Royal HaskoningDHV

Environmental Impact Assessment Report for the Charlie 1 Landfill Optimisation and Stormwater Management Project, Sasol Synfuels, Secunda, Mpumalanga

December 2015

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Prashika Reddy

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Glossary

Alternative: Different means of meeting the general purpose and requirements of the activity, which may include site or location alternatives; alternatives to the type of activity being undertaken; the design or layout of the activity; the technology to be used in the activity and the operational aspects of the activity.

Development: Means the building, erection, construction or establishment of a facility, structure or infrastructure, including associated earthworks or borrow pits, that is necessary for the undertaking of a listed or specified activity, including any associated post development monitoring, but excludes any modification, alteration or expansion of such a facility, structure or infrastructure, including associated earthworks or borrow pits, and excluding the redevelopment of the same facility in the same location, with the same capacity and footprint.

Cumulative Impact: The impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Do-nothing Alternative: The 'do-nothing' or 'No go' alternative is the option of not undertaking the proposed activity, that is, the maintenance of the status quo.

Environmental Assessment Practitioner (EAP): The individual responsible for planning, management and coordination of environmental impact assessments, strategic environmental assessments, environmental management programmes or any other appropriate environmental instrument introduced through the EIA Regulations.

Environmental Management Programme (EMPr): A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive impacts and limiting or preventing negative environmental impacts are implemented during the life cycle of a project. The EMPr focuses on the construction phase, operation (maintenance) phase and decommissioning phase of the proposed project.

Environmental Impact: A change to the environment, whether adverse or beneficial, wholly or partially, resulting from an organisation's activities, products or services.

Fatal Flaw: Issue or conflict (real or perceived) that could result in a development being rejected or stopped. Such an issue or conflict would be considered to be a significant issue that mitigation could not address.

Integrated Environmental Management: A philosophy that prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development and decision-making process. The IEM philosophy (and principles) is interpreted as applying to the planning, assessment, implementation and management of any proposal (project, plan, programme or policy) or activity - at local, national and international level - that has a potentially significant effect on the environment. Implementation of this philosophy relies on the selection and application of appropriate tools for a particular proposal or activity. These may include environmental assessment tools (such as strategic environmental assessment and risk assessment), environmental management tools (such as monitoring, auditing and reporting) and decision-making tools (such as multi-criteria decision support systems or advisory councils).

Interested and Affected Party: For the purposes of Chapter 5 of the NEMA and in relation to the assessment of the environmental impact of a listed activity or related activity, means an interested and affected party contemplated in Section 24(4)(a)(v), and which includes - (a) any person, group of persons or organisation interested in or affected by such operation or activity; and (b) any organ of state that may have jurisdiction over any aspect of the operation or activity.

Leachate: Highly contaminated water which has seeped through the waste.

Mitigate: The implementation of practical measures designed to avoid, reduce or remedy adverse impacts, or to enhance beneficial impacts of an action.

Piezometer: A device used to measure groundwater levels, providing information essential to understanding site baseline information.

Watercourse: Means:

a) a river or spring;
b) a natural channel or depression in which water flows regularly or intermittently;
c) a wetland, lake or dam into which, or from which, water flows; and
d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998) and a reference to a watercourse includes, where relevant, its bed and banks.

Wetland: Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

Work Face: The active part of the landfill where waste is deposited.

Abbreviations and Acronyms

CA	Competent Authority
CLP	Contaminated Leachate Pond
CMA	Catchment Management Agency
CSP	Contaminated Stormwater Pond
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECA	Environmental Conservation Act
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIR	Environmental Impact Assessment Report
EMF	Environmental Management Framework
EMI	Environmental Management Inspectorate
EMPr	Environmental Management Programme
ESS	Environmental Scoping Study
ESR	Environmental Scoping Report
FEP	Feasibility Engineering Package
GCL	Geosythetic Clay Liner
GMLM	Govan Mbeki Local Municipality
GN	Government Notice
GSDM	Gert Sibande District Municipality
HDPE	High Density Polyethylene
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IGS	Institute for Groundwater Studies
LIDPs	Local Integrated Development Plans
mamsl	meters above mean sea level
MAP	Mean Annual Precipitation
MBSP	Mpumalanga Biodiversity Sector Plan
MDARDLEA	Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs
NEMA	National Environmental Management Act
NEM:WA	National Environmental Management: Waste Act

NWA	National Water Act
PCD	Pollution Control Dam
PPP	Public Participation Process
SAWS	South African Weather Services
SDF	Spatial Development Framework
SEMAs	Specific National Environmental Management Acts
WML	Waste Management Licence
WULA	Water Use Licence Application

1 INTRODUCTION

The Sasol Synfuels, Secunda, Charlie 1 Landfill site was authorised in 1993 as a Class II Site, in terms of the Environmental Conservation Act (ECA) (No 73 of 1989). The landfill has been in operation since 1993, receiving domestic waste, office waste and plant waste of a non-hazardous nature from the Synfuels plant.

