event that the planned results are not achieved because of misapplication or inadequacy of the measures applied, the situation should be analysed and assessed critically, by specialists if necessary, with the objective of amending the mitigation measures to achieve the desired results. The specific objectives of this EMPr are to:

- Describe actions for implementing, maintaining and appropriately amending, as and when necessary, the mitigation measures described in the EIA Report.
- Define organisational and administrative arrangements for environmental management and monitoring of the ash/gypsum co-disposal facility operations, including defining co-ordination, liaison and reporting procedures and the responsibilities of staff.
- Ensure that site supervisory staff understand the recommended pro-active environmental management measures, so that potential problems can be identified and mitigation measures adopted prior to the ash/gypsum co-disposal facility and associated dams operations being undertaken, and to
- Define actions for environmental control, in the event of unexpected pollution or other deleterious events occurring as a result of the operation of the co-disposal facility and associated dams.

The major areas covered by the EMP are as follows:

- **Air Quality:** Mitigation and monitoring measures with the objective of achieving adequate control over the emission of dust and particulate matter from the ash/gypsum co-disposal construction site and meeting South African standards and guidelines are described.
- **Groundwater**: Monitoring measures aimed at early detection of significant impacts on groundwater quality and mitigation measures to minimise such impacts are described.

- **Surface Water**: Monitoring measures aimed at early detection of significant impacts on surface water quality and mitigation measures to minimise such impacts are described.
- **Terrestrial Ecology**: Mitigation measures to minimise the impacts of the co-disposal facility on the ecological characteristics and function of the site, to rehabilitate construction laydown areas and to restore as much ecological function as practicable after closure are described, together with monitoring actions during the relevant phases of the life cycle of the ash/gypsum co-disposal facility ad associated dams.
- **Aquatic Ecology**: Monitoring and mitigation measures to minimize the impacts of the co-disposal facility on the aquatic ecological characteristics and functions.

Other areas covered by the EMPr are:

- **Noise**: Mitigation and monitoring measures to ensure compliance with South African legislation and best practice and to avoid the generation of nuisance noise at sensitive receptor points are described.
- **Visual Impact**: Mitigation measures aimed at reducing the visual impact of the ash/gypsum co-disposal facility and associated dams at residential and other potentially sensitive viewpoints to acceptable levels are described.

1.3 SCOPE OF THIS DOCUMENT

The scope of this document is to provide an environmental management programme for the construction, operation and closure of the ash/gypsum co-disposal facility and associated dams, the K3 site and the spoil sites.

An assessment of the existing Kusile Environmental Management Programme (EMPr) that was compiled in 2006 and the Wetland Management Plan (WMP) that was compiled in 2013 showed that most of the potential impacts and mitigation measures that were identified by the specialists were included. Kusile Power Station designed the lining system for the ash/gypsum co-disposal facility, in conjunction with the Department of Water and Sanitation (DWS), taking the gypsum into account. The liner system was designed to ensure minimum seepage into the groundwater and surface water resources. This additional EMPr is therefore specifically for the co-disposal facility and associated dams.

The following assumptions were made on compiling this EMPr:

- No additional Contractors camps and associated infrastructure will be required for the construction of the co-disposal facility and associated dams. The Contractors will make use of the existing camps; and
- No additional access roads will be required for the construction of the co-disposal facility and associated dams. The Contractors will make use of the existing and approved access roads.

Contractors must also refer to the Standard Environmental Specification (SES) for the Kusile Project. All the mitigation measures identified in the SES must be adhered to in addition to the mitigation measures outlined in this EMPr. Kusile Power Station applied for relaxations to the SES and conditions of the original 2008 EA. **Table 1-4** gives a summary of the relaxations that were applied for and approved by the DEA. Please refer to **Appendix C** for a copy of the SES and the letters of approval for the applications for relaxation of the conditions of the 2008 EA and sections of the SES.

Table 1-4: Consolidated list of construction EMP Amendments letters/ DEA approvals

EMP/SES/RoD section	Specification	DEA approval dates	Comments
SES 622 and 6.3.5.	-Top soil height and -Fencing	07 May 2009	approved
RoD 13.17.2	Exclusion of Occupation health and Safety	15 Jul 2009	OHS excluded on RoD
SES 5.2.2.	Dust level	04 Nov 2010 and 02 Dec 2010	Approved from 0.25 g/ m^2/ day to 1.2 g/ m^2/ day
RoD 6.1.1	Reflective structures	15 July 2009	Permanent structures and non-reflective materials
RoD 3.7.6.	Mercury removal	25 Aug 2010	Condition deferred
RoD 3.10.2	Quarterly monitoring of mortality and fatality rates of chicken	29 Oct 2010	Monitoring to commence a year before operation of the site i.e implementation by Dec 2014

Eskom requires a commitment from the Eskom Project Manager and the Contractor on the following issues:

1) Ensure environmental conditions stipulated in the EA are implemented.
2) To preserve the natural environment by limiting destructive actions on site.

1.4 REPORTING STRUCTURE

The reporting structure at Kusile Power Station in terms of environmental management is summarised in **Figure 1-1**.

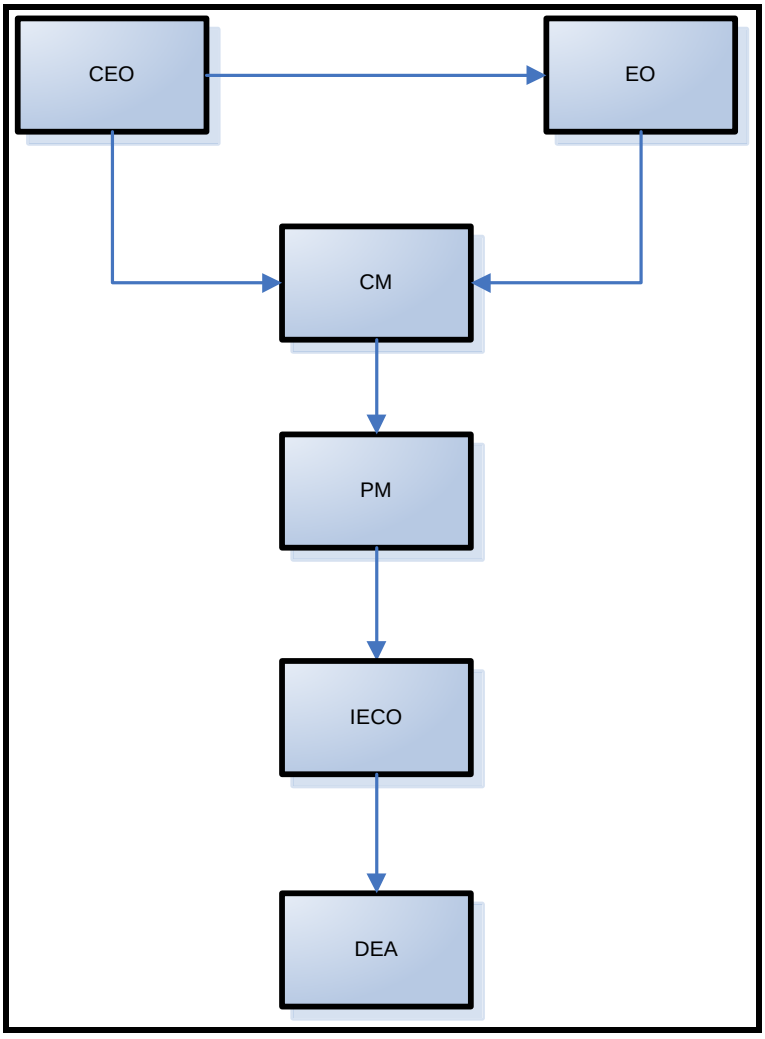

Figure 1-1: Reporting Structure at Kusile Power Station

Where:

EO: - Environmental Officer (Can be the Eskom Site Supervisor depending on the

size of the project)

C: - Contractor

CM: - Contract Manager (Eskom)

CEO: - Contractor Environmental Officer (Dedicated person)

PM: - Project Manager (Eskom)

IECO: - Independent Environment Control Officer who reports to DEA

DEA: - Department of Environmental Affairs

1.5 RESPONSIBILITY MATRIX

Function	Responsibility
Project Manager (PM) (Eskom)	Overall management of project and EMPr implementation.
Site Supervisor/ Contract Manager (CM) (Eskom)	Oversees site works, liaison with Contractor, PM and ECO.
Environmental Officer (EO) – appointed by Eskom	Implementation of EMPr.
Contractor (C)	Implementation and compliance with recommendations and conditions of the EMPr. Appoints dedicated person (Community Liaison Officer) to work with ECO
Contractor Environmental Officer (CEO)	Implementation of EMPr, environmental control of site actions, re-mediation and rehabilitation work.
Independent Environment Control Officer (ECO)	Compliance to EMPr, report to DEA ,Auditing
Environmental Advisor (Eskom)	Environmental advice

1.6 PROJECT TEAM

The EMPr has been compiled by Ndomupei Dhemba and Deon Esterhuizen, with specialist input from René von Gruenewaldt from Airshed (air quality), Mrs Manda Hinsch from SRK (Surface Water Quality and Hydrology), Dr Johann du Preez from MDA (Ecology), Ms Kylie Farrell from Golder (Aquatic Ecology) and Ms Claudia Brites from GCS (Hydrogeology).

2. LOCATION OF THE PROJECT

The Kusile Project is located on approximately 2 500 ha on the farms of Hartbeestfontein 537 JR and Klipfontein 566 JR within the Mpumalanga Province.

The Kusile Project falls within the jurisdiction of the Delmas Local Municipality which is in the Mpumalanga Province. The largest town within a 30 km radius of the Kusile Project site is Emalahleni. The smaller town of Kungwini lays approximately 20 km north-west of the site.

Figure 2-1 shows the Kusile Project location. **Figure 2-2** and **Figure 2-3** show the current Project Layout Plan