Furthermore, with the promulgation of the National Environmental Management: Waste Act, 2008 [NEM:WA] (No 59 of 2008) and the Waste Classification and Management Regulations, 2013 (GN R.634) as well as GN R.635 of 2013 (National Norms and Standards for Assessment of Waste for Landfill Disposal) and GN R.636 of 2013 (National Norms and Standards for Disposal of Waste to Landfill), there is a need to improve waste and water management at waste disposal sites like the Charlie 1 Landfill site.

Sasol South Africa Pty Ltd (Sasol) therefore propose to construct a contaminated leachate and stormwater pond within a pollution control pond area, adjacent to the western boundary of the existing landfill site on the farm Driehoek 275 IS, to ensure compliance with the existing permit requirements and ensure the effective management of leachate and stormwater at the Charlie 1 Landfill site (Figure 1 – **Appendix A**).

The estimated size of the ponds is as follows:

- Contaminated leachate pond (CLP) – 1500 m^3.
- Contaminated stormwater pond (CSP) – 15000 m^3.

Sasol also proposes increasing the existing landfill height up to 20 m to achieve the required airspace for the remaining life of the landfill.

1.1 Key Project Objectives

The key objectives of the proposed project are to:

- Develop the contaminated groundwater interception system and stormwater management system to serve both the current site as well as any extension thereof within the permit boundaries, ensuring that the systems are within the applicable legislation, guidelines, regulations and standards, as a minimum requirement;
- Optimize the remaining airspace volume to maximize the life of the site; and
- Extend the life of the site within the bounds of the existing landfill permit requirements/conditions.