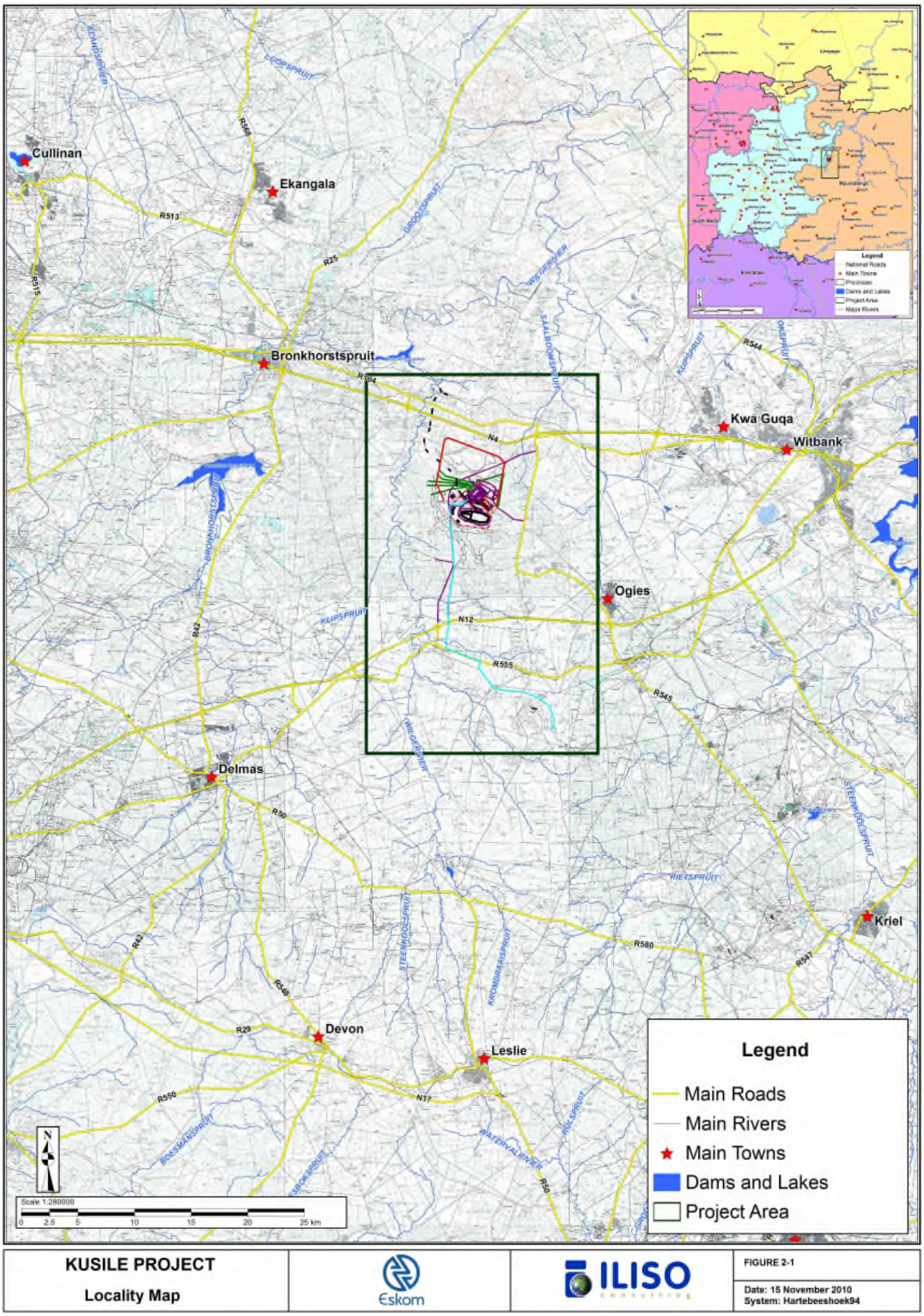

Figure 2-1: Kusile Project Location

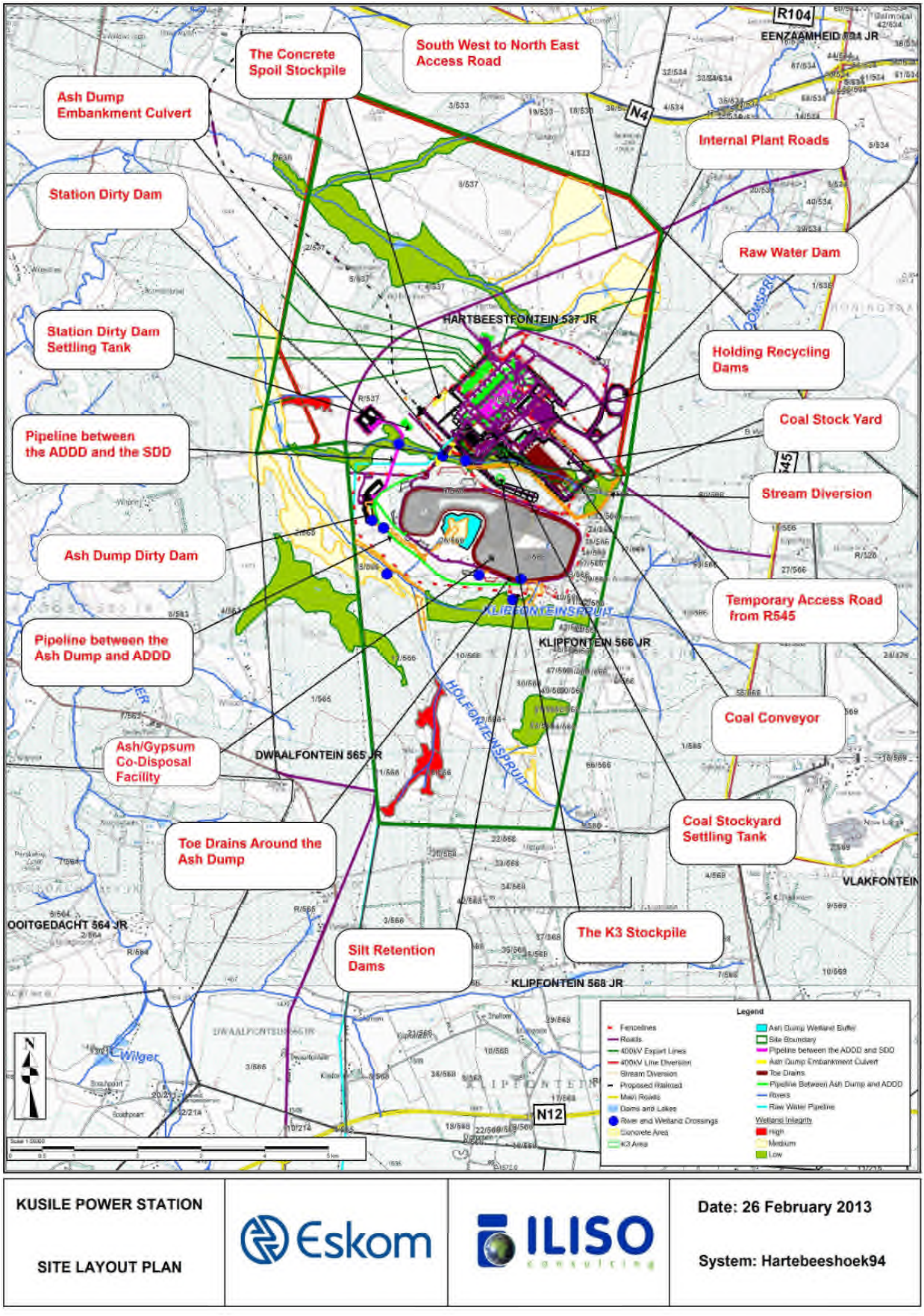

Figure 2-2: General Kusile Site Layout Plan

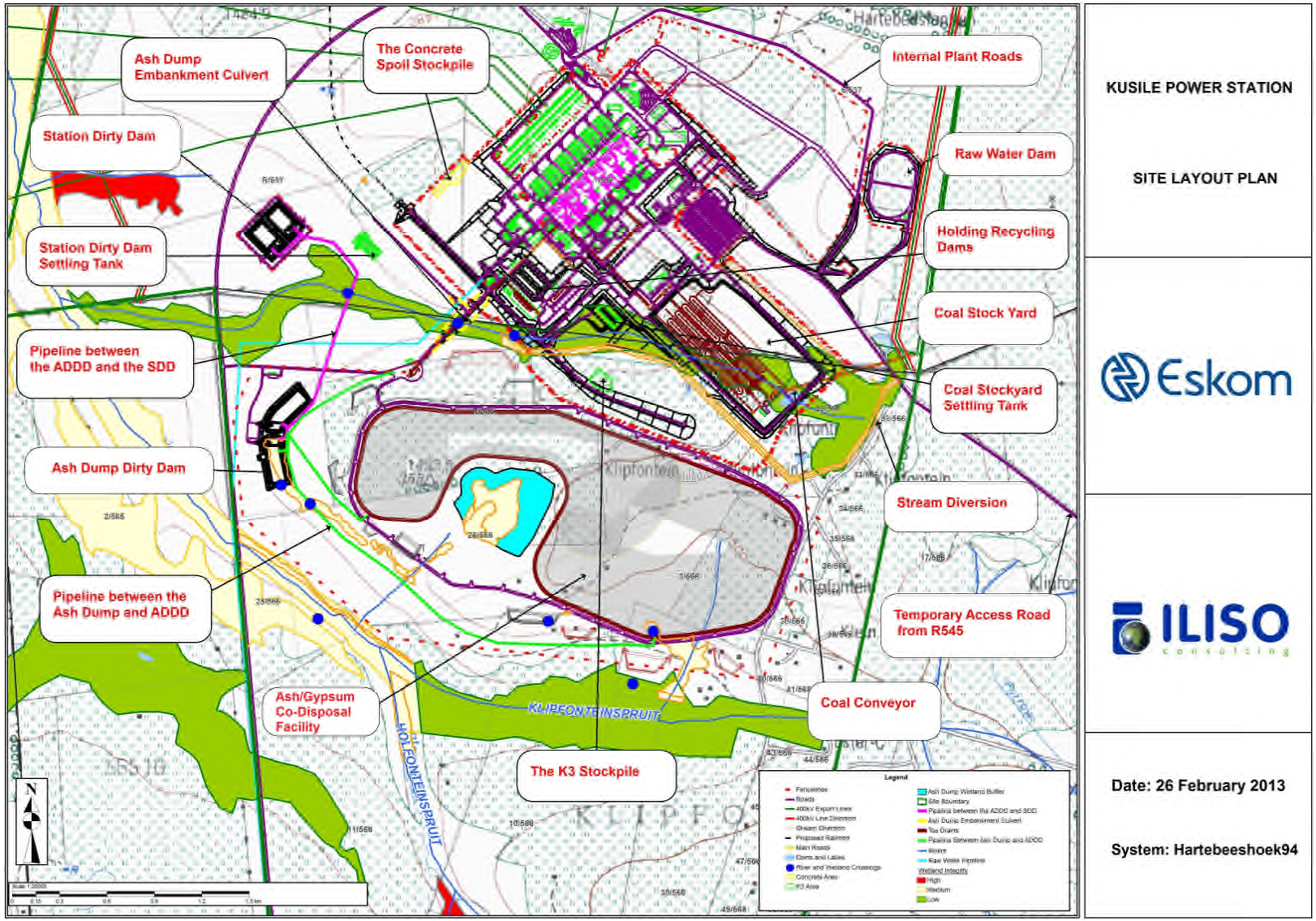

Figure 2-3: Co-Disposal Facility and Associated Dams

3. PROJECT DESCRIPTION

The Kusile Project entails the construction of the following:

Power Station Precinct:

i) Power station buildings
ii) Administration buildings (control buildings, medical, security, etc);
iii) High voltage yard

Associated Infrastructure:

i) Coal stock yard
ii) Coal and ash conveyors
iii) Water supply pipelines (temporary and permanent)
iv) Water and waste water treatment facilities
v) Ash disposal system
vi) Access roads (including haul roads)
vii) Dams for water storage
viii) Railway siding and/or line for sorbent supply

This integrated waste management licence application is applicable to the following:

- The ash/gypsum co-disposal facility and the ADDD;
- The SDD and the SDD ST; and
- Concrete and K3 Stockpile Areas.

All the design Reports are attached in **Appendix D**.

3.1 ASH/GYPSUM CO-DISPOSAL PROCESS

Above ground ash disposal will be used. The ash produced through the combustion of the coal will be removed from the bottom of the boiler (boiler bottom ash) and the fly ash removed from the top of the boiler together with the flue gas (via electrostatic precipitators or bag filters) and sent to an ash/gypsum co-disposal facility.

The Flue Gas Desulphurisation (FGD) process that will be used to reduce sulphur emissions will also result in filter cake/gypsum which will be transported via a conveyer belt to the ash/gypsum disposal facility.

3.2 ASH/GYPSUM CO-DISPOSAL FACILITY

The ash/gypsum co-disposal facility will be located to the south of the power station, on

high ground between two drainage paths. Construction of the facility will entail:

- Excavate and construct the dirty water concrete channels in 1 000 m lengths at a time.
- Backfill trenches after completion of each section.
- Construct perimeter road bed and balance of culvert crossings over 1 000 m lengths at a time.
- Excavate and form clean water drains in 1 000 m sections together with culverts and culvert discharge trenches to silt retention dams.
- Topsoil removal and foundation preparation in 0.25 km squared sections of the phase one footprint to receive the liner sandwich installation (also installed in 0.25 km squared sections).
- Deliver, spread and tip the 300 mm G5 protection layer over the installed liner as soon as each 0.25 km squared section is complete.
- From toe wall to each liner panel section, including drainage pipes at 75 m intervals for storm water discharge to the silt retention dams.

The disposal of ash/ gypsum is to be undertaken as follows:

Place the ash/gypsum onto the ash/gypsum co-disposal facility for the first 4 years of power station operation by a load and haul operation. The ash and gypsum will be delivered by conveyer to a radial stacker near the ash/gypsum co-disposal facility, for subsequent loading, hauling and placement into paddocks of approximate size 200 m by 200 m, developed in 2 m lifts, spread initially over the ash/gypsum co-disposal facility 5-year half-footprint, to full design height on the ash/gypsum disposal facility, and then similarly over the second half of the footprint.

3.3 ASH/GYPSUM CO-DISPOSAL MODELLING

The power station comprises six boiler units which will be commissioned one every eight months, starting December 2014. The full power station ash/gypsum output will thus only be effective in the 4th year of operation. In years 6 to 60 of operation, only gypsum will be placed at significantly reduced tonnages onto the ash/gypsum co-disposal facility by the same, but smaller, load and haul operation.

3.4 ASH/GYPSUM CO-DISPOSAL FACILITY FLOOD HYDROLOGY

The ash/gypsum load and haul deposition system will enable the disposal facility operators to place the ash/gypsum co-disposal facility in such a manner as to be free draining in shape, with minimisation of any depression that will collect and retain

stormwater run-off.

Temporary artificial channels will be constructed on the exposed ash surfaces to lead stormwater down the faces to the dirty water collection channels in a controlled manner thereby preventing erosion. Irrigation of the exposed ash surfaces will take place to achieve dust control. Irrigation water volumes will be restricted as far as possible to limit any seepage potential arising from the irrigation waters.

3.5 ASH/GYPSUM CO-DISPOSAL FACILITY STABILITY

Exposed surfaces will be finally shaped at 1:5 on the side slopes and at 1:200 on the top surfaces and rehabilitated as soon as practically possible by placement of selected topsoil and vegetation cover. These areas will be irrigated to promote and sustain the vegetation.

3.6 ASH/GYPSUM CO-DISPOSAL FACILITY DIRTY WATER DAM

The dirty water collection channels will be routed to the ADDD, which is located northwest of the disposal facility. The liners for the ADDD were designed in conjunction with the DWS, taking the gypsum into account to ensure no or minimal seepage. The ADDD will also have concrete lined sections at the low end of the ADDD for equipment access and removal of accumulated solids. The water stored in the ADDD will be used for dust suppression. In case of excessive stormwater in the ADDD, manual controls will allow gravity flow to the station dirty dam contingent on water quality. The outlet pipe in the ADDD will be elevated above operation volume levels to minimize the conveyance of solids to the SDD. Note that a 50 year, 8 day storm event can be stored in the ADDD for the worst case dirty area of the ash/gypsum co-disposal facility and that the ADDD is comprised of two 50 % cells so that one cell can remain in service while the other cell is being maintained when necessary.

3.7 RADIAL STACKER

The Radial Stacker will be located adjacent to ash/gypsum co-disposal facility. Ash and gypsum will be delivered by conveyor to a radial stacker near the ash/gypsum co-disposal facility, for subsequent loading, hauling and placement into paddocks of approximated size 200 m by 200 m, developed in 2 m lifts. The ash and gypsum will be spread initially over the ash/gypsum co-disposal facility 5-year half-footprint, to full design height on the ash/gypsum co-disposal facility, and then similarly over the second half of the footprint.

For the radial stacker operation, the combined waste product from the overland conveyors will be stacked in a kidney shaped pile by a radial stacker machine adjacent to the ash/gypsum co-disposal facility. The kidney shaped pile will be reclaimed by mobile equipment and loaded into trucks which will drive into the ash/gypsum co-disposal facility and dump the waste product. The radial stacker area will be large enough to accommodate the pile from the radial stacker and to also accommodate multiple trucks and mobile equipment working on the pile simultaneously. The radial stacker area will have a concrete slab with a liner under it and will be fed by one of the overland link ash conveyors. The other overland link ash conveyor will discharge directly onto a concrete slab, also lined, and create a conical shaped pile just North of the radial stacker. This conical shaped pile will be much smaller than the kidney shaped pile but will be used if the conveyor to the radial stacker is disabled or separation of the ash and FGD dewatered solids is required. The liners for the radial stacker were designed in accordance with the requirements of the DWS.

Should there be a problem with the radial stacker or the ash/gypsum co-disposal facility, the handling system will convey the waste products to an emergency ash/gypsum co-disposal facility (EAD) area.

3.8 EMERGENCY ASH/GYPSUM CO-DISPOSAL FACILITY (EAD) AREA

The Emergency Ash/gypsum co-disposal facility (EAD) will consist of a concrete lined area of approximately 1.4 ha, sloped to fall with a concrete trapezoidal drain on two adjacent sides and a concrete rectangular channel drain on the other two sides that joins the trapezoidal drain. The EAD will be used occasionally for the temporary storage of quenched ash for periods of up to 24 hours, before being removed for permanent disposal on the appropriately licensed waste disposal facility. The EAD therefore does not represent the same level of environmental risk as the permanent ash disposal facility.

The purpose of the EAD is to have a place to stack waste product should both the overland link ash conveyors become disabled. The EAD is sized to provide 24 hours storage of bottom ash and FGD dewatered solids for all 6 units running at full capacity. The fly ash will be stored in the fly ash silos for up to 24 hours in case of an emergency. The EAD will have a large concrete slab on which the pile will be stacked. Underneath the concrete will be a liner which will be designed in accordance with the DWS Minimum Requirements for Waste Disposal by Landfill, and will be subject to DWS approval. The concrete slab is designed to contain and drain the EAD area and direct

run off to a sump located on the North West corner of the slab. After an emergency and once the overland link ash conveyors are operational again the bottom ash will be reclaimed and loaded onto the overland link ash conveyors and taken to the ash/gypsum co-disposal facility.

3.9 STATION DIRTY DAM

All potentially contaminated water on the Kusile Power Station will be managed in a closed system. The SDD are two equal capacity, lined, temporary holding dams that act as a collection point for all polluted storm-water and wash-down water on the Kusile site, before it is pumped to the Holding/Recycle Dams (HRD).

The SDD will receive inflows from two distinct sources:

1) Coal Stockyard Settling Tanks (CSY ST): The CSY ST will receive inflows from the Coal Stockyard (CSY), EAD, limestone processing area, and a number of grit sumps. Clarified water leaving the CSY ST will travel via gravity pipeline to the SDD.
2) Station Dirty Dams Settling Tanks (SDD ST): The SDD ST will receive inflows from the station terrace area. Clarified water leaving the SDD ST will travel via gravity pipeline to the SDD.

The SDD will receive gravity discharges of dirty water from the rest of the Kusile Power Station. It will be the furthest downstream dirty water structure on the site and therefore is required to be down-gradient from the power station. The natural contours of the site slope downwards to the north-west, towards the non-perennial tributary of the Klipfonteinspruit. The SDD will be optimally located approximately 1 km north-west of the power station's north-west fence corner. The selected position avoids surrounding wetlands and the 1:100 year flood line of the natural stream. The SDD elevation will range from 1 441 meters above sea level (masl) at the sump of Compartment No. 2 to 1 454 masl at the crest of Compartment No. 1.

To prevent contamination to the underlying soil, the SDD is required to be a fully contained structure. The liners for the SDD will be designed in accordance with the DWS Minimum Requirements for Waste Disposal by Landfill (1998)", and will be subject to DWS approval.

3.10 STATION DIRTY DAM SETTLING TANK

The SDD ST will be located to the north-west of the main power block, and south-east of the SDD. This position is down-gradient of the power station terrace and in close proximity to the SDD. The SDD ST will receive gravity discharges of dirty water from the power station terrace. The two compartments of the settling tank will be partially excavated into the natural ground and partially built in a fill terrace. The terrace elevation was carefully planned in conjunction with the inlet and outlet pipe hydraulic requirements.

The SDD ST will consist of two equal capacity concrete basins that clarify contaminated water from the power station terrace before it travels by gravity pipeline to the SDD. The SDD ST will transmit dirty water inflows from the main power station terrace via a pipeline, to the SDD.

The SDD ST is designed:

- To pass all of the dirty water runoff from its inflow sources for the 1:50 year, peak instantaneous storm event.
- With an emergency spillway to accommodate larger events.
- With two equal capacity compartments which can each pass 6.55 m^3/s. The water enters each compartment of the SDD ST via four sluice gates (1.75 m^2). The two compartments will allow for occasional maintenance and inspection access (preferably during the dry season) without interrupting the functionality of the SDD ST under normal circumstances.

3.11 FLUE GAS DESULPHURISATION WASTEWATER TREATMENT PLANT

The FGD process will result in the production of an FGD wastewater/brine stream which has significantly high concentrations of chlorides, magnesium, calcium, and heavy metals. This wastewater cannot be directly re-used elsewhere in the station. As Kusile Power Station is to be a zero-liquid effluent discharge site, this wastewater will require specialised treatment. Kusile Power Station will employ a three step process of 1) Pre-treatment, 2) Evaporation/Concentration, and 3) Crystallisation to treat this wastewater. This will produce a clean water stream that can be reused, which allows the power station to reduce its raw water intake by up to 3%. Wastes will be generated in the pre-treatment step and crystallization step. This waste will be in solid form and will consist of the gypsum that will be disposed of at the ash/gypsum co-disposal facility. The initial plan was to dispose of the salts from the FGD Sludge at the Holfontein Disposal Facility. However due to the costs, the salts will now be

disposed of on-site. The site for the disposal of salts from the FGD Sludge will be identified and applied for in a separate application.

3.12 SPOIL AREAS

Two separate spoil areas have been developed at Kusile as follows:

- The Concrete Spoil Stockpile which is a mixture of waste containing mostly concrete, unusable soil , rebar (re-enforcing steel) and rubbish; and
- The K3 stockpile which will comprise of silty soils and degradable rock which is not suitable for use as general backfill within the project.