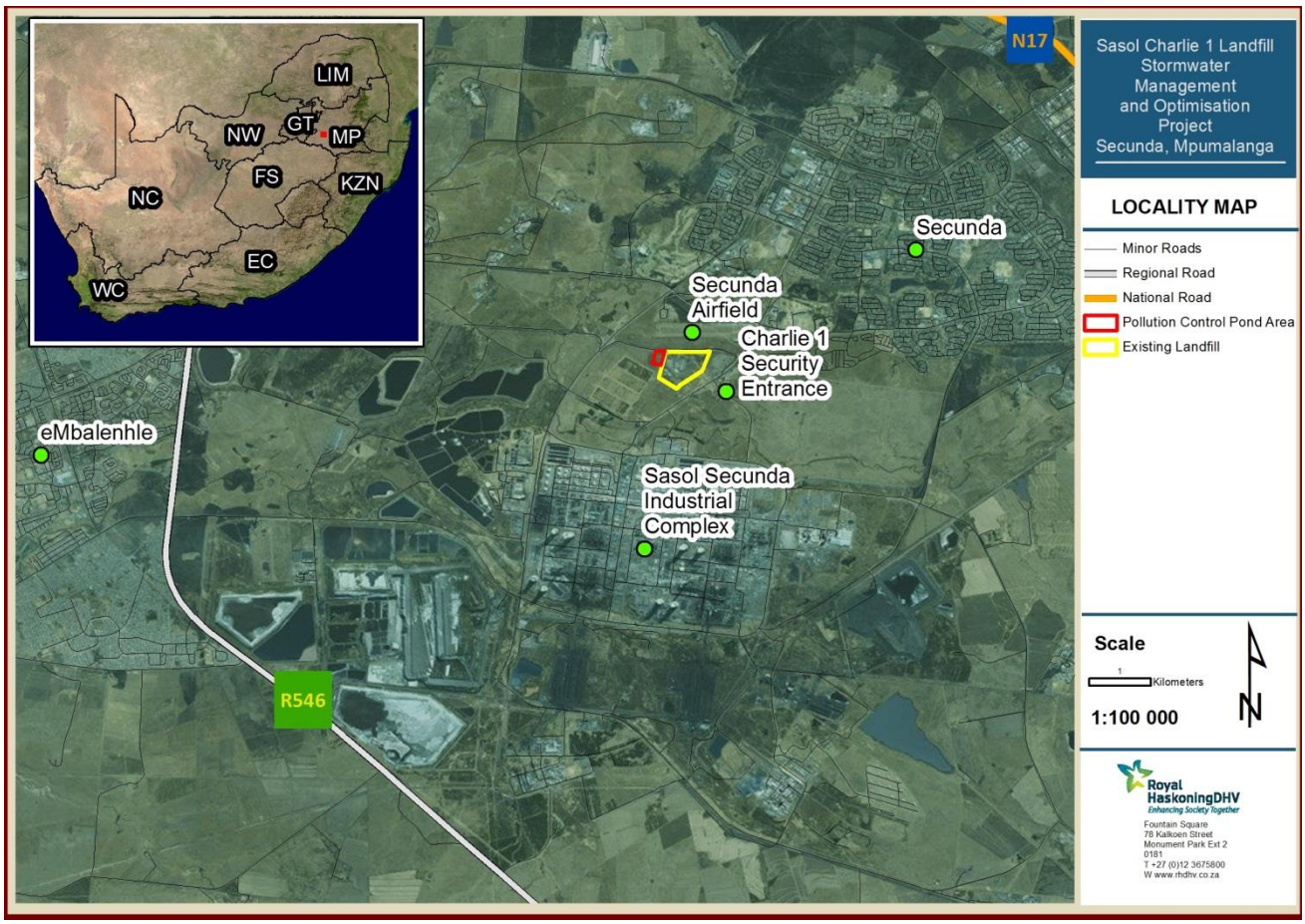


Figure 1: Locality map

1.2 Approach to the Environmental Impact Assessment Study

The environmental impacts associated with the proposed project require investigation in compliance with the EIA Regulations (2014) published in Government Notice (GN) No. R. 982 to No. R. 985 and read with Section 24 (5) of the National Environmental Management Act (No 107 of 1998) as amended. In addition, GN No. 921 of 2013 (*List of waste management activities that have, or are likely to have a detrimental effect on the environment)* and GN R. 634 of 2013 (*Waste Classification and Management Regulations*) of the National Environmental Management: Waste Act (No 59 of 2008) will also be considered in this study.

A Waste Management Licence (WML) process is being undertaken for the proposed project. The Department of Environmental Affairs (DEA) is the Competent Authority (CA) that will issue a decision for the project and the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA) is the commenting authority for this WML process.

The EIA process is being undertaken in two phases (Figure 2) that will ultimately allow the Competent Authority to make an informed decision:

- Phase 1 – Environmental Scoping Study (ESS) including, site selection and Plan of Study for EIA - *complete*; and
- Phase 2 – Environmental Impact Assessment (EIA) and Environmental Management Programme (EMPr).

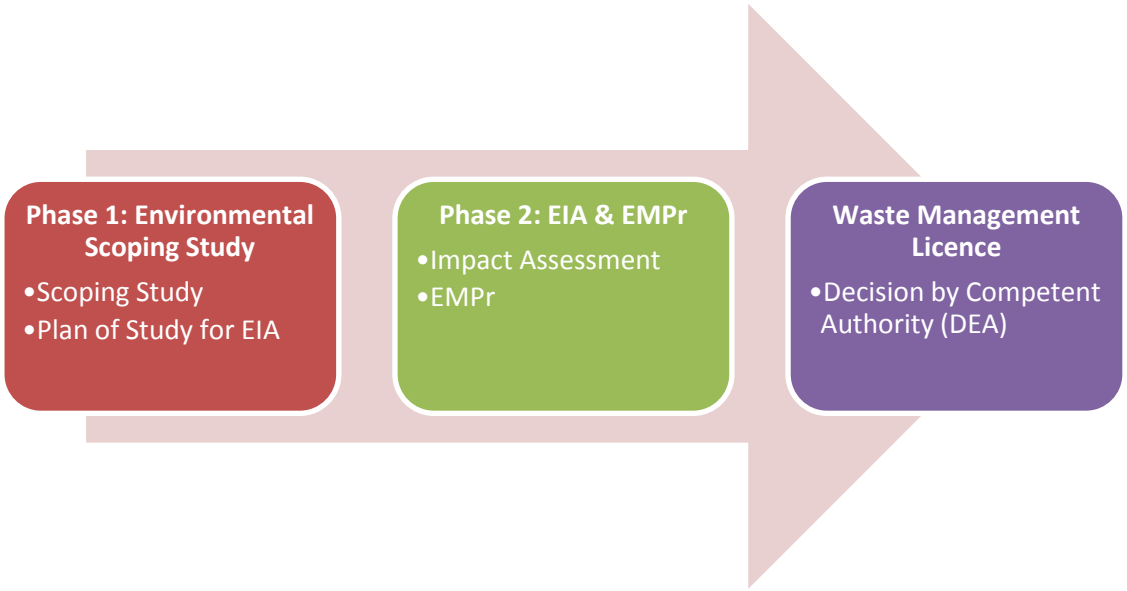


Figure 2: Environmental studies flowchart

1.2.1 Conclusions of the Environmental Scoping Study (ESS)

The ESS provided a description of the receiving environment and how the environment may be affected by the proposed project. The ESS aimed to identify any fatal flaws, alternatives and mitigation options to be evaluated and investigated during the EIA phase of the project.

Desktop studies making use of existing information and a site visit were used to highlight and assist in the identification of potential significant impacts (both social and biophysical) associated with the proposed project.

Additional issues for consideration were extracted from feedback during the Public Participation Process, which commenced at the beginning of the Scoping phase, and which will continue throughout the duration of the project. All issues identified during the ESS were documented within the Environmental Scoping Report (ESR). The Final Consultation ESR and Plan of Study for EIA were submitted to the DEA on 21 September 2015 and accepted on 07 December 2015.

1.2.2 Environmental Impact Assessment Process

This EIA process is being undertaken in line with the approved Plan of Study submitted to the DEA on 21 September 2015 as well as Appendix 3 of GN R.982.

The objective of the EIA process is to, through a consultation process:

- Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- Identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- Determine the-
    (i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and

(ii) degree to which these impacts can be reversed; may cause irreplaceable loss of resources, and can be avoided, managed or mitigated;

- Identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- Identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- Identify suitable measures to avoid, manage or mitigate identified impacts; and
- Identify residual risks that need to be managed and monitored.

1.2.2.1 Environmental Impact Assessment Report Structure

This Environmental Impact Assessment Report (EIR) will be compiled in accordance with the accepted Plan of Study and incorporates the findings and recommendations from the Scoping Study as well as specialist studies conducted for the project.

In addition, this EIR is being compiled according to the guidelines provided in Appendix 3 of GN R.982 of the EIA Regulations (2014).

Table 1: EIR requirements according to Appendix 3 of GN R. 982

EIR Requirements according to Appendix 3 of GN R. 982	Chapter/Section
(a) details of (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae.	1.4 CVs attached in **Appendix B**
(b) the location of the activity, including: (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties.	2.1
(c) a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is- (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken.	Figure 1
(d) a description of the scope of the proposed activity, including- (i) all listed and specified activities triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development.	2.1; 5
(e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.	5
(f) a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location.	4
(g) a motivation for the preferred development footprint within the approved site.	3.1
(h) a full description of the process followed to reach the proposed development footprint within the approved site, including: (i) details of the development footprint alternatives considered; (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; (iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated; (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	3; 6;7; 8; 9;10

EIR Requirements according to Appendix 3 of GN R. 982	Chapter/Section
(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (viii) the possible mitigation measures that could be applied and level of residual risk; (ix) if no alternative development locations for the activity were investigated, the motivation for not considering such; and (x) a concluding statement indicating the preferred alternative development location within the approved site;	
(i) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred (i) location through the life of the activity, including- (ii) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (iii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	9
(j) an assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated;	9
(k) where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.	7; 8
(l) an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment: (i) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (ii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.	10
(m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.	8
(n) a the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment.	3; 10
(o) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.	10
(p) a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.	10
(q) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	10
(r) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised.	NA
(s) an undertaking under oath or affirmation by the EAP in relation to: (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.	**Appendix J**
(t) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.	NA
(u) an indication of any deviation from the approved scoping report, including the plan of study, including-	NA

EIR Requirements according to Appendix 3 of GN R. 982	Chapter/Section
(i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation.	
(v) any specific information that may be required by the competent authority.	NA
(w) any other matters required in terms of section 24(4)(a) and (b) of the Act.	NA

1.2.2.2 Specialist Studies

To ensure the scientific vigour of the EIA process as well as a robust assessment of impacts, Royal HaskoningDHV was assisted by various specialists and specialist assessments in order to comprehensively identify both potentially positive and negative environmental impacts (social and biophysical) associated with the project and where possible mitigate the potentially negative impacts and enhance the positive impacts.

The following specialist studies have been conducted for the proposed project from 2008 and 2013 (Table 2).

Table 2: List of specialist studies undertaken from 2008 – 2013

Specialist Study	Specialist and Organisation
Charlie 1 Domestic Waste Site, Sasol Synfuels, Secunda: Quantification of Impacts, Assessment of Risk and Possibility of Expansion (August, 2008)	Institute for Groundwater Studies
Investigation into Remediation Options for the Charlie 1 Landfill Leachate (2009)	SRK Consulting
Sasol Synfuels Co-disposal Waste Landfill Facility Pre-feasibility (2012)	SRK Consulting
Pre-feasibility Assessment for Site Extension and Stormwater Management for Charlie 1 Landfill (2013)	Golder Associates

In addition to the above specialist studies, the following reports have been prepared in support of the EIA study (Table 3):

Table 3: Specialist studies undertaken for EIA Study

Specialist Study	Specialist and Organisation
Pollution Control Dam Site Selection and Location	Golder Associates
Feasibility Engineering Package (FEP) for the Stormwater and Leachate Management of Charlie 1 Landfill	Golder Associates
Ecological Assessment	Clayton Cook & Leslie Brown (Private)

1.2.2.3 Draft Environmental Management Programme

As part of this EIR, a draft EMPr will be compiled in accordance with Appendix 4 of GN R.982 of the EIA Regulations (2014). The draft EMPr provides the actions for the management of identified environmental impacts emanating from the proposed pollution control pond area and expansion of the Charlie 1 Landfill and a detailed outline of the implementation programme to minimise and/or eliminate the anticipated negative environmental impacts. The draft EMPr provides strategies to be used to address the roles and responsibilities of environmental management personnel on site, and a framework for environmental compliance and monitoring.