These spoil areas will be temporary. The concrete will be disposed of offsite and the remaining K3 will be spread out and grass will be planted on top.

4. AMOUNTS OF WASTE TO BE DISPOSED OF

It is expected that the ash/gypsum co-disposal facility will handle approximately 3 600 tonnes of ash and gypsum per day within the first four years, and 21 600 tonnes of ash and gypsum per day at year 5. For the next 55 years (year 6-60), only gypsum will be disposed of at the facility. The amounts of gypsum to be handled at the ash/gypsum co-disposal facility will be 2 783.52 tonnes per day. It is expected that an additional 72 tonnes of gypsum per day will be produced from the FGD as belt filter press sludge.

The rock spoils to be stored daily at Kusile are estimated to be 75 tonnes at the concrete spoil area and 500 tonnes at the K3 spoil area. **Table 4-1** provides a summary of all the waste sites that are being applied for and the total amounts of waste expected to be disposed of at each site.

Table 4-1: Summary of Waste Sites being applied for

Waste Site	Size of facility for a waste management activity	Area where the waste management activity takes place	Classification of facility in terms of climatic water balance	Type of Facility	The quantity of waste received
Ash/Gypsum co-disposal facility	The footprint of the ash/gypsum co-disposal facility is approximately 250 ha	The ash/gypsum co-disposal facility will be located on Farm Klipfontein 566JR (Coordinates: 25º 56' 13.05"S, 28º 55' 11.49"E).	The ash/gypsum co-disposal facility is classified as B^+ (water excess).	Ash is classified as non-hazardous waste and gypsum is classified as a moderate hazardous waste according to the DWS Minimum Standards Classification, therefore, the mixture is classified as a moderate hazardous waste. The co-disposal of ash and gypsum will require a class H:h (LB^+) waste disposal facility.	The total waste storage for the Ash/gypsum co-disposal facility will be 84 423 000 m^3.
Ash/gypsum co-disposal facility Dirty Water Dam	The ADDD will be approximately 7.01 ha.	The ADDD will be located on Farm Klipfontein 566JR (Coordinates: 25º 55' 54.17"S, 28º 53' 50.35"E).	The ADDD is classified as B^+ (water excess).	The dirty water collection channels from the Ash/gypsum co-disposal facility will be routed to the ADDD. The ADDD is therefore classified as a hazardous waste disposal facility. .	The total waste storage volume of the ADDD will be 227 410 m^3

Waste Site	Size of facility for a waste management activity	Area where the waste management activity takes place	Classification of facility in terms of climatic water balance	Type of Facility	The quantity of waste received
Station Dirty Water Dam	The footprint of the SDD is approximately 5.615 ha.	The Station Dirty Dam will be located on Farm Hartbeestfontein 537JR (Coordinates: 25º 55' 12.82"S, 28º 53' 50.48"E).	The Station Dirty Water Dam is classified as B^+ (water excess).	The Station Dirty Water Dam is classified as a hazardous waste facility.	The design storage capacity of each dam with the sloping floors is 181 890 m^3.
Station Dirty Dam Settling Tank	The footprint of the Station Dirty Dam Settling Tank is approximately 0.8 ha.	The Station Dirty Dam Settling Tank will be located on Farm Hartbeestfontein 537JR (Coordinates: 25º 55' 12.82"S, 28º 53' 50.48"E).	The Station Dirty Dam Settling Tank is classified as B^+ (water excess).	The Station Dirty Water Dam Settling Tank is classified as a hazardous waste facility.	The waste storage volume of the Station Dirty Dam Settling Tank will be 7 975 m^3.
Spoil Areas	The footprint of the Concrete Spoil Stockpile will be approximately 9.6 ha and the K3 stockpile will be approximately 4.84 ha.	The concrete spoil stockpile will be located on Farm Hartbeestfontein 537JR (Coordinates: 25° 55' 2.15" S and 28º 54' 30.33" E) and the K3 spoil area will be located on Farm Klipfontein 566JR (Coordinates: 25º 55' 43.46" S and 28º 55' 4.32" E).	The rock stockpile is classified as B^-.	The rock stockpile is classified as General Waste. It will primarily consist of silty soils and degradable rock not suitable for use as general backfill.	The total waste storage volume of the concrete spoil stockpile and K3 stockpile will be approximately 229 500 m^3 and 750 000 m^3 respectively

5. KEY ISSUES IDENTIFIED IN THE SCOPING PHASE AND SPECIALIST STUDIES

The following potential issues were identified during the Scoping phase by the EIA team and were considered in the impact assessment phase:

- Groundwater Quality;
- Surface Water Quality;
- Air Quality;
- Aquatic Ecology; and
- Terrestrial Ecology

All the specialist studies entailed the baseline characterization, impact prediction and quantification as well as identification of mitigation measures.

5.1 FINDINGS

5.1.1 Air Quality

The air quality assessment was conducted by Airshed Planning Professionals (Pty) Ltd. The main aim to the study was to determine the potential for dust impacts and Particulate Matter (PM) on the surrounding environment and human health from the proposed ash/gypsum co-disposal facility and associated dams, K3 and soil site operations, with specific reference to air quality.

The study found that the proposed ash/gypsum co-disposal facility is located approximately 20 km from the towns of Bronkhorstspruit (to the northwest), Kwa-Guaqa (to the northeast) and Ogies (to the southeast). Kusile Power Station and the co-disposal facility fall on the boundary of the Highveld Priority Area – an area of known or potentially poor air quality. It is likely that the disposal facility will influence the air quality within the Priority Area.

In modelling the projected impacts to air quality in the vicinity, meteorological data from the Kendal monitoring station for the period January 2009 to October 2012 was used. The modelling of the impact to air quality included four scenarios, with respect to windblown dust emissions from the disposal facility: (1) unmitigated emissions; (2) mitigation through re-vegetation (to 80% of the facility area); (3) mitigation through wetting (maintaining the moisture content to 5%); and, (4) mitigation through both re-vegetation and wetting.

5.1.1.1 Assumptions and Limitations

The following assumptions and limitations were considered in the interpretation of the findings from the air quality assessment for the Project:

- An ash sample was acquired from Kendal Power Station. It is assumed that the particle size distribution and elemental composition will be similar to that from Kusile, when operational.
- Meteorological data used was acquired from the Kendal Power Station, for January 2009 to October 2012. Due to the proximity between Kusile and Kendal, it was assumed that the meteorological data are representative of the site.
- The dispersion model cannot compute real-time processes therefore the end-of-life, worst-case, area footprint for each ash disposal facility alternative was used in the model.
- Increased life-time cancer risk was calculated at the identified sensitive receptors for arsenic, nickel and chromium.
- The gypsum material co-disposed of on the disposal facility is expected to provide a crust when mixed with water.

5.1.1.2 Key Findings

The predicted PM_{10} ground level concentrations exceeded the National Ambient Air Quality Standards (NAAQS) beyond the project boundary. Mitigation scenarios were included to illustrate the value in effective mitigation of wind-blown dust emissions to reduce the impact of the disposal facility. Mitigation using re-vegetation was more effective in controlling wind-blown dust emissions than only watering; however, the combination of both re-vegetation and watering was the most effective. Using either re-vegetation or a combination of re-vegetation and watering will reduce particulate concentrations to levels, off-site, that comply with NAAQS. Similar pattern is evident for $PM_{2.5}$ concentrations. Dust deposition due to unmitigated operations exceeds the draft dust fallout regulations of 600 mg/m²/day beyond the boundary. Impacts are, however, significantly reduced to within the boundary once mitigation measures are applied.

The life-time increased cancer risk was calculated at identified sensitive receptors for exposure to inhalable arsenic, nickel and chromium. The calculations were based on the projected annual PM_{10} concentrations at the various sensitive receptors, literature values for the proportion of the toxic forms of the trace metals in coal fly ash in combination with

total trace metal concentrations in a sample of ash from Kendal Power station and the US-EPA IRIS Unit Cancer Risk Factor for exposure via inhalation. These calculations showed that the increased life-time cancer risk was low to very low.

5.1.2 Groundwater

GCS undertook a hydrogeological study in October 2013, for the ash/gypsum co-disposal facility and associated dams, K3 and spoil areas at the Kusile Power Station.

5.1.2.1 Site Specific Information

The topography of the area slopes in a general north westerly direction towards the perennial Wilge River, located approximately 5 km to the west of the proposed ash/gypsum co-disposal facility. The surrounding land use consists of agricultural land.

5.1.2.2 Previous Investigations

A water quality monitoring programme is currently being undertaken for the Kusile Power Station, since June 2008 by Zitholele Consulting. During this period a total of thirty-four (34) water samples were collected, which includes 16 boreholes and 16 surface water points and 2 duplicates. Fifteen of the 47 monthly monitoring sites were not sampled due to dried up springs, no flowing water, destroyed or collapsed boreholes. The sampling points are shown in **Figure 5-1**.

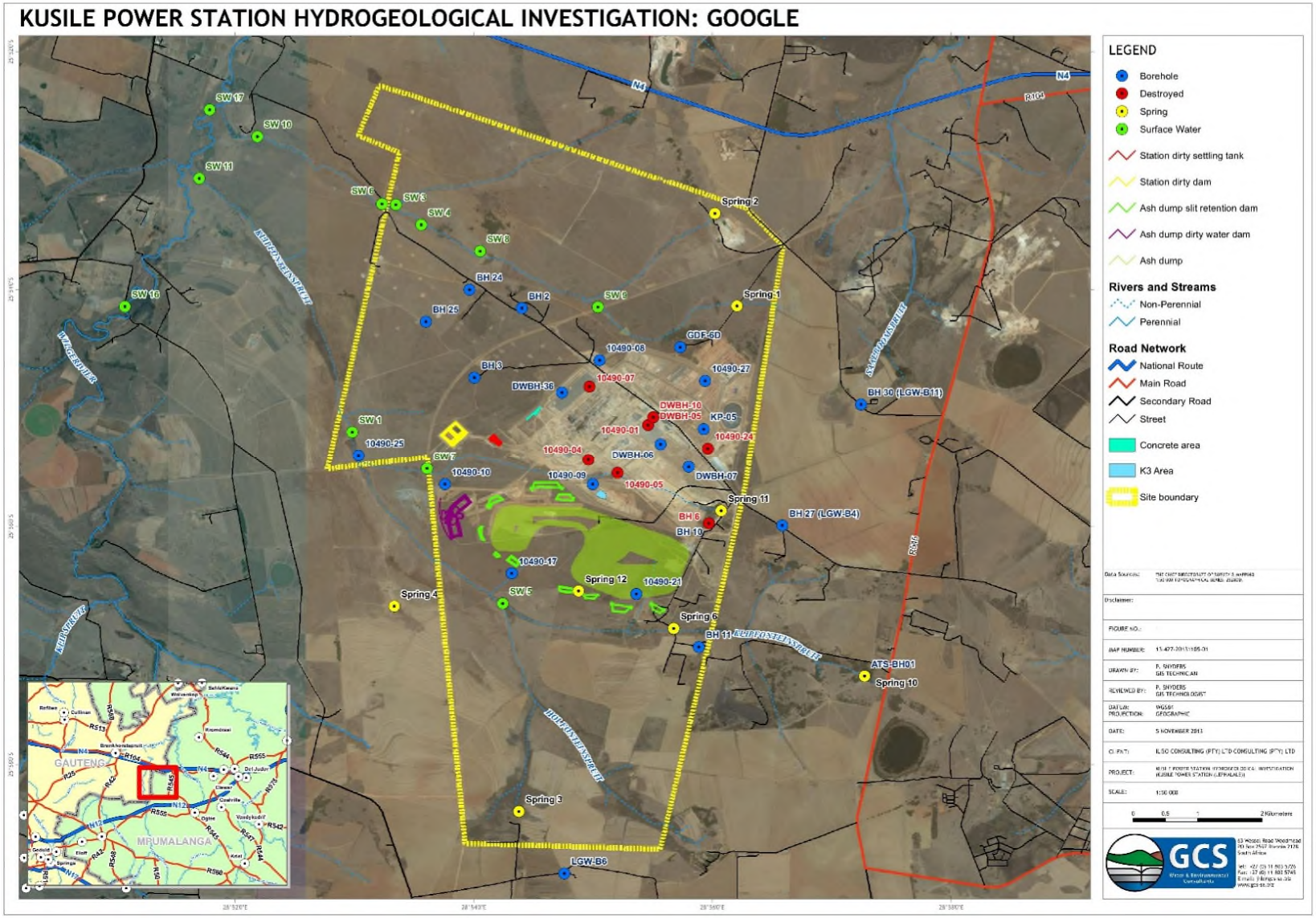

Figure 5-1: Hydrocensus Maps

5.1.2.3 Field Investigation

In total, 20 boreholes were identified during the hydrocensus from which data was collected, which included static water levels. The depths of the boreholes ranged from 16 to 60 metres. The static water levels recorded ranged between 0.59 to 25.34 mbgℓ (metres below ground level).

The short duration constant discharge test was used to determine the aquifer's response to stress (constant pumping) and to be able to calculate the aquifers hydraulic parameters i.e. transmissivity. The transmissivity in the two boreholes associated with the Dwyka Formation ranged from 0.3 to 0.5 m^2/day.

The data obtained from borehole 10490-17 indicated insufficient results as minimal recovery was observed. This would be indicative of a very low yielding borehole with a low transmissivity value of less than 0.05 m^2/day. Borehole BH 27 (LGW-B4) indicated a high yielding borehole. In order to obtain accurate aquifer parameters for the borehole, long duration aquifer testing is recommended. Based on the results obtained, a transmissivity value ranging between 20 and 50 m^2/day was allocated for the borehole.

5.1.2.4 Hydrochemistry

The chemistry of majority of the boreholes indicated good water quality with very few parameters which were not compliant with the SANS 241-1:2011 drinking water quality standards.

Boreholes 10490-17 and BH3 indicated non-compliant manganese with concentrations of 4mg/l and 0.58mg/l respectively, which exceeded the SANS standard of 0.5mg/l. Borehole 10490-25 indicated non-compliance for fluoride with a concentration of 1.8mg/l which exceeded the SANS standard of 1.5mg/l.

5.1.2.5 Risk Assessment

The hazards associated with the proposed ash/gypsum co-disposal facility and associated dams and their impact on the groundwater environment include: Hydrocarbon contamination as well as poor quality water stored on site recharging the groundwater. The impact of hydrocarbon contamination on the soil and groundwater environment during construction indicates moderate environmental significance without mitigation in place and low environmental significance with mitigation in place.

Another negative impact envisaged is the result of poor quality artificial recharge from the ash/gypsum co-disposal facility. The mitigation measures shall include properly lining the ash/gypsum co-disposal facility and associated dams. This would reduce the impact on the groundwater environment as it inhibits the seepage of poor quality water into the aquifer. Mitigation measures should also include implementing the proposed groundwater monitoring programme.

5.1.3 Surface Water

The surface water and hydrological impact assessment was conducted by SRK Consulting Considering the information already available, the scope of work has been defined as:

a. Describe all the surface water impacts and then propose mitigation measures as normally required for and EIA/EMP This will be done for the construction, operational, decommissioning and closure phases;
b. A Storm Water Management Plan (SWMP) as prescribed by the Best Practice Guideline G1: Storm Water Management by DWAF, 2006. All recommendations to be in line with Regulation 704 of the NWA, 1998 and to include the following:
    - Catchment characteristics i.e. catchment boundaries (clean and dirty water), rainfall, water bodies (pans, dams, etc.), slope and drainage directions;
    - Determine the impact of all water retention infrastructure (dirty water dams associated with the ash dump) on the Mean Annual Runoff (MAR) by simulating the life of the development over the affected streams;
    - Determine the storm water flows and volumes (1:50 & 1:100 year recurrence intervals) for both the dirty and clean water areas together with the infrastructure

engineer. For storm water containment purposes the volumes for longer storm durations (24 hours) should also be determined;

- Flood lines on all river sections that might be affected by or is in close proximity to Power Plant activities (100 m).