The EMPr includes the following:

(a) details of-
  (i) the EAP who prepared the EMPr; and
  (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;
(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;

(c) a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers;
(d) a description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including-
    (i) planning and design;
    (ii) pre-construction activities;
    (iii) construction activities;
    (iv) rehabilitation of the environment after construction and where applicable post closure; and
    (v) where relevant, operation activities;
(e) a description and identification of impact management outcomes required for the aspects contemplated in paragraph (d);
(f) a description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable, include actions to-
    (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
    (ii) comply with any prescribed environmental management standards or practices;
    (iii) comply with any applicable provisions of the Act regarding closure, where applicable; and
    (iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;
(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);
(h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);
(i) an indication of the persons who will be responsible for the implementation of the impact management actions;
(j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;
(k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);
(l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;
(m) an environmental awareness plan describing the manner in which-
    (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and
    (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and
(n) any specific information that may be required by the competent authority.

1.3 Concurrent Licencing Processes

1.3.1 Water Use Licence

In terms of Chapter 4 of the National Water Act [NWA], (No 36 of 1998) activities and processes associated with the proposed pollution control pond area may require a Water Use Licence (WUL). Subsequent to a discussion and site visit conducted with the Department of Water and Sanitation (DWS), Solid Waste Management on 28 October 2015, it was indicated that Sasol would not require a WUL as the DWS would provide a Record of Decision to the DEA Waste Licencing Directorate that would be incorporated into the WML.

1.3.2 Zoning

Sasol has submitted a Land use Rights Application for Discretionary Land Use to the Govan Mbeki Municipality to change the existing land use from agricultural to agricultural industrial.

1.4 Details of the Environmental Assessment Practitioner

Royal HaskoningDHV is the service provider appointed by Sasol to provide independent Environmental Assessment Practitioner (EAP) services in the undertaking of appropriate environmental studies for this proposed project.

The professional team of Royal HaskoningDHV have considerable experience in the environmental management and EIA fields. Royal HaskoningDHV has been involved in and/or managed several of the largest Environmental Impact Assessments undertaken in South Africa to date. A specialist area of focus is on the assessment of multi-faceted projects, including the establishment of linear developments (national and provincial roads, and power lines), bulk infrastructure and supply (e.g. wastewater treatment works, pipelines, landfills), electricity generation and transmission, the mining industry, urban, rural and township developments, environmental aspects of Local Integrated Development Plans (LIDPs), as well as general environmental planning, development and management.

The particulars of the EAP are presented in Table 4 below.

Table 4: Details of EAP

Details	
Consultant:	Royal HaskoningDHV
Contact Persons:	Nicole Botham and Prashika Reddy
Postal Address	PO Box 25302, Monument Park, 0105
Telephone:	012 367 5800
Facsimile:	012 367 5878
E-mail:	nicole.botham@rhdhv.com / prashika.reddy@rhdhv.com
Expertise:	Ms Botham is an Environmental Consultant with seven years experience in the mining sector, having undertaken work in Africa, Europe, Middle East, USA and Fiji. She has focussed on management plan preparation, mine decommissioning (closure) and audits of mine investments. Areas of expertise include: Scoping Reports, Environmental Impact Assessment (EIA), Environmental Management Reports, Environmental Audits, and Baseline Studies. Key project experience includes: Sol Plaatje Municipality, Trekkopje Mine, Tshipi è ntle Mine, Bon Accord Mine, Wonderfontein Mine, Manganese mine in Burkina Faso, Vatukoula Gold Mine, Northland Mine, Antimony Process Plant in Oman, and a Biofuels project in Mozambique. Ms Reddy is a Principal Associate / Senior Environmental Scientist (*Pr Sci Nat* 400133/10) with a BSc Honours in Geography and Botany. Ms Reddy has the necessary experience in various environmental fields including: environmental impact assessments, environmental management plans/programmes, public participation and environmental monitoring and auditing. Ms Reddy has extensive experience in compiling environmental reports (Screening, Scoping, EIA and *Status Quo* Reports). Ms Reddy is/has been part of numerous multi-faceted large–scale projects, including the establishment of linear developments (roads, and power lines); industrial plants; electricity generation plants and mining-related projects.

CVs of the EAPs are attached in **Appendix B**.

2 PROJECT DESCRIPTION

2.1 Charlie 1 Landfill

2.1.1 Landfill Size and Location

The footprint area of the landfill is approximately 31 ha, within the about 1611 ha owned by Sasol that is predominantly zoned as industrial. The site was originally a dolerite borrow area, presumably for aggregate required during the building of the plant and road network. Some informal disposal of rubble and coarse ash began as a means of filling the pits. In 1991, a formal permit application process for a disposal site was initiated. A Class II permit was issued in 1993.

Sasol Synfuels is situated on the Remainder Portion of the farm Driehoek 275 IS. The Charlie 1 Landfill site is located 1.3 km north of the Sasol Synfuels main plant area. It is located within the secondary security fence of the plant, approximately 450 m west of the Charlie 1 security gate. Figure 3 shows the landfill boundary outlined in yellow. The Charlie 1 Security Entrance is immediately east of the landfill, with the main plant access road on the east and south. A secondary road runs east-west on the northern edge of the site, along the main plant security fence. All waste delivery vehicles approach the site on this road, from the west.