5.1.3.1 Findings

Status Quo

- Zero liquid effluent discharge: Eskom's Kusile Power Station has implemented a zero liquid effluent discharge philosophy at the Kusile Power Station to ensure that water management is optimised.
- Minimising seepage losses: The engineering of the ash/gypsum co-disposal facility and its associated infrastructure lining for all dirty water is designed to reduce seepage losses and reduce risks on the receiving water environment.
- Segregation of clean and dirty water systems: In accordance with the principles of Regulation 704 of the Water Act, clean storm water will be diverted around the footprint area of ash/gypsum co-disposal facility and the impacted storm water within the footprint area of ash/gypsum co-disposal facility will be contained and reutilised through the ADDD and SDD.
- Existing Pollution Control System: The existing pollution control system consisting mainly of the Dirty Dams which are not yet in operation.
- Catchment Delineation and Classification: The study area lies approximately 35km east south east of Witbank, situated in Quaternary Catchment B20F, which has a MAP of 661 mm and MAR of 16.7 mm.
- More than half of sub-catchments are classified as dirty. This is mainly due to the construction of the dirty water dams, ash/gypsum co-disposal facility and the haul roads.
    - There is some mining activity in the area which contributes to the moderately dirty and dirty catchments. The most prominent coal mine is found to the south east of the power station.
    - A quarry is situated to the north-east corner of the power station.
    - The ash/gypsum co-disposal facility will be built to the south of the power station, which contributes to the dirtying of a few of the catchment areas.
    - All the areas in direct contact with the power plant were also classified as dirty
- Only two catchments were classified as moderately dirty.

  - The moderately dirty catchment areas have a haul road which will be used to transport coal.
- The defined clean sub-catchments consist of the following areas:
  - Natural vegetation and farm land lies mostly to the south, west and north of the power station.
  - To the south east lies farmland with what appears to be a clean dam on the border of the catchment area.
- The surface water quality at Kusile is generally of good quality with the variables ranging within the ideal and Marginal/No Health effect in terms of the Drinking Water Guidelines. The only exception is that of turbidity, which is mostly within the unacceptable range. This is attributed to the construction activities at the power stations. The macro-constituents are within the ideal and marginal/ no health effects range except for two sites where calcium is within the marginal to no health effects range and unacceptable level. Insufficient sampling of the other micro constituents was done over the sampling period, making it impossible to make meaningful conclusions in terms of trends. The water quality measured to date indicates that the water user requirements are being met and only Aluminium and Manganese showing elevated levels and falling within the unacceptable level for domestic water use. It is assumed that the higher levels are normal background levels since no activity as yet has taken place which could have increased these values.
- The floodline determination study showed that the existing development and infrastructure is not affected by the 1:50 year and 1:100 year floodlines and the diverted channel running on the south eastern and south western sides of the coal stock yard can handle the 1:50 year and 1:100 year flood events.

The following impacts and mitigation measures were identified:

Construction Phase

- Increase in turbidity of surface water during construction caused by an increase in runoff from the cleared and stripped areas or from topsoil stockpiles which is high in suspended solids (Aluminium, Manganese, and Iron).
- Accidental spillages of hazardous substances from construction vehicles used during the site clearing and grubbing.

- Reduction of catchment yield as a result of the footprint areas of the dirty water dams and the ash/gypsum co-disposal facility. The footprint areas will no longer form part of the natural downstream catchment thereby potentially resulting in a decrease of runoff downstream.
- Increase of surface runoff and potentially contaminated water that needs to be maintained in the areas where site clearing and grubbing occur.
- Excess storage of rainfall within the dirty water dams and settling tanks during the construction phase.
- Failure to properly separate the clean water runoff upstream of the dirty water dams and settling tanks.

Operation Phase

- Spillages from the dirty dams and wastewater treatment plant.
- Inadequate removal of silt will result in a steady decrease in the storage capacity of the SDD ST.
- Maintenance of upstream clean water controls.
- Increase in volume of contaminated water that needs to be managed on the Kusile Power Station footprint.

Closure Phase

- Seepage of water out of the ash/gypsum co-disposal facility into the environment.
- Accidental spillages of hazardous substances from decommissioning vehicles used during the closure phase of the power station.

Mitigation Measures

Construction Phase

- The runoff from the upstream clean water catchment is to be diverted away from the dirty water dams and co-disposal disposal facility. Temporary surface water ditches should be constructed on the upstream boundary of the ash/gypsum co-disposal facility, which will meet regulation 704 requirements regarding the separation of clean and dirty water runoff. All clean water runoff will therefore be diverted away from the cleared area.

- Management measures regarding the maintenance of all Power Plant vehicles must be undertaken. This will ensure that any spillages or leakages of fuel and oil are reduced.
- The loss of catchment area as a result of the dirty water dams and the ash/gypsum co-disposal facility and other associated infrastructure cannot be fully mitigated. The impact was mitigated by reducing the size of the co-disposal facility from 1 000 ha to 250 ha.
- Within the cleared area along the downstream boundary of the ash/gypsum co-disposal facility, temporary ditches are to be constructed along with temporary excavated storage areas. All dirty water runoff will then be captured and contained within the temporary storage facility.
- Based on Reg 704 requirements regarding stormwater management it is noted that all clean and dirty water must be separated. Therefore clean water emanating from upstream of the dirty water dams and settling tanks will be diverted away and discharged to the nearby watercourse or environment. The clean water diversion will be sized to accommodate the 1:50 year storm event and the dirty water dams will also have a minimum freeboard from spillway to crest of 0.8 m as per Reg 704 requirements.

Operation Phase

- A monitoring program for structural maintenance of the dirty dams and wastewater treatment plant must be developed and maintenance on leakages or spills should be carried out immediately.
- The SDD ST will consist of two equal capacity concrete basins that clarify contaminated water from the power station terrace before it travels by gravity pipeline to the SDD. The two compartments will allow for occasional maintenance and inspection access (preferably during the dry season) without interrupting the functionality of the SDD ST under normal circumstances.
- Upstream clean water controls should be maintained regularly by site monitoring, to ensure no blockages by vegetation or debris occur. Also to ensure berm walls that has collapsed or have been damaged be repaired
- A stormwater management maintenance program should be maintained regularly to ensure that the stormwater system is functioning sufficiently.

- Water upstream of the dirty water dams and settling tanks is considered clean and will have to be separated from the dirty water area. Dirty water Spillages from the dirty water dams and settling tanks into the environment must be managed.

Closure Phase

- A monitoring program of ground and surface water must continue to be implemented and maintenance on any seepage must be carried out immediately if detected.
- Management measures regarding the maintenance of all power plant vehicles must be undertaken. This will ensure that any spillages or leakages of fuel and oil are reduced.

Many of the water related environmental impacts are considered to be of moderate significance, in the absence of appropriate mitigation measures. There is the risk of spillage of ash and gypsum into the surface water system both from the ash/gypsum co-disposal facility itself and from the dirty water dams and wastewater treatment plant. These risks can be significantly reduced if the mitigation measures are applied.

Of concern is the increase in turbidity and suspended solids in the surface water. The mitigation measures will need to be implemented immediately during the current construction phase and managed during operation to maintain acceptable water quality levels.

It is expected that consideration will also be given to the on-going updates to the National Waste Management Strategy including the Waste Classification Regulations, Waste Information System Regulations and National Standard for Leach Tests and Screening Values for Risk Profiling of Waste and Standard for the Disposal of Waste to Solid waste management services.

5.1.4 Terrestrial Ecology

The terrestrial ecological assessment was conducted by MDA Environmental Consultants. The aim of the study was to provide a description of the current situation on the sites proposed for the ash/gypsum co-disposal facility and associated dams, the K3 site and spoil area.

The study entailed an assessment of the environment and vegetation with special

emphasis on the possible presence of Red Data species on the site earmarked for the proposed development. In general, the assessment included the following:

- Identification and description of ecologically sensitive areas.
- Identification problem areas in need of special treatment or management e.g. bush encroachment, erosion, degraded areas, reclamation areas.
- Making recommendations on aspects that should be monitored during development.

5.1.4.1 Findings

The findings from the study are summarised as follows:

- Three plant communities (*Eragrostis curvula – Themeda triandra* community, *Hyparrhenia hirta – Cynodon dactylon* degraded fallow land community and *Acacia mearnsii – Tagetes minuta* alien invasive plant community) occur on the site that has been earmarked for development.
- No Red Data species or protected species were found in any of these communities.
- The animal species present on site are also common species. It is expected that these animals will move away from the site when construction commences.
- Should the development be undertaken at the study area, the vegetation of the footprint area of the proposed development will be destroyed along with its specific species richness. The footprint of the proposed development is extensive but is mostly limited to the already degraded grassland communities.

The risks identified for the construction and operational phases were:

- Construction Phase
  - Destruction of natural vegetation;
  - Migration of animals away from site;
  - Vegetation loss due to the removal of vegetation cover and soil disturbance may cause erosion damage; and
  - Alien plants that colonise disturbed areas.
- Operational Phase
  - Loss of vegetation due to contamination of the soil downwind from the waste dump due to dust pollution;
  - Loss of vegetation due to contamination of the soil due to ash and gypsum spillage;

- Erosion damage due to soil disturbance and poor vegetation cover;
- Alien plants that colonise disturbed areas;
- Decline in the biodiversity of the surrounding vegetation due to wind deposition of ash and gypsum; and
- Negative effect on crop production and the palatability of grazing due to wind deposition of ash and gypsum on plants.

5.1.4.2 Mitigation Measures

To reduce the predicted emissions, the following recommendations were provided as a minimum:

- Spillage of ash and gypsum between the Kusile Power Station and the ash/gypsum co-disposal facility must be prevented.
- Dust suppression measures must always be applied to prevent dust pollution.
- The lining of the ash/gypsum co-disposal facility and dirty water dams must be tested for leaks before the deposition of the first ash takes place.
- Care must be taken not to rupture the lining during the construction and operational phases.
- Areas must be regularly monitored for alien plants that could colonise the topsoil cover of the ash/gypsum co-disposal facility.
- The ash/gypsum co-disposal facility must be regularly monitored for erosion damage of the topsoil cover.

The impact on these plant communities can be regarded as relatively small in terms of the regional context and the plant communities have a relatively low biodiversity conservation importance in a local, regional or national context.

The assessed environmental risks can be minimised if the proposed mitigation measures are implemented during the construction and operational phase of the proposed project. Construction workers should be trained in the prevention (including mitigation measures) of any environmental impacts associated with the project.

5.1.5 Aquatic Ecology

The aquatic ecological assessment was conducted by Golder Associates Africa (Pty) Ltd (Golder). The main aim of the study was to conduct an aquatic baseline assessment and

impact assessment for the proposed Kusile ash disposal facility and associated activities.

The assessment conducted in August/September 2013 aimed to quantify the potential impacts emanating from the proposed project on the biotic ecosystem in the Klipfonteinspruit and adjoining tributaries of the Wilge River, and to further identify potential problems and recommend suitable mitigation measures. The aquatic monitoring sites are shown in **Figure 5-2**.

5.1.5.1 Findings

As assessment of the *in situ* water quality illustrated that the Dissolved Oxygen (DO) concentration and percentage saturation was a limiting factor of aquatic biodiversity at certain sites. Both of these parameters were below the TWQR guidelines at sites TRI1 and KUS15. Low DO concentrations may be attributed to the large amount of decaying organic matter on the stream beds and limited flow conditions at the time of the survey. The remainder of the *in situ* water quality parameters were within the guideline values and thus not considered to be limiting factors to the aquatic ecosystem.

Habitat availability was a limiting factor of aquatic macroinvertebrate diversity at all sites except KUS4 and KUS9. The limited habitat availability was due to the absence of the stones biotope.

Based on the aquatic macroinvertebrate assessment biotic integrity in the project area ranged from slightly to critically modified (Class B to F) and comprised primarily of tolerant taxa. This was primarily attributed to limited habitat availability and low flow conditions.

An assessment of the ichthyofauna within the study area showed that the fish species diversity in the Klipfonteinspruit and adjoining tributaries was low. Based on the fish results biotic integrity in the project area ranged from largely to critically modified. The low biotic integrity was primarily attributed to limited habitat availability and low flow conditions. No fish species were recorded at sites KUS7, KUS8 and TRI1.

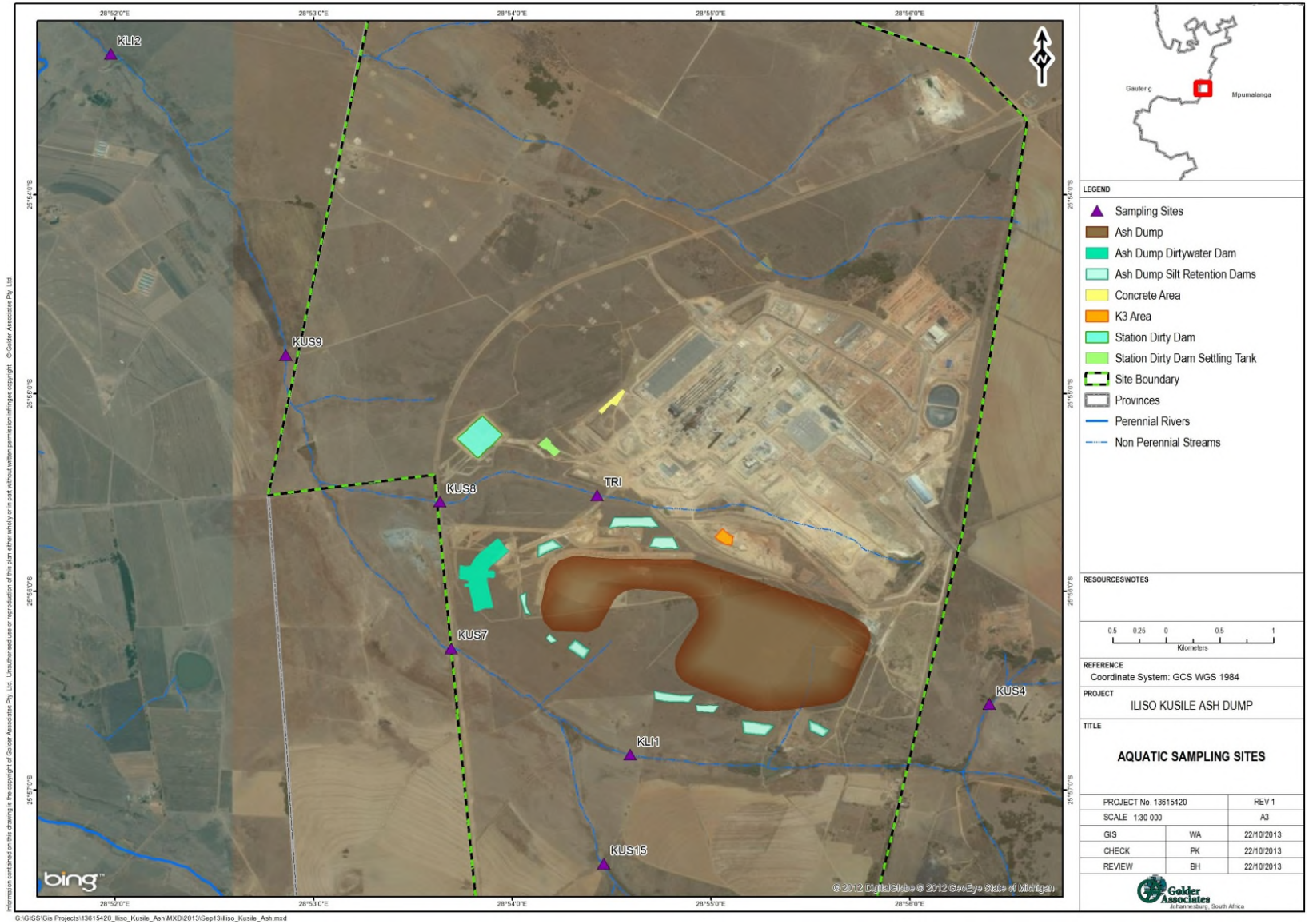

Figure 5-2: Map of aquatic monitoring sites

Based on the risk assessment the following potential impacts on aquatic ecosystems were identified:

- Degradation of aquatic ecosystems due to increased sedimentation;
- Change to natural flow regime; and
- Loss of indigenous species and biodiversity due to declines in water quality and habitats.

The majority of the identified impacts were rated as low, should mitigation measures be implemented. Although their severity was primarily high, the probability of the impacts taking place was low, duration was short term over a regional scale. However, should mitigation measures not be implemented, the significance of the impacts would be moderate. The only impact rated high prior to mitigation measures was degradation of aquatic ecosystems due to increased sedimentation. The high significance will be as a result of no adequate sediment control measures installed into the aquatic systems in order to evade large sediment plumes migrating downstream from the project site. However, the significance of this impact will be reduced to moderate, following the implementation of mitigation measures.

The study determined that in addition to the site specific impacts, there are cumulative impacts expected as a result of the existing construction footprint of the Kusile Power Station, surrounding agricultural activities, industrial activities (waste rock crushing plant), and surrounding mining activities, all contribute to the cumulative impacts on the receiving environment.