Entrance to the site is midway along the northern boundary. To the west and south, the site is surrounded by open fields. To the north, beyond the road and fence lies a buffer zone of open veld that is a light aircraft landing strip. This buffer will be maintained.

2.1.2 Landfill Classification

The Charlie 1 Landfill site was issued with a permit in 1993, which was prior to the publication of the *Minimum Requirements*[1] series and GN R.636, resulting in it being classified as a Class 2 Landfill, which does not produce significant leachate (GMB$^-$).

2.1.3 Current Operations

Since the early nineties, the Charlie 1 Landfill site has been receiving general waste from the Sasol Synfuels plant. The waste streams currently received are scrap rubber, office waste, beverage tins, plastics, cardboard, wood, scrap metal, cables, building rubble, soil, insulation waste, spent catalyst, garden waste, general household and canteen waste. The average waste volume per month is approximately 16000 m³. No waste generated outside the Sasol boundary is disposed at the landfill. A contractor, ,operates the site with a staff complement of 6 on-site, including a gate clerk, 3 spotters, plant operators and 1 supervisor (*ad hoc*).

The waste volumes are not large and therefore the waste is tipped into cells, pushed by bulldozer into the end of the cell, and covered with soil or rubble. The landfill site receives comparatively large volumes of builder's rubble and excavated soils from trenching and building works on the Sasol plant. The soil and rubble is stockpiled upslope of the cells, while the waste is pushed to the back of the cell at a lower level. At the end of the day, the bulldozer is used to push down some cover material to cover the waste below. This system is suitable for the size of the operation.

Waste is reclaimed and recycled and this includes cans, plastic, wooden pallets, etc.

[1] Department of Water Affairs and Forestry [DWAF] (2005): Minimum Requirements for Waste Deposal by Landfill. In: Waste Management Series 3rd Ed.

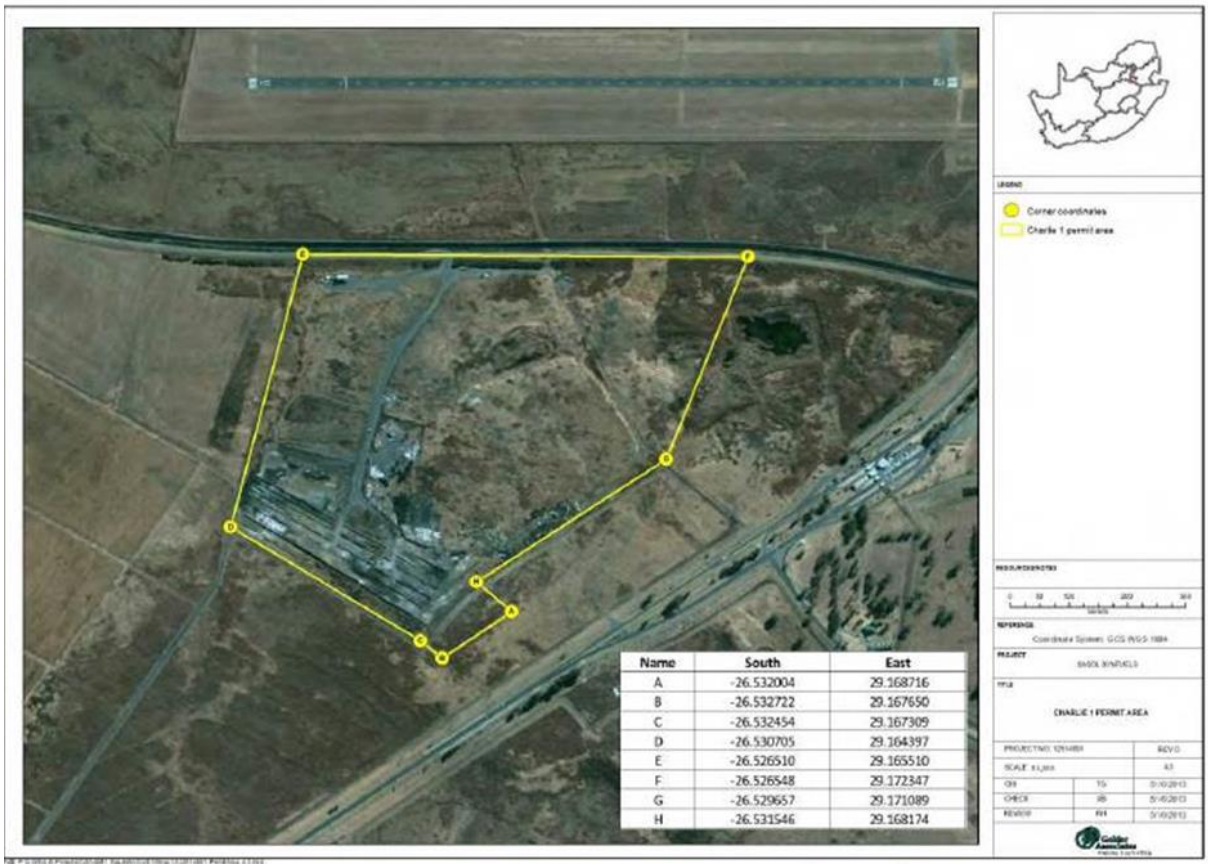


Figure 3: Charlie 1 landfill site[2]

2.1.4 Proposed Extension of the Charlie 1 Landfill Height

The Charlie 1 waste permit (B33/2/310/28/P51 dated January 1993, **Appendix C**) states no height restriction for the landfill site but does specify the allowable landfill footprint (the permitted landfill footprint is shown in Figure 3).