It was recommended that appropriate mitigation measures concerning the aquatic environment should be implemented during both the construction and operational phase of the project. The following were recommended for the proposed project:

- Silt traps should be placed down-slope of where vegetation stripping will take place to minimise siltation in rivers and wetlands. These silt traps need to be regularly maintained to ensure effective drainage;
- The runoff should be routinely monitored for acidity/alkalinity and TDS as an early warning for potential increases in discharge water. The water in these pollution control dams should be reused at the Kusile Power Station if possible; and

- Water quality and biotic integrity should be routinely monitored in the Klipfonteinspruit and adjoining tributaries of the Wilge Rivers to assess and quantify the potential impact on the receiving environment.

5.2 QUANTITATIVE IMPACT ASSESSMENT

A quantitative risk assessment methodology was used for the risk assessment. This method makes use of the basic risk assessment approach of deriving an expression for risk from the product of likelihood (probability) and consequences.

The risk assessment entailed the quantification of the risks associated with the project. The potential significance of potential environmental risks identified was determined using the significance rating as described below. The terminology has been taken from the Guideline Documentation on EIA Regulations as follows:

- Severity / magnitude;
- Reversibility;
- Duration of impact; and
- Spatial extent.

Consequence and probability ranking

Severity / magnitude (S)	**Reversibility (R)**	**Duration (D)**	**Spatial extent (E)**	**Probability (P)**
5 – Very high / don't know	1 – Reversible (regenerates naturally)	5 – Permanent	5 – International	5 – Definite / don't know
4 – High		4 – Long term (impact ceases after operational life)	4 – National	4 – High probability
3 – Moderate	3 – Recoverable (needs human input)	3 – Medium term (5 – 15 years)	3 – Regional	3 – Medium probability
2 – Low		2 – Short term (0 – 5 years)	2 – Local	2 – Low probability-negligible
1 – Minor	5 – Irreversible	1 - Immediate	1 – Site only	1 – Improbable
0 - None				0 - None

The maximum value which can be obtained is 100 significance points. The risks will be rated as High, Moderate or Low significance by combining the consequence of the impact and the probability of occurrence:

Consequence = severity + reversibility + duration + spatial scale

Consequence X Probability = Significance

- More than 60 significance points indicate **High** environmental significance;
- Between 30 and 60 significance points indicate **Moderate** environmental significance;
- Less than 30 significance points indicate **Low** environmental significance.

The abovementioned criteria were used to generate likelihood (probability) and consequence for the construction and operation phases of the project. The identified impacts and their rating are presented in the table below.

5.3 QUANTITATIVE RISK ASSESSMENT RESULTS

5.3.1 Construction Phase

	Risk	Rating Before Mitigation Measures							Rating After Mitigation Measures						
		S	R	D	E	C	P	Significance =C*P	S	R	D	E	C	P	Significance =C*P
SURFACE WATER	Increase in turbidity of surface water during construction caused by an increase in runoff from the cleared and stripped areas or from topsoil stockpiles which is high in suspended solids (Aluminium and Iron).	4	3	4	3	14	4	56 - Moderate	3	3	4	2	12	3	36 - Moderate
	Accidental spillages of hazardous substances from construction vehicles used during the site clearing and grubbing.	4	3	3	2	12	3	36 - Moderate	3	3	2	1	9	2	18 – Low
	Reduction of catchment yield as a result of the footprint areas of the dirty water dams and the Ash/gypsum co-disposal facility Disposal Facility and associated infrastructure. The footprint areas will no longer form part of the natural downstream catchment thereby potentially resulting in a decrease of runoff downstream	3	3	4	3	13	5	65 - High	3	3	4	3	13	5	65 - High
	Increase of surface runoff and potentially contaminated water that needs to be maintained in the areas where site clearing and grubbing occur.	4	3	4	3	14	4	56 - Moderate	3	3	4	2	12	3	36 - Moderate
	Excess storage of rainfall within the dirty water dams and settling tanks during the construction phase.	2	3	2	1	8	2	16 - Low	1	3	1	1	6	2	12 - Low
	Separation of clean water runoff upstream of the dirty water dams and settling tanks. Water upstream of the dirty water dams and settling tanks is considered clean and will have to be separated from the dirty water area. Dirty water Spillages from the dirty water dams and settling tanks into the environment must be managed.	4	3	4	3	14	4	56 - Moderate	3	3	4	2	12	3	36 - Moderate
TERESTRIAL ECOLOGY	Destruction of natural vegetation	4	5	5	1	15	4	60- Moderate	4	5	5	1	15	4	60- Moderate

	Risk	Rating Before Mitigation Measures							Rating After Mitigation Measures						
		S	R	D	E	C	P	Significance =C*P	S	R	D	E	C	P	Significance =C*P
	Migration of animals away from site	4	5	5	1	15	4	60- Moderate	4	5	5	1	15	4	60- Moderate
	Vegetation loss due to the removal of vegetation cover and soil disturbance may cause erosion damage	2	1	1	1	5	3	15-Low	1	1	1	1	4	3	12-Low
	Alien plants that colonise disturbed areas	2	1	1	1	5	3	15-Low	1	1	1	1	4	3	12-Low
AQUATIC ECOLOGY	Degradation of aquatic ecosystems due to increased sedimentation	5	3	2	4	14	5	70-High	0	1	1	1	3	1	10-Low
	Change to natural flow regime	2	1	2	2	7	2	14-Low	4	3	1	2	10	1	3-Low
AIR QUALITY	Dust deposition	3	1	2	2	8	4	32-Moderate	2	1	2	1	6	3	18-Low
	PM_{10}	4	1	2	2	9	4	36-Moderate	2	1	2	1	6	3	18-Low
	$PM_{2.5}$	4	1	2	2	9	4	36-Moderate	2	1	2	1	6	3	18-Low
GROUNDWATER	Hydrocarbon contamination associated with heavy machinery on site	3	3	3	2	11	3	33-Moderate	3	3	3	2	11	2	22-Low

5.3.2 Operational Phase

	Risk	Rating Before Mitigation Measures							Rating After Mitigation Measures						
		S	R	D	E	C	P	Significance =C*P	S	R	D	E	C	P	Significance =C*P
SURFACE WATER	Spillages from the dirty dams and wastewater treatment plant.	4	3	4	3	14	3	42 - Moderate	3	3	2	1	9	2	18 - Low
	Inadequate removal of silt will result in a steady decrease in the storage capacity of the SDD ST.	2	3	1	2	8	3	24 - Low	1	3	1	1	6	2	12 – Low
	Maintenance of upstream clean water controls.	4	3	2	2	11	3	33 - Moderate	2	3	2	1	8	2	16 - Low

	Risk	Rating Before Mitigation Measures							Rating After Mitigation Measures						
		S	R	D	E	C	P	Significance =C*P	S	R	D	E	C	P	Significance =C*P
	Increase in volume of contaminated water that needs to be managed on the Kusile Power Station footprint.	4	3	4	3	14	3	42 - Moderate	3	3	2	1	9	2	18 - Low
TERRESTRIAL ECOLOGY	Loss of vegetation due to contamination of the soil downwind from the waste dump due to dust pollution	3	5	3	1	12	1	12-Low	3	5	3	1	12	1	12-Low
	Loss of vegetation due to contamination of the soil due to ash and gypsum spillage	3	5	3	1	12	1	12-Low	3	5	3	1	12	1	12-Low
	Erosion damage due to soil disturbance and poor vegetation cover	3	1	2	1	7	4	28-Low	1	1	1	1	4	4	16-Low
	Alien plants that colonise disturbed areas	2	1	1	2	6	3	18-Low	1	1	1	1	4	3	12-Low
	Decline in the biodiversity of the surrounding vegetation due to wind deposition of ash and gypsum	1	1	1	2	5	3	15-Low	1	1	1	1	4	3	12-Low
	Negative effect on crop production and the palatability of grazing due to wind deposition of ash and gypsum on plants	1	1	1	2	5	3	15-Low	1	1	1	1	4	3	12-Low
AQUATIC ECOLOGY	Change to natural flow regime	0	1	1	1	3	2	6-Low	0	1	1	1	3	1	3-Low
	Loss of indigenous species and biodiversity due to declines in water quality and habitats	5	5	2	3	15	2	30-Moderate	4	3	1	2	10	1	10-Low
AIR QUALITY	Dust deposition	3	1	4	2	10	4	40-Moderate	2	1	4	1	8	3	24-Low
	PM_{10}	4	1	4	2	11	4	44-Moderate	2	1	4	1	8	3	24-Low
	$PM_{2.5}$	4	1	4	2	11	4	44-Moderate	2	1	4	1	8	3	24-Low
	Cancer Risk	1	1	4	2	8	4	32-Low	1	1	4	1	7	3	21-Low
GROUNDWATER	Poor quality artificial recharge from the ash gypsum ash/gypsum co-disposal facility	4	3	4	2	13	4	52-Moderate	3	3	4	2	12	3	36-Moderate

	Risk	Rating Before Mitigation Measures							Rating After Mitigation Measures						
		S	R	D	E	C	P	Significance =C*P	S	R	D	E	C	P	Significance =C*P
	Artificial recharge to groundwater	3	3	4	2	12	4	48-Moderate	2	3	4	2	11	3	33-Moderate
	Poor quality water emanating from the Flue Gas Desulphurisation Wastewater Treatment Plant	4	3	4	1	12	4	48-Moderate	2	3	4	1	10	3	30-Moderate

5.3.3 Closure Phase

Risk	Rating Before Mitigation Measures							Rating After Mitigation Measures						
	S	R	D	E	C	P	Significance =C*P	S	R	D	E	C	P	Significance =C*P
Seepage of water out of the Ash/gypsum co-disposal facility into the environment.	4	3	4	3	14	3	42 - Moderate	3	3	2	1	9	2	18 - Low
Accidental spillages of hazardous substances from decommissioning vehicles used during the closure phase of the power station.	4	3	3	2	12	3	36 - Moderate	3	3	2	1	9	2	18 – Low

6. LEGISLATION, DEVELOPMENT STRATEGIES AND GUIDELINES

On compiling this EMPr, the following legislation and guidelines/policies were taken into consideration:

- The National Environmental Management Act, 1998 (Act 107 of 1998);
- The National Environmental Management: Waste Act, 1998 (Act 107 of 1998);
- The National Water Act, 1998 (Act No 36 of 1998);
- The National Ambient Air Quality Standard;
- The National Forests Act, of 1998 (Act 84 of 1998);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004); and
- The National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) and its Regulations.

7. ENVIRONMENTAL IMPACT MANAGEMENT

The ash/gypsum co-disposal facility and associated dams project will go through a life cycle consisting of construction, operation and decommissioning/closure. Certain unique, project-specific construction and operational activities, with identifiable environmental impacts, will be undertaken. These activities, their impacts and the management actions required to implement the recommended mitigation measures are dealt with in some detail in the sub-sections below.

7.1 CONSTRUCTION PHASE

The management of environmental issues during the construction phase are dealt with through specific management and mitigation plans for each identified environmental component. The construction activities involved are described in **Section 3** of this EMPr. The expected impacts for the construction phase include impacts on:

- Groundwater;
- Surface Water;
- Air Quality;
- Terrestrial Ecology (Flora, Avi-fauna and Fauna); and
- Aquatic Ecology.

7.1.1 General

Construction can be a noise and dust producing activity which may cause a nuisance to people living in the vicinity. Kusile has an existing EMPr for the whole power station and a Wetland Management Plan (WMP) that was developed in 2013. The mitigation measures for these general impacts were included in the existing EMPr and should be applied to the construction of the ash/gypsum co-disposal facility and associated dams, including, but not limited to:

- Environmental awareness training must be provided before commencement of construction activities for all contractors and workers.
- A maximum impact footprint must be appropriately delineated and sign posted before construction commences.
- Sensitive areas outside the impact footprint must be clearly demarcated and sign posted as “No Go” areas.
- Existing construction camps shall be used and these must be recovered and removed shortly after construction has been completed. The construction must be located outside of the 100 year floodline as shown in the Flood Delineation Report (**Appendix H** of the EIR).

- All machinery and equipment must be kept in good working order.
- Existing access roads authorised by the DEA shall be used during construction.

Provision of sanitation facilities

- The Contractor shall provide the necessary ablution facilities at the project area for his employees:
  - ❖ Sufficient ablution facilities shall be provided to service the construction site (this must not exceed 20 users per one toilet),
  - ❖ The maximum walking distance from a work site to a toilet shall not exceed 50 metres,
  - ❖ Ablution facilities shall not be placed within 100 m of the rivers and wetlands or boreholes used for drinking water for human or animal consumption,
  - ❖ Ablution facilities shall be serviced on a regular basis by an approved service provider to keep them in good, functional working order and in an acceptable state of hygiene,
  - ❖ Contents from the chemical toilets shall not be discharged to into the environment but shall be removed by an approved service provider to the nearest Waste Water Treatment Works,
  - ❖ The necessary agreement between the Service Provider and the Contractor for the removal of the sewage must be in place and shall be made available on request, and
  - ❖ The necessary agreement between the Service Provider and the WWTW for the disposal of the sewage must be made available on request.

Housekeeping

- The area required for the Contractor's camp/laydown shall be kept to the minimum;
- Laydown areas and construction camps shall be established outside the 1 in 100 year floodlines as shown in the Floodline Determination Report;
- Sufficient areas shall be provided for the washing of vehicles;
- No washing of vehicles shall be allowed outside demarcated areas. Washing bays for vehicles and other equipment shall be provided with appropriate soak aways, will be clearly demarcated and will not be allowed to contaminate any surface runoff;
- Refuelling of vehicles will only be allowed in designated areas;
- All construction equipment shall be parked in a demarcated area. Drip trays shall be used when equipment is not used for some time;

- Designated eating areas shall be provided for employees;
- A sufficient number of waste bins with the appropriate lids will be provided to prevent any littering;
- The employees will be made aware through awareness training on how to appropriately dispose of waste;
- No accommodation for construction workers will be provided at the construction camp;
- Designated smoking areas will be provided;
- No open flames will be allowed;
- No pets will be allowed;
- No alcohol will be allowed;
- All personnel must adhere to the relevant speed limits;
- The construction camp must have the necessary security measures implemented to ensure the safety and security of workers, materials, and surrounding communities;
- The security of the surrounding communities shall not be compromised by the construction activities in any way; and
- All temporary structures must be removed after construction and the impacted areas must be rehabilitated.

7.1.2 Air Quality

The construction of the co-disposal facility will give rise to the generation of dust and emissions of exhaust gases from construction vehicles. It is expected that the exhaust emissions from the construction vehicles will make a negligible contribution to the ambient air quality. The air quality specialist quantified the impact of construction activities to be of *moderate* significance in terms of dust deposition and PM. The following mitigation measures will be implemented to reduce the significance of the impact to *low*.

- Monitoring of Particulate Matter (PM) concentrations and dust deposition rates. Dust monitoring at Kusile commenced with the start of the construction activities around the power station. PM monitoring equipment was set up at points on the site closest to the nearest residential area. To date the monitoring of PM at Kusile shows compliance with the requirements of the National Ambient Air Quality Standard (NAAQS). The monitoring of PM must continue to ensure continued compliance with the NAAQS as follows:

Substance	Molecular formula / notation	Averaging period	Concentration limit (µg/m^3)	Frequency of exceedance[a]	Compliance date[b]
Particulate matter	PM_{10}	24 hour	120	4	Immediate – 31 Dec 2014
			75	4	1 Jan 2015
		1 year	50	0	Immediate – 31 Dec 2014
			40	0	1 Jan 2015
Particulate matter	$PM_{2.5}$	24 hour	65	4	Immediate – 31 Dec 2015
			40	4	1 Jan 2016 – 31 Dec 2029
			25	4	1 Jan 2030
		1 year	25	0	Immediate – 31 Dec 2015
			20	0	1 Jan 2016 – 31 Dec 2029
			15	0	1 Jan 2030

- The contractor will apply water sprays to suppress dust on dry, windy days. A lack of visible dust clouds drifting on and off site would be a good indication of successful dust suppression.
- The contractor will maintain dust suppression by water spraying on stockpiled topsoil (if any) until grass cover has been established.
- The contractor shall apply water sprays to suppress dust on dry, windy days. If water availability is a constraint, windbreaks of shade cloth will be erected around dusty areas of operation.
- Stockpiled topsoil will be moistened with water sprays during reclamation at the end of the construction phase.
- The contractor will maintain all construction vehicles in good working order to keep their atmospheric emissions under control and will enforce vehicle speed limits to reduce particulate mobilisation by entrainment.

7.1.3 Groundwater

The construction activities will have the potential to contaminate the soil, and hence the groundwater, with fuels, lubricants and hydraulic fluids from the machinery and from cement during the construction of the infrastructure. According to the groundwater specialist studies, without mitigation, the significance of the impact could be *moderate*. Diligent implementation of the following recommended mitigation measures is expected to reduce it to *low:*

- All hazardous substances or possible pollutants such as hydrocarbons shall be stored at an approved site or in sealed areas on site to prevent surface water pollution in accordance with SANS Standard.

- Vehicles shall be parked on impermeable surfaces, to prevent the absorption of leaked hydrocarbons in to the soil profile, and stormwater from these areas channelled away from water courses
- Drip trays will be placed under parked vehicles.
- Spills will be cleaned up immediately.
- Contaminated soil will be excavated immediately, followed by proper disposal at a licensed site.
- Groundwater monitoring shall be conducted as described in **Section 8** of this EMPr.

7.1.4 Surface Water Resources

The soil and hence the surface water runoff could potentially become contaminated with fuels, lubricants and hydraulic fluids from the vehicles and machinery used in during construction. Without mitigation, the significance of the impact is classified as *moderate*.

- Contaminated soil shall be removed and disposed of to an appropriate licensed landfill site in terms of NEMWA, or can be removed by a service provider that is qualified to clean the soil.
- All hazardous substances or possible pollutants such as hydrocarbons shall be stored at an approved bunded site or in sealed areas on site to prevent surface water pollution in accordance with SANS Standard.
- Vehicles should be parked on impermeable surfaces, to prevent the absorption of leaked hydrocarbons in to the soil profile, and stormwater from these areas channelled away from water courses.
- Storage areas for fuels, lubricants, diesel, oil, hydraulic fluids and grease shall be bunded with cement in a manner that will contain any spillage and will allow for reclamation without causing ground and surface water pollution.
- Drip trays will be placed under parked vehicles.
- Spills will be cleaned up immediately.
- Stormwater must be diverted into vegetated buffer zones and not directly into surface water. Concentrated flow must be prevented and velocities may not exceed 0.5 m/s.
- Low level berms and sediment traps should be used in low points. This will contain the extent of erosion and deposition reducing the scale of the impacts to the site itself as follows:

Track Slope	Berm Placement
<2 %	Every 50 m
2%-10%	Every 25 m
10 -15 %	Every 20 m
>15 %	Every 10 m

- Silt/sediment shall be cleared before removing the sediment traps after construction has been completed.
- Contours shall also be used where necessary to prevent water from flowing away and maximising ingress.
- Back filled trenches shall be restored to the same soil texture and compaction as neighbouring soils.
- The ash/gypsum co-disposal facility may not be extended to encroach into the Klipfontein wetland system.
- Wetland soils must be preserved, soils and subsoils shall be moved only twice, once to get it off the line of the trench and a second time to replace it.
- Contaminated stormwater must be contained and returned into the process circuit.
- The runoff from the upstream clean water catchment must be diverted away from dirty water dams and the ash/gypsum co-disposal facility.
- During construction, the Contractor must ensure that storage, washing and maintenance of equipment and machinery is undertaken outside the 1:100 year floodline and/or delineated riparian habitat, whichever is greatest or within a 500 m radius from the boundary of a wetland, except for activities authorised by the DWS and only in demarcated areas where runoff and spills are managed in an environmentally sound manner.
- Litter shall be disposed of in appropriate waste disposal bins.
- Topsoil must be removed and stockpiled within specified areas and must be outside water resources.
- Spill kits and drip trays shall be made available at point of use.
- Temporary ditches must be constructed along with temporary excavated storage areas, within the cleared area along the downstream boundary of ash/gypsum co-disposal facility to ensure that all the dirty water runoff is captured and contained within the temporary storage facility. All clean water runoff will therefore be diverted away from the cleared area.
- Sanitation and waste management facilities must be located outside of the extent of a watercourse and must be managed in an environmentally sound manner.

- Construction materials must be stored outside the extent of any wetland and/or watercourse and transported and prepared/handled in an environmentally sound manner, in compliance with relevant legislation.
- Discharges into wetlands must be prevented and stockpiles must be protected from erosion.
- Storm water discharge points must be fitted with energy dissipaters to slow down the high velocity water discharged into water resources.
- An emergency plan (i.e. measures for prevention, detection, management and reporting) dealing with accidental spills and leaks in compliance with relevant legislation and regulations shall be adhered to.
- All pollution incidents shall be handled in terms of Section 19 (1) of the National Water Act, 1996 (Act 36 of 1998). Pollution incidents shall be reported to the DWS Bronkhorstspruit Regional Office within 24 hours of occurring.
- All clean and dirty water must be separated. The clean water emanating from upstream of the dirty water dams and settling tanks will be diverted away and discharged to the nearby watercourse or environment. The clean water diversion will be sized to accommodate the 1:50 year storm event. The dirty water dams will also have a minimum freeboard from spillway to crest of 0.8 m.
- Stormwater must be diverted from construction works and managed in such a way as to disperse runoff and to prevent the concentration of stormwater flow.
- All run-off should be contained in a settling dam before being discharged to a drainage line. No water can be discharged directly into drainage lines.
- All contaminated materials will be disposed of at permitted waste disposal facilities.
- Water quality monitoring must be conducted as stipulated in **Section 8** of this document.

The implementation of these mitigation measures is expected to reduce the significance of the assessed impact to *low*.

7.1.5 Terrestrial Ecology (Flora and Fauna)

The ecological assessment conducted showed that construction activities will result in vegetation loss due to the removal of vegetation cover, soil disturbance which may cause erosion damage, migration of animals away from the site and colonisation of the area by alien invasive plant species. Without mitigation measures, the significance of the impacts was deemed to be *moderate* and low significance.

- Existing indigenous vegetation must be retained where possible and only vegetation within the construction servitude must be removed.
- Protection of the soils till plant germination and establishment can be afforded by the placement of Hessian mats.
- Vegetation removal must be done in stages, in order to reduce impact of construction and areas outside the construction area must not be disturbed as is standard practice at Kusile (Please refer to **Figure 7-1**).

Figure 7-1: Evidence that Contractors clear areas in stages

- Prior to removing or damaging any protected plant species, the necessary permits must be obtained in terms of the National Forests Act, of 1998 (Act 84 of 1998).
- All sites disturbed by construction activities shall be monitored for colonisation of invasive alien plant species. Ensure that weeds do not invade disturbed areas in the short term, by implementing an invasive alien species eradication programme.
- Invasive alien plant species shall be controlled by means of mechanical or chemical removal of the plants and seeds. Chemical removal shall only be undertaken by a suitably qualified and approved person.
- Mechanical methods must be favoured rather than chemical methods where possible to remove unwanted vegetation cover and trees
- Riparian zones shall be maintained and rehabilitated.

- All areas impacted during construction must be rehabilitated by seeding the area using a cocktail of indigenous grasses as follows:

Scientific name	Common name	Description	Suitability	Establishment
Eragrostis curvula	Weeping love grass	Robust, densely perennial tufted grass. Establishes easily.	Pasture, disturbed soils, good soil stabilizer	October - December
Eragrostis tef	Tef	Loose annual, sometimes dense tufted grass	Pasture, disturbed soils, good soil stabilizer	September - December
Cynodon dactylon	Couch/Bermuda grass	Short, mat-forming grass	Pasture, disturbed soils, damp soil, excellent soil stabilizer	September - February
Digitaria eriantha	Common finger grass	Perennial tufted grass	Pasture, damp soil	September - February
Panicum maximum	Guinea grass	Leafy perennial tufted grass	Pasture, damp soil	September - February
Chloris gayana	Rhodes grass	Leafy grass which spreads by means of stolons	Pasture, damp soil, good soil stabilizer	October - November, February - March

- Construction activities shall be minimised to the smallest area and to as short a time as possible.
- Disturbed areas shall be re-vegetated after the construction phase has been finalised.
- Open fires must not be allowed on site. Contained fires for heating and cooking shall be restricted to designated areas on site.
- Fire breaks around the work sites must be established and maintained and immediate action must be taken to extinguish any fire which may break out on the construction site.
- Topsoil must be stockpiled separately with the natural seed bank intact and protected against weed infestation and erosion.
- The natural vegetation must be retained, wherever possible.
- Vehicular / pedestrian access into natural areas beyond the demarcated area must be prohibited.
- A free-draining surface must be ensured at areas to be disturbed as far possible to prevent ponding of surface water.
- No smoking shall be permitted within 3 m from any fuel or chemical storage area.
- Animal species, populations and nests to be relocated must be identified. The identified animal species, populations and nests shall be relocated to areas where these will not be at risk.

- Animals shall not be relocated to areas where population stress is already evident.
- Animals shall not be hunted, snared, captured, injured or killed. The work site must be kept clean, tidy and free of waste that would attract animal pests.
- Problem animals and venomous animals shall be reported to the ECO.
- No pesticides may be used unless approved by the ECO.
- Vegetation health downwind of site shall be monitored monthly and correlated with dust fall data.

The implementation of the abovementioned mitigation will result in an impact significance of *moderate* and *low*.

7.1.6 Aquatic Ecology

The aquatic impact assessment found that the construction of the ash/gypsum co-disposal facility and associated dams would have an impact on the aquatic ecosystem through degradation of aquatic ecosystems due to increased sedimentation and changes to natural flow regime. The degradation of aquatic ecosystems was classified as an impact of *high* significance and the changes to flow regimes as an impact of *low* significance. The following mitigation measures will reduce the significance of the impact from *high* to a *low*.

- Runoff water from the ash/gypsum co-disposal facility must be channelled into pollution control dams to avoid effects on the aquatic ecosystem and natural flow regime.
- Silt traps should be placed down-slope of where vegetation stripping will take place to minimise siltation in rivers and wetlands. These silt traps need to be regularly maintained to ensure effective drainage.
- Stockpiling of removed soil must be done outside the 1:100 year floodline or riparian habitat to prevent being washed into the rivers and shall be covered to prevent wind and soil erosion.
- It is important that rehabilitation and re-vegetation of the exposed areas be undertaken on a continual basis and should not be left for the closure phase. If erosion has taken place, rehabilitation shall be implemented as soon as possible.
- Where possible, the water in the pollution control dams should be reused at the Kusile Power Station.
- The use of machinery and vehicles within in-stream/riparian habitat shall be kept to a minimum to prevent compaction of soil and vegetation.

- Noise and mechanical vibrations in the vicinity of the watercourses shall be kept to a minimum, with the noise resulting from the co-disposal facility and associated dams to be kept below 35 dB from 18:00 to 06:00 daily in the wetland areas and its buffer areas.
- The existing riparian vegetation composition shall be maintained or improved by maintaining the natural variability in flow fluctuations, ensuring that rehabilitated areas have basal cover of at least 15 % at all times.
- The runoff shall be routinely monitored for Suspended Solids and TDS as an early warning for potential increases in discharge water.
- Water quality and biotic integrity shall be routinely monitored in the Klipfonteinspruit and adjoining tributaries of the Wilge Rivers to assess and quantify the potential impact on the receiving environment.

7.1.7 Noise

The construction phase of the project will involve the use of machinery and vehicles that will generate noise. The following mitigation measures must be implemented to reduce the noise impact:

- Noise levels will be measured at the commencement of the construction activities.
- All vehicles will be properly maintained.
- Noise abatement equipment will be maintained in good condition.
- If complaints are received, the noise levels will be measured as soon as possible, the source(s) will be identified and appropriate action will be taken.

Copies of the 2006 EMPr and the 2013 WMP have been attached as **Appendix D**.

7.2 OPERATION PHASE

The co-disposal of ash/gypsum onto the co-disposal facility for the first 5 years of power station operation will be done by a load and haul operation. Ash and gypsum will be delivered by conveyor to a radial stacker near the ash dump, for subsequent loading, hauling and placement into paddocks of suggested size 200 m by 200 m, developed in 2 m lifts, spread initially over the ash dump 5-year half-footprint, to full design height on the ash/gypsum co-disposal facility, and then similarly over the second half of the footprint.

In years 5 to 55 of operation, gypsum only will be placed at significantly reduced tonnages onto the ash dump by the same, but much smaller, load and haul operation.

The ash/gypsum load and haul deposition system will enable the ash dump operators to place the ash/gypsum in such a manner as to be free draining in shape, with minimisation of any depression that will collect and retain stormwater run-off. Temporary artificial channels will be deployed on the exposed ash surfaces to lead stormwater down the faces to the dirty water collection dams in a controlled manner thereby preventing erosion.

Irrigation of the exposed ash/gypsum surfaces will take place to achieve dust control. Irrigation water volumes will be restricted as far as possible to limit any seepage potential arising from the irrigation waters.

Exposed ash/gypsum surfaces will be finally shaped at 1:5 on the side slopes and at 1:200 on the top surfaces and rehabilitated as soon as practically possible by placement of selected topsoil and vegetation cover. These areas will be irrigated to promote and sustain the vegetation. Spillages at ash transfer houses will be contained and removed in an effective manner.

Dirty stormwater run-off from the radial stacker terrace adjacent to the ash dump will be contained by perimeter ditches, and transferred to the ADDD.

It is expected that like the construction phase, the operation phase will also have an impact on:

- Groundwater;
- Surface water;
- Terrestrial Ecology;
- Air Quality; and
- Aquatic Ecology.

7.2.1 Groundwater

The groundwater impact assessment found that the operation of the ash/gypsum co-disposal facility an associated dams would have an impact on the groundwater due to artificial recharge to groundwater and the artificial recharge of poor water quality from the ash/gypsum co-disposal facility and associated dams to the groundwater. Without mitigation measures, the impacts identified were deemed to be of *moderate* significance. The following mitigation measures must be implemented to reduce the significance of the identified risks:

- The groundwater under drain system shall also be maintained in proper working order.
- Regular inspection of leachate collection and containment systems shall be conducted.
- The leachate collection and containment systems shall b regularly maintained
- Groundwater monitoring shall be conducted as detailed in **Section 8** of this EMPr. If impacts are identified, appropriate operational and engineering interventions must be devised and implemented.
- The groundwater monitoring results shalll be documented and assessed by a suitably qualified and registered hydro-geologist or environmental specialist. The groundwater monitoring report will summarise the monitoring data, provide an interpretation of the data in terms of potential impact of the ash/gypsum co-disposal facility on the local groundwater resource and provide recommendations for modifying the monitoring programme as required. Such modifications could include, but will not be limited to refining the list of variables and/or changing the frequency of monitoring.

Regular inspection and monitoring, as recommended, would make it possible to reduce the impact to one of ‘lower” *moderate* significance by early detection and the implementation of appropriate engineering interventions if and when required.

7.2.2 Surface water

The risks to surface water quality associated with the operation phases of the co-disposal facility and associated dams included spillages from the dirty dams and wastewater treatment plant, inadequate removal of silt will result in a steady decrease in the storage capacity of the SDD ST. inadequate maintenance of upstream clean water controls and an increase in the volume of contaminated water that needs to be managed on the Kusile Power Station footprint. The impacts were classified as being of low and moderate significance. The mitigation measures that must be implemented to reduce the significance of the identified risks are as follows:

- Regular maintenance and inspection of the SDD ST concrete basins that clarify contaminated water from the power station terrace before it travels by gravity pipeline to the SDD shall be conducted in a way that the functionality of the SDD ST is not interrupted.
- Upstream clean water controls shall be maintained regularly by site monitoring, to ensure no blockages by vegetation or debris occur.

- Uncontrolled releases of polluted water from the ADDD into the water resources shall not be permitted.
- During rainfall events that result in significant runoff the quality of runoff downstream of the ash/gypsum co-disposal facility site shall be monitored.
- Berm walls that have collapsed or have been damaged must be repaired immediately.
- A stormwater management maintenance program shall be maintained regularly to ensure that the stormwater management system is functioning sufficiently.
- The surface water quality monitoring programme as stipulated in **Section 8** of this document shall be implemented on a monthly basis to ensure that the operation of the co-disposal facility and associated dams is not having adverse effects on the water resources. This will also ensure that any adverse impacts on the surface water quality are detected early.

The implementation of the mitigation measures will reduce the impacts on surface water to be of *low* significance.

7.2.3 Terrestrial Ecology

According to the terrestrial ecological impact assessment, the operation phase of the co-disposal facility and associated dams is expected to result in:

- Loss of vegetation due to contamination of the soil downwind from the waste dump due to dust pollution;
- Loss of vegetation due to contamination of the soil due to ash and gypsum spillage;
- Erosion damage due to soil disturbance and poor vegetation cover;
- Colonization of the project areas by alien invasive plant species;
- Decline in the biodiversity of the surrounding vegetation due to wind deposition of ash and gypsum; and
- Negative effect on crop production and the palatability of grazing due to wind deposition of ash and gypsum on plants.