Sasol proposes to increase the height of the Charlie 1 Landfill by 20 m to achieve the required airspace for the remaining life of the landfill. The aesthetics of the landfill will be addressed, for stakeholders in general, but specifically for a number of key receptors:

- Charlie 1 Security Entrance;
- Graceland Casino and Hotel;
- Secunda Mall; and
- Secunda X66 light industrial development (under consideration).

2.1.5 Proposed Project Location

The contaminated leachate pond - CLP (±1500 m^3) and the contaminated stormwater pond - CSP (±15000 m^3) will be constructed in a pollution control pond area adjacent to the western boundary of the existing landfill site on the farm Driehoek 275 IS (Figure 4) which is located within the property boundaries of the Sasol Complex.. The overall footprint of the pollution control pond area is approximately 2 ha and Sasol

[2] Map courtesy of Golder Associates (2013) – Site extension and stormwater management for Charlie 1 Landfill.

Chemical Industries Pty Ltd is the landowner. The site details as well as landowner information is presented in Table 5.

Table 5: Site details

Pollution Control Pond Area	
Farm details:	Driehoek 275 IS Portion 43
Current Zoning	Agricultural
SG 21 digit code	T0IS00000000027500043
Landowner details:	Sasol Chemical Industries Pty Ltd
Co-ordinates (centre point):	26° 31' 38.94" S; 29° 9' 52.66" E

Figure 4: Google Earth™ image of the Charlie 1 landfill as well as proposed pollution control pond area

2.2 Contaminated Leachate Management

2.2.1 Leachate Interception and Management

Leachate onsite is formed when stormwater recharge seeps through the waste. As the Charlie 1 Landfill was not equipped with a bottom liner system, an effort must be made to intercept, collect and handle this leachate as effectively as possible to limit the potential contamination of local shallow groundwater. A dedicated leachate interception system is proposed by constructing interception “curtain” drains along the downslope boundaries (south-west and north) of the site.

The “curtain” drains along the southern, western and northern downslope boundaries of the landfill site will extend to depths varying from 2 to 5 m below surface level. The interception drain will collect leachate from

the landfill into an HDPE pipe which directs flow to a sump located in the north-west corner of the site. This sump will be constructed with two sets of manhole rings with concrete infill to prevent leachate leakage and to ensure structural integrity at this critical point of the system. Leachate is then pumped from this sump into the CLP that is lined with a geosynthetic liner system meeting regulatory requirements.

The leachate system general arrangement and proposed leachate interception drains are presented in the Figure 5 and Figure 6 respectively.

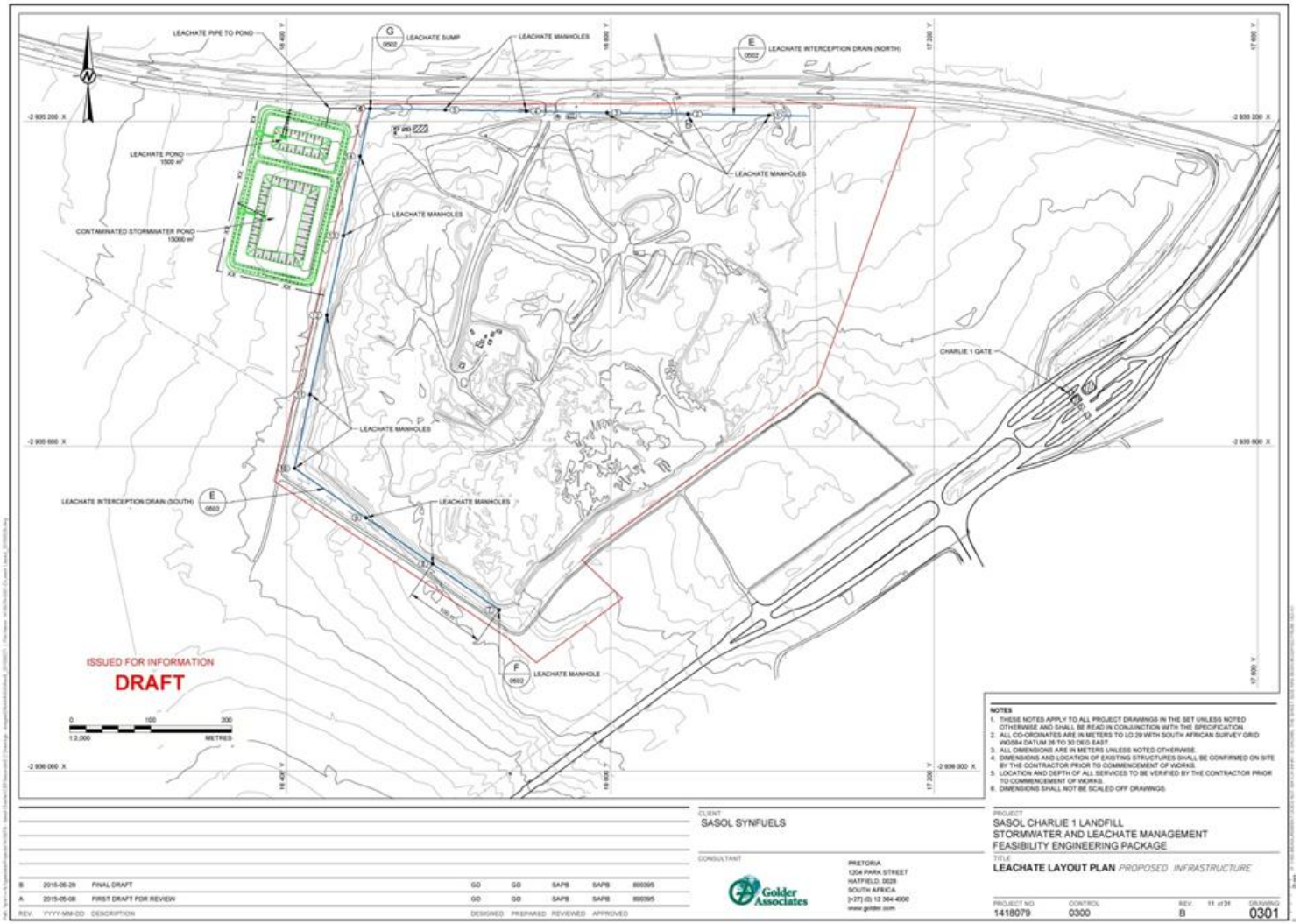


Figure 5: Leachate system general arrangement

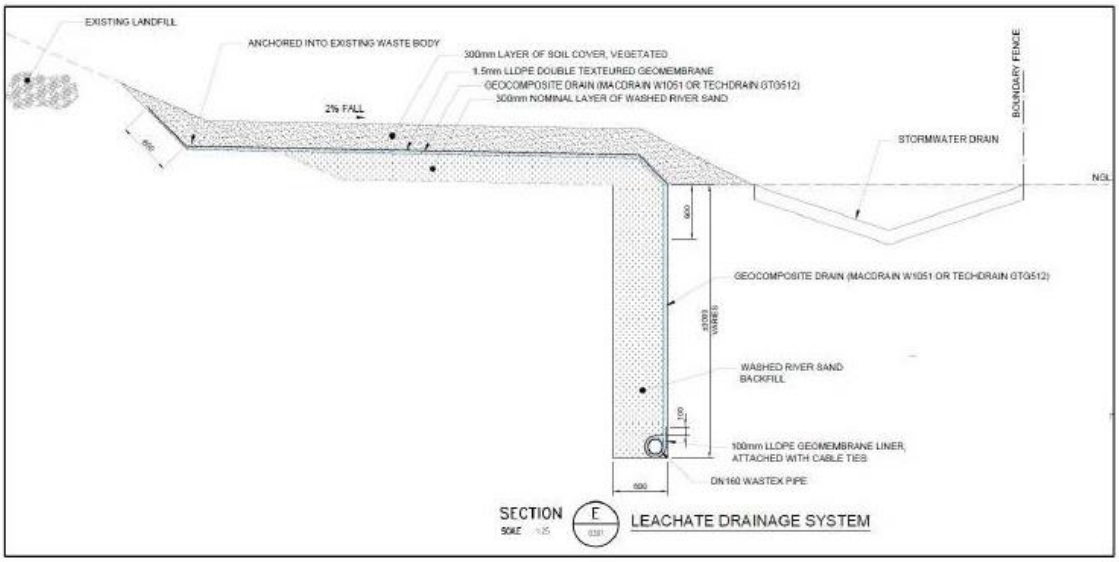


Figure 6: Proposed leachate interception drains

2.2.2 Leachate Collection, Impoundment and Handling

The CLP will have a capacity of ±1500 m^3, designed to maintain a freeboard of at least 0.5 m. To limit the frequency of abstraction from the pond to maintain/manage the in-pond water levels, the pond will be equipped with an evaporative fringe.

2.2.3 Leachate Enhanced Evaporation

The enhanced evaporation system involves the combination of a 12.5 m evaporative fringe surrounding the CLP with a micro sprayer system to spray leachate over the fringe for enhancing evaporation by at least 30%. The system has spray headers located at approximately 4.5 m intervals around the fringe, with isolation valves enabling sectors of the system to be enabled or disabled as required.

The fringe is inclined away from the pond to drain water towards a low point within the fringe from which point the water will gravitate towards an inlet point and back into the CLP. The water is therefore recirculated through the lined CLP