All the predicted impacts were classified as low significance. The following mitigation must be implemented to ensure that the impacts are reduced in significance.

- Invasive alien plants shall be controlled by means of mechanical or chemical removal of the plants and seeds. Chemical removal shall only be undertaken by a suitably qualified and approved person.

- Mechanical methods must be favoured rather than chemical methods where possible to remove unwanted vegetation cover and trees.
- An indigenous alternative plant cover shall be established and managed to limit re-growth and re-invasion of the unwanted plant species.
- Topsoil cover of the ash/gypsum co-disposal facility must be regularly monitored for colonisation by invasive alien plants.
- All sites disturbed by operational activities shall be monitored for colonisation of invasive alien plant species, which must be eradicated as they emerge.
- Dust suppression measures such as regular wetting of the ash/gypsum co-disposal facility must always be applied to prevent dust pollution as this will minimise the wind deposition of ash and gypsum on surrounding vegetation and crops.
- Spillage of ash and gypsum between the Kusile power plant and the ash/gypsum co-disposal facility must be prevented.
- Care must be taken not to rupture the lining during the construction and operational phases.
- Spills of any product, including fuels, oils and hydrocarbons should be cleaned up immediately by removing the spillage together with the polluted soil and by disposing it at a recognised facility
- The facility shall be regularly monitored for erosion damage of the topsoil cover.

7.2.4 Air Quality

The operation of the ash/gypsum co-disposal facility and associated dams is expected to have impacts on air quality. The study conducted showed that the impacts on air quality will be due to dust deposition and Particulate Matter ($PM_{2.5}$ and PM_{10}). Without implementing the mitigation measures, the impacts were deemed to be of *moderate* significance. The following mitigation measures will be implemented in addition to the standard operating procedures:

- Monitoring of Particulate Matter (PM) concentrations and dust deposition rates must continue to ensure continued compliance with the NAAQS as follows:

Substance	Molecular formula / notation	Averaging period	Concentration limit (µg/m^3)	Frequency of exceedance[(a)]	Compliance date[(b)]
Particulate matter	PM_{10}	24 hour	120	4	Immediate – 31 Dec 2014
			75	4	1 Jan 2015
		1 year	50	0	Immediate – 31 Dec 2014
			40	0	1 Jan 2015

Substance	Molecular formula / notation	Averaging period	Concentration limit (µg/m^3)	Frequency of exceedance[(a)]	Compliance date[(b)]
Particulate matter	$PM_{2.5}$	24 hour	65	4	Immediate – 31 Dec 2015
			40	4	1 Jan 2016 – 31 Dec 2029
			25	4	1 Jan 2030
		1 year	25	0	Immediate – 31 Dec 2015
			20	0	1 Jan 2016 – 31 Dec 2029
			15	0	1 Jan 2030

- Any paved roads around the site will be cleaned regularly by sweeping, using PM certified mechanical sweeping equipment. More frequent sweeping will be done at higher silt loading to maintain the roads in a clean condition.
- Unpaved roads will be kept in good repair and watered regularly by tanker vehicle or by fixed spraying installations. The watering frequency will be determined by the evaporation rate. Where high traffic volumes occur, chemical stabilisation of surfaces shall be considered.
- Speed limits around the site shall be enforced.
- Inactive surfaces will be covered with topsoil and vegetated as soon as possible.
- Exposed areas must be stabilised using top-soil covering. Additional mitigation of dust emissions from the top soil layer can be achieved by wetting of exposed top-soil.
- Re-vegetation of the ash/gypsum co-disposal facility through application of a deeper top-soil layer and seeding with appropriate grass seeds shall be implemented.

Implementation of the above mitigation measures is expected to reduce the PM_{10}, $PM_{2.5}$ and dust fall impacts to a level of *low* significance.

7.2.5 Aquatic Ecology

The aquatic ecological assessments determined that the impacts on the aquatic environmental during the operation phase of the ash/gypsum co-disposal facility due to loss of indigenous species and biodiversity due to declines in water quality and habitats and change to natural flow regime. Without the implementation of mitigation measures, it was determined that the impact would be of moderate and low significance.

- The lining of the ash/gypsum co-disposal facility and dirty water dams shall be tested for leaks before the deposition of the first ash/gypsum takes place.
- Runoff water from the ash/gypsum co-disposal facility shall be channelled into pollution control dams to minimise effects on the natural flow regime.
- The water in the pollution control dams shall be reused at the Kusile Power Station if possible.
- Only water from the ADDD shall be used in the wetting of the co-disposal facility.
- Silt traps should be placed down-slope of the facility to minimise siltation in rivers and wetlands.
- The silt traps must be regularly maintained to ensure effective drainage.
- The runoff should be routinely monitored for Suspended Solids and TDS as an early warning for potential increases in discharge water.
- The water in these pollution control dams shall be reused at the Kusile Power Station if possible. Water from the ADDD shall be reused at the Power Station for dust control.
- Water quality and biotic integrity should be routinely monitored in the Klipfonteinspruit and adjoining tributaries of the Wilge Rivers to assess and quantify the potential impact on the receiving environment.

7.2.6 Land use and Land Capability

The land use will remain that of operating the ash/gypsum co-disposal facility and associated dams during the operational life of the facility. Proper design and operation of the facility will ensure that the capability of the land adjacent to the facility does not deteriorate as a result of the ash/gypsum co-disposal facility and associated dams operations. However, inadequate operation and poor maintenance of the surface water management system and the leachate and contaminated water could lead to the off-site migration of contaminated surface water. This could, in turn, cause the deposition of contaminants in the soil downstream of the project site.

In the event of severe mismanagement, such events could cause sufficient off-site soil contamination to result in a diminished land capability, in which case the significance of the impact would be rated as *high*. Application of the mitigation measures set out in **Sections 7.2.1** to **7.2.5** above will reduce the significance of potential impacts on the off-site land capability to *low.*

7.2.7 Visual

According to the Visual impact Assessment that was conducted for the Kusile Power Station in 2006, the landscape around the Kusile Power Station has been disturbed by agricultural and industrial activities. Air quality is poor and characterized by smog, especially in winter. It appears that the landscape is currently in transition, moving from a traditional rural/ agricultural setting towards becoming a landscape with more industrial elements in it. Accordingly, it was believed that the landscape exhibits a moderate sensitivity with a fair tolerance for change.

The severity of the impact depends on whether the proposed activity would be screened by existing topographical features, vegetation or other structures. Added to this would be the "form" of the power station – its regularity, lines and vertical posture in the landscape.

The study found that the above ground ash/gypsum co-disposal facility would have a significant impact due to both its size and to the colour of the ash and gypsum (light grey) in the active portion of the dump, which would contrast with the surrounding natural colours.

The significance of the visual impact without mitigation is assessed as *moderate* to *high.* The visual impact of the ash/gypsum co-disposal facility shall be reduced by ongoing rehabilitation, shaping and re-vegetating of the project area. Only indigenous species will be used for re-vegetation, due to their lower water demand and their ecological value. The shrubs and trees will be irregularly spaced and clumped so as to create a more natural appearance. Shrubs will be used as undergrowth, to encourage nesting birds and create potential habitat for other small animals.

Visual inspections of the vegetation screen will be done quarterly. If areas of plant die-back or stunted growth are found, the reasons will be determined by consultation with an appropriately qualified botanist and suitable corrective actions will be taken to maintain the vegetation screen in good condition.

Successful implementation of all the mitigation measures described in this section may be expected to reduce the significance of the visual impact to *low.*

7.3 CLOSURE PHASE

During the eventual decommissioning and closure phase of the ash/gypsum co-disposal facility and associated dams, the top layer of the liner system will be covered with topsoil and vegetated with hardy locally indigenous species of grasses and shrubs. The upper surfaces will be shaped to make them free draining to a dedicated spillway that will route runoff to ground level.

Unwanted infrastructure will be demolished and any contaminated soil on areas not occupied will be excavated and disposed of at appropriately licensed facilities. The pollution control dams will be emptied.

The synthetic HPDE liners will be removed and disposed of at an appropriately licensed site. The clay liners will be sampled and assessed for contamination. Contaminated sections of the clay liners will be managed in accordance with the requirements prevailing at that point in time, (e.g. excavated and disposed of at an appropriately licensed facility). The remaining clay liners will be ripped. The dams will be filled with layers of sand, rubble and soil, covered with topsoil and vegetated. As these dams will no longer be operational, the impermeable liners over the remaining wastes will be of crucial importance in preventing the ingress of rainwater.

Eskom will apply for a Waste Management Licence in terms of the NEMWA for the decommissioning of the co-disposal facility and associated dams. The application will include an EMPr, which will include mitigation measures for the decommissioning phase.

Table 7-1: Summary of the Mitigation Measures

Aspect	Risks	Objective	Target	Mitigation/Management Measures	Responsible Person	Timeframe
CONSTRUCTION PHASE						
SURFACE WATER	• Contamination with fuels, lubricants and hydraulic fluids from vehicles. • Contamination with dirty water runoff. • Inadequate separation of dirty and clean water runoff.	• To prevent pollution of surface water resources	• No release of polluted water into the water resources. • Only water meeting South African water quality guidelines may be released into water resources	• The runoff from the upstream clean water catchment must be diverted away from dirty water dams and ash/gypsum co-disposal facility. • Place drip trays under parked vehicles • Service vehicles in properly equipped workshops • Clean spills up immediately • Store all hazardous substances or possible pollutants such as hydrocarbons at an approved bunded site or in sealed areas on site to prevent surface water pollution in accordance with SANS Standard. • Vehicles should be parked on impermeable surfaces, to prevent the absorption of leaked hydrocarbons in to the soil profile, and stormwater from these areas must be channelled away from water courses. • Stormwater must be diverted into vegetated buffer zones and not directly into surface water. • Temporary surface water ditches must be constructed on the upstream boundary of the ash/gypsum co-disposal facility. • Ensure that all clean and dirty water is separated.	• Contractor	• Duration of the construction activities
TERESTRIAL ECOLOGY	• Loss of vegetation due to contamination of the soil downwind from the waste dump due to dust pollution • Loss of vegetation due to contamination of the soil due to ash and gypsum spillage • Erosion damage due to soil disturbance and poor vegetation cover • Alien plants that colonise disturbed areas • Decline in the biodiversity of the surrounding vegetation due to wind deposition of ash and gypsum.	• To minimise the loss of biodiversity from the construction and adjacent areas.	• Lack of harm to the ecology	• Confine all construction activities to the construction servitude. • Animals may not be hunted, snared, captured, killed or harmed. • Animals must not be relocated to areas where population stress is already evident. • Housekeeping should be done in a way that will keep the area free of waste that would attract animal pests. • Problem animals and venomous animals should be reported to the ECO. • Alien invasive plants shall be monitored for colonisation and eradicated as they emerge. • An indigenous alternative plant cover should be established and managed (where necessary) to limit re-growth and re-invasion of the unwanted plant species.	• Contractor	• Duration of the construction activities

Aspect	Risks	Objective	Target	Mitigation/Management Measures	Responsible Person	Timeframe
AQUATIC ECOLOGY	• Loss of indigenous species and biodiversity due to declines in water quality and habitats. • Change to natural flow regime	• To avoid the degradation of aquatic ecosystems due to increased sedimentation. • To avoid the siltation of water resources	• TDS and Suspended solids within the South African Guidelines • No decrease in the biotic intergrity in the Klipfonteinspruit and adjoining tributaries of the Wilge Rivers.	• Continued use of silt traps down slope of where vegetation stripping will take place. • Regular maintenance of silt traps to ensure effective drainage • Continual rehabilitation and re-vegetation of exposed surfaces throughout the construction phase • Runoff water from the ash/gypsum co-disposal facility shall be directed into pollution control dams to avoid effects on the aquatic ecosystem and natural flow regime. • The runoff shall be routinely monitored for Suspended Solids and TDS to measure the effectiveness of erosion control measures in place • Water from the pollution control dams should be reused at the Kusile Power Station if possible. • Water quality and biotic integrity shall be routinely monitored in the Klipfonteinspruit and adjoining tributaries of the Wilge Rivers to assess and quantify the potential impact on the receiving environment	• Contractor • Contractor	Duration of the construction activities Duration of the construction activities
AIR QUALITY	• Dust deposition • PM_{10} • $PM_{2.5}$	• No visible dust at construction sites • No increase in PM10 or PM2.5 at monitoring points • No increase in dust fall at monitoring points	• Dust fallout below the target level (600 mg/m^2/day) at the nearest residential areas at all times • PM 10 and PM2.5 levels kept below the NAAQS as shown in the Table in **Section 7.1.2**.	• Continued use of dust buckets. • Implement dust suppression measures with water sprays when required • Have standby equipment available should equipment fail. • Record weekly measurements of PM_{10} and $PM_{2.5}$ and monthly mass of dust collected in fallout buckets. • Maintain machinery and exhaust systems.	• Contractor	Duration of the construction activities
GROUNDWATER	• Contamination with fuels, lubricants and	• To avoid deterioration of groundwater quality	• Maintenance of groundwater parameters to within acceptable ranges in terms of the DWS Guidelines.	• Ensure proper construction of liner systems in accordance with design specifications by diligent supervision and weekly inspections • Refuel vehicles off site • Place drip trays under parked vehicles • Service vehicles in properly equipped workshops • Clean spills up immediately • Contaminated soil to be excavated immediately, followed by proper disposal at a licensed site • Sample and analyse monitoring boreholes for hydrocarbons as stipulated in **Section 8**.	• Contractor	Duration of the construction activities
OPERATIONAL PHASE						

Aspect	Risks	Objective	Target	Mitigation/Management Measures	Responsible Person	Timeframe
SURFACE WATER	• Spillages and leakages from the dirty dams and wastewater treatment plant. • Inadequate removal of silt will result in a steady decrease in the storage capacity of the SDD ST. • Maintenance of upstream clean water controls. • Increase in volume of contaminated water that needs to be managed on the Kusile Power Station footprint. • Contamination with leachates, or fuels ,lubricants, and hydraulic fluids from vehicles	• To prevent contamination of surface water resources.	• No release of polluted water into the water resources. • Only water meeting South African water quality guidelines for domestic water may be released • No collapsed berms on site • No blocked clean water controls on site	• A monitoring program for structural maintenance of the dirty dams and wastewater treatment plant must be developed and clean-up of leakages or spills should be carried out immediately. • Where there are spillages, the emergency preparedness programme must be implemented • The SDD ST will consist of two equal capacity concrete basins that clarify contaminated water from the power station terrace before it travels by gravity pipeline to the SDD. The two compartments will allow for occasional maintenance and inspection access (preferably during the dry season) without interrupting the functionality of the SDD ST under normal circumstances. • Regular clean-up of the dams must be conducted or as required • The siltation in the dams must be visually inspected regularly. • Upstream clean water controls should be maintained regularly by site monitoring, to ensure no blockages by vegetation or debris occur. • Berm walls that have collapsed or have been damaged must be repaired immediately • A storm water management and maintenance program must be implemented regularly to ensure that the storm water system is functioning sufficiently. • The water balance shall be updated regularly to ensure that there is adequate capacity available in the dirty water system.	• CEO • Eskom Project Manager	• Duration of the Operation Phase

Aspect	Risks	Objective	Target	Mitigation/Management Measures	Responsible Person	Timeframe
TERESTRIAL ECOLOGY	• Loss of vegetation due to contamination of the soil downwind from the waste dump due to dust pollution • Loss of vegetation due to contamination of the soil due to ash and gypsum spillage • Erosion damage due to soil disturbance and poor vegetation cover • Alien plants that colonise disturbed areas • Decline in the biodiversity of the surrounding vegetation due to wind deposition of ash and gypsum • Negative effect on crop production and the palatability of grazing due to wind deposition of ash and gypsum on plants	• To restore ecological function to areas not occupied by permanent infrastructure.	• Self-sustaining population of local indigenous grasses and shrubs, providing habitat for small animals and insects	• Dust suppression measures must always be applied to prevent dust pollution • Spillage of ash and gypsum during transportation between the Kusile power plant and the ash/gypsum co-disposal facility must be prevented. • The lining of the ash/gypsum co-disposal facility and dirty water dams must be tested for leaks before the deposition of the first ash takes place. • Care must be taken not to rupture the lining during the construction and operational phases. • Spills of any product should be cleaned up immediately by removing the spillage together with the polluted soil and by disposing it at a recognised facility • The facility must be regularly monitored for erosion damage of the topsoil cover to prevent rat holes • An indigenous alternative plant cover should be established and managed (where necessary) to limit re-growth and re-invasion of the unwanted plant species • All sites disturbed by construction activities should be monitored for colonisation of invasive plant species, which must be eradicated as they emerge. • Mechanical methods must be favoured rather than chemical methods where possible to remove unwanted vegetation cover and trees • Construction areas must be regularly monitored for alien invasive plants . • Dust suppression measures such as regular wetting of exposed areas must always be applied.	• CEO • Eskom Project Manager	• Duration of the Operation Phase

Aspect	Risks	Objective	Target	Mitigation/Management Measures	Responsible Person	Timeframe
AQUATIC ECOLOGY	• Change to natural flow regime • Loss of indigenous species and biodiversity due to declines in water quality and habitats	• To ensure that the natural flow regime in the Klipfonteinspruit, the tributaries of the Wilge River and the Holfonteinspruit is preserved • To minimise/avoid the loss of aquatic biodiversity due to the decline in water quality and habitats	•	• Runoff water from the ash/gypsum co-disposal facility should be channelled into pollution control dams to avoid effects on the aquatic ecosystem; • Silt traps should be placed down-slope of where vegetation stripping will take place to minimise siltation in rivers and wetlands. These silt traps need to be regularly maintained to ensure effective drainage. • Exposed areas must be rehabilitated and re-vegetated on a continual basis and should not be left for the closure phase. • If erosion has taken place, rehabilitation should be implemented as soon as possible • Runoff water from the ash/gypsum co-disposal facility should be channelled into pollution control dams to avoid effects on the natural flow regime. • The water in the pollution control dams should be reused at the Kusile Power Station if possible. • The runoff should be routinely monitored for Suspended Solids (SS) and TDS as an early warning for potential increases in discharge water. • The water in these pollution control dams should be reused at the Kusile Power Station if possible. • Water quality and biotic integrity should be routinely monitored in the Klipfonteinspruit and adjoining tributaries of the Wilge Rivers to assess and quantify the potential impact on the receiving environment	• CEO • Eskom Project Manager	• Duration of the Operation Phase
AIR QUALITY	• Dust deposition • PM_{10} • $PM_{2.5}$	• To ensure that there is no excessive dust emitted from the construction of the ash/gypsum co-disposal facility. • To ensure compliance of PM_{10} levels with the NAAQS during construction. • To ensure compliance of $PM_{2.5}$ levels with the NAAQS during construction.	• Dust fallout below the target level (600 mg/m^2/day) at the nearest residential areas at all times • PM_{10} and $PM_{2.5}$ levels kept below the NAAQS as shown in the Table in **Section 7.1.2**.	• Exposed areas of disposed ash and gypsum must be regularly wetted. • Exposed areas must be stabilised top-soil covering. • Additional mitigation of dust emissions from the top soil layer can be achieved by wetting of exposed top-soil. • Re-vegetation of the ash/gypsum co-disposal facility through application of a deeper top-soil layer and seeding with appropriate grass seeds.	• CEO • Eskom Project Manager	• Duration of the Operation Phase

Aspect	Risks	Objective	Target	Mitigation/Management Measures	Responsible Person	Timeframe
GROUNDWATER	• Poor quality artificial recharge from the ash gypsum ash/gypsum co-disposal facility • Artificial recharge to groundwater • Poor quality water emanating from the Flue Gas Desulphurisation Wastewater Treatment Plant	• To prevent any deterioration in groundwater quality	• Maintenance of groundwater quality parameters	• The ash/gypsum co-disposal facility will be lined in a way that will reduce the impact on the groundwater environment as it inhibits the seepage of poor quality water into the aquifer. • Leach tests must be conducted on the ash/gypsum waste in order to determine the leachable concentrations of the waste samples and whether they are within acceptable limits. • The continual implementation of the groundwater monitoring programme will allow for the early detection of water quality deterioration associated with the site. • If there are any boreholes located on the site footprint that have been destroyed, the boreholes must be backfilled using a cement – bentonite slurry so as to prevent direct migration of potentially poor quality water into the aquifers. • The pollution control dams must be lined as this will reduce the impact on the groundwater environment as it inhibits the seepage of poor quality water into the aquifer. • The continual implementation of the groundwater monitoring programme will allow for the early detection of water quality deterioration associated with the site. • Lining of the dams where the waste water is to be stored will reduce the impact on the groundwater environment as it inhibits the seepage of poor quality water into the aquifer. • The continual implementation of the groundwater monitoring programme will allow for the early detection of water quality deterioration associated with the site.	• CEO • Eskom Project Manager	• Duration of the Operation Phase
LAND USE AND LAND CAPABILITY	• Impairment of land capability off site due to escape of contaminated surface water	• Prevent off-site contamination of soil, crop and grazing.	• No deterioration of off-site land capability due to the operation of the ash/gypsum co-disposal facility and associated dams	• Please refer to Section 7.2.6	• CEO • Eskom Project Manager	• Duration of the operation phase
GEOLOGY AND SOILS	• Contamination of soil, causing changes in its chemistry and capability	• To avoid contamination of soil underlying ash/gypsum co-disposal facility	• No contamination of soil underlying ash/gypsum co-disposal facility	• Please refer to Section 7.2.7	• CEO • Eskom Project Manager	• Duration of the operation phase
VISUAL	• Visual appearance objectionable to most observers	• To avoid creating an objectionable appearance from local observation points	• Acceptable visual appearance as evidenced by a lack of complaints from neighbours	• Please refer to Section 7.2.8	• CEO • Eskom Project Manager	• Duration of the operation phase

8. MONITORING PROGRAMMES

8.1 AQUATIC ECOLOGY

Kusile must continue monitoring the aquatic sampling points. The sampling must be extended to include the additional sampling sites that are associated with the ash/gypsum co-disposal facility and associated dams (KLI1, TRI1 and KLI2) as shown in **Table 8-1**.

Table 8-1: Aquatic Monitoring Programme

Site	Latitude	Longitude	River	Description
KUS4	-25.94279	28.93998	Klipfonteinspruit	*Existing site.* This site has been selected as an upstream point on the Klipfonteinspruit, which may be impacted upon by the ash/gypsum co-disposal facility
KUS15	-25.95740	28.90733	Holfonteinspruit	*Existing site.* This site is located in the Holfonteinspruit, just before it enters into the Klipfonteinspruit upstream of site KUS07
KLI1	-25.947033	28.909867	Klipfonteinspruit	Additional site. This site is located south of the proposed Kusile ash/gypsum co-disposal facility on the Klipfonteinspruit within the Kusile construction footprint.
TRI1	-28.907083	28.907083	Unnamed tributary of the Klipfonteinspruit	Additional site. This site is located north of the proposed Kusile ash/gypsum co-disposal facility within the Kusile construction footprint and forms part of the river diversion
KUS7	-25.93887	28.89471	Klipfonteinspruit	*Existing site.* This site has been selected as a downstream point on the Klipfonteinspruit, which may be impacted upon by the ash/gypsum co-disposal facility. Associated infrastructure also crosses the river at this point
KUS8	-25.92462	28.90022	Unnamed tributary of the Klipfonteinspruit	*Existing site.* This site has been selected as a downstream point for the diversion. Associated infrastructure also crosses the river at this point. This point will also represent any impacts from the Power Station upstream. This site will hereafter be referred to in the report as the Kusile tributary

Site	Latitude	Longitude	River	Description
KUS9	-25.91424	28.88064	Klipfonteinspruit	*Existing site.* This point is located below the confluence of the two tributaries draining the Power Station and ash/gypsum co-disposal facility area. This point will monitor the combined effect on the river system
KLI2	-28.866033	28.866033	Klipfonteinspruit	Additional site. This site is located downstream of the Kusile construction footprint on the Klipfonteinspruit approximately 960m from the confluence of the Wilge River
WGS_84 Datum co-ordinate system represented in decimal degrees				

The monitoring shall be conducted on a bi-annual basis, during the high flow and low flow seasons during construction and operation phases of the ash/gypsum co-disposal facility and associated dams**.** The monitoring must include:

- Water Quality;
- Habitat;
- Aquatic Macroinvertebrates; and
- Ichthyofauna.

8.2 SURFACE WATER

The following points associated with the ash/gypsum co-disposal facility and the dams must be monitored during construction and operation as shown in **Table 8-2**, in accordance with the ash/gypsum co-disposal facility Water Use Licence (WUL) that was issued to Kusile in 2012.

Table 8-2: Surface water Monitoring Programme

Sampling Point	Description	Latitude	Longitude	Variables
1	Spruit upstream of the ash/gypsum co-disposal facility (south)	25°56'55.1"S	28°55'50.6"E	Temperature, pH, Electrical Conductivity, Suspended Solids, Dissolved Oxygen, Chemical Oxygen Demand, Turbidily, Sechi
2	Spruit upstream of the ash/gypsum co-disposal facility tributary (south)	25°57'24.8"S	28°54'30.0"E	

Sampling Point	Description	Latitude	Longitude	Variables
3	Spruit downstream of the ash/gypsum co-disposal facility (south)	25°55'41.3"S	28°53'04.9"E	disk depth, Alkalinity, Calcium, magnesium, Sodium, Potasium, Suphate, Fluoride, Iron, Manganese, Aluminium, Chromium VI, Boron, Arsenic, Mercury, Silica, Ammonia, Phosphate, Nitrate/Nitrite, BTES, TPH, Faecal Coliforms
4	Spruit north of the ash/gypsum co-disposal facility	25°55'34.9"S	28°53'39.3"E	
5	Before Wilge River confluence	25°53'04.3"S	28°51'41.7"E	
6	Pan	25°56'12.5"S	28°54'39.1"E	
7	Offset Wetland Upstream	25°52'36.7"S	28°55'16.0"E	
8	Offset Wetland Downstream	25°53'17.5"S	28°53'21.9"E	
9	Wilge River A	25°52'17.6"S	28°51'57.7"E	
10	Wilge River B	25°52'40.4"S	28°51'48.7"E	

The sampling frequency for the identified variables should be monthly during the construction and operation phases.

8.3 GROUNDWATER

The following boreholes are currently being monitored by on a monthly basis: 10490-09, 10490-10, 10490-17, 10490-21, 10490-25, 10490-27, BH2, BH3, BH11, BH25, BH27, BH30, GDF-6D, DWBH-06, DWBH-07 and DWBH-36 in order to comply with the conditions of the Environmental Authorisation (EA) issued by the Department of Environmental Affairs (DEA), and the Water Use License (WUL) from the Department of Water and Sanitation (DWS).

The monitoring of the boreholes shall continue as per **Table 8-3.** The monitoring programme will include all boreholes sampled during this investigation. Boreholes should be sampled on a quarterly basis for indicator elements and a full analysis on a bi-annual basis.

Table 8-3: Groundwater Monitoring Programme

Borehole Name	Proposed Sampling Frequency	Analysis
10490-09	Quarterly for indictor elements and a full analysis on an bi-annual basis	Indicator elements include TDS, SO4, Na, Cl, Mg, Al, B, As, Cr, Fe, Ni, Se and Zn
10490-10		
10490-17		
10490-21		
10490-25		
BH11		
BH 27 (LGW-B4)		
BH 3		
BH 30 (LGW-B11)		
LGW-B6		

Long-term groundwater monitoring at similar ash disposal facilities have indicated varying degrees of groundwater quality deterioration therefore all new data collected from the existing boreholes must be compared to the existing data to identify any trends in the groundwater levels and chemistry over time.

If the monitoring data indicates the need for corrective action, the magnitude of the impact must be assessed by an appropriately qualified and experienced specialist and the necessary measures put forward based on the magnitude of the impact.

9. REHABILITATION

Rehabilitation aims at returning the land/environment in a given area to some degree of its former state after a particular process has resulted in its damage. Rehabilitation in this case will be aimed at restoring the disturbed vegetation and water resources to a situation that is as close to its natural situation as is possible.

The objectives of the rehabilitation plan include:

- Rehabilitation of all areas disturbed by the construction of the ash/gypsum co-disposal facility and associated dams;
- Rehabilitate any erosion that occurred as a result of the construction work; and
- Removal of alien invasive species that occur in the disturbed area.

The method statements for each component were developed to address the rehabilitation of the areas affected by construction (**Appendix E**).

9.1 REHABILITATION PHASE

Where possible the rehabilitation of construction servitudes will be done concurrently with the construction activities. Other rehabilitation activities will be conducted immediately after construction.

9.2 REHABILITATION ACTIVITIES

On completion of construction, the Contactor must ensure that all disturbed areas are re-vegetated in consultation with an indigenous plant expert, and only indigenous sedges, shrubs, and grasses shall be used to restore biodiversity. Grass species that could be considered for planting on disturbed areas are shown in **Table 9-1**.

Table 9-1: Grass species that could be considered for planting on disturbed areas.

Scientific name	Common name	Description	Suitability	Establishment
Eragrostis curvula	Weeping love grass	Robust, densely perennial tufted grass. Establishes easily.	Pasture, disturbed soils, good soil stabilizer	October - December
Eragrostis tef	Tef	Loose annual, sometimes dense tufted grass	Pasture, disturbed soils, good soil stabilizer	September - December
Cynodon dactylon	Couch/Bermuda grass	Short, mat-forming grass	Pasture, disturbed soils, damp soil, excellent soil stabilizer	September - February

Scientific name	Common name	Description	Suitability	Establishment
Digitaria eriantha	Common finger grass	Perennial tufted grass	Pasture, damp soil	September - February
Panicum maximum	Guinea grass	Leafy perennial tufted grass	Pasture, damp soil	September - February
Chloris gayana	Rhodes grass	Leafy grass which spreads by means of stolons	Pasture, damp soil, good soil stabilizer	October - November, February - March

Rehabilitation of disturbed riparian and in-stream habitat shall commence immediately after construction. This shall be overseen by an Aquatic Scientist.

The vegetation of the surrounding catchment shall also be managed to prevent erosion and siltation of watercourses. A systematic, long-term rehabilitation programme shall be implemented immediately after construction, to restore natural streams to environmentally acceptable and sustainable conditions. This programme shall be directed by an Aquatic Scientist, and shall include, but not be limited to:

- Rehabilitation of disturbed and degraded riparian areas to restore and upgrade the riparian habitat integrity to sustain a bio-diverse riparian ecosystem.
- Rehabilitation could include (not limited to) the following:
  - Ripping and scarifying the disturbed area to alleviate soil compaction;
  - Landscaping of the area to approximate the natural landscape profile to avoid any preferential flow paths across the site that could lead to erosion;
  - Seeding of the disturbed area with an appropriate seed mix; and
  - Implementation of a monitoring plan to ensure successful establishment of vegetation and to prevent invasion by alien species.

The rehabilitation activities must also include the following activities as listed in **Section 4** of the 2012 IWULA:

- An active campaign for controlling invasive species must be implemented within disturbed zones and its bordering areas (seed depots) to ensure that it does not become a conduit for the propagation and spread on invasive exotic plants.
- Topsoil must be stripped and redistributed. A height restriction on stockpiles of not more than 2 m must be followed in order to preserve the soil's microbiological and nutrient characteristics. Where possible, topsoil must be placed immediately after stripping, but may not be stockpiled for longer than 3 months.

- Compacted and disturbed areas must be shaped to natural forms and to follow the original contour. In general cut and fill slopes and other disturbed areas must not exceed 1:3 (v:h) ratio, it must be protected, vegetated, ripped and scarified parallel with the contour.

The IWULA is attached as **Appendix F**.

10. CONCLUSION AND RECOMMENDATIONS

The construction and operation of the ash/gypsum co-disposal facility and associated dams will have an impact on:

- Groundwater
- Air Quality
- Terrestrial Ecology
- Surface Water; and
- Aquatic Environment

Most of the mitigation measures that were identified are already in place at Kusile. Kusile Power Station designed the lining system for the ash/gypsum co-disposal facility in conjunction with the DWS (the liner system approvals are attached as **Appendix G**). The lining system was designed in such a way that there will be no seepage to the groundwater and surface water resources. To reduce the impacts on the catchment, Kusile redesigned the ash/gypsum co-disposal facility to avoid impacting on a pan associated with the facility. The pan will be protected by a 35 m buffer that has been created around it.

The generic mitigation measures stipulated in the 2006 EMPr and the 2013 WMP must be implemented as to maintain/contribute to improvement of the environment at the Kusile Power Station. In addition to the EMPr, contractors must also refer to the Standard Environmental Specification (SES) for the Kusile Project.

The rehabilitation plan included in this EMPr will contribute to restoring the disturbed vegetation and water resources to a situation that is as close to its natural situation as is possible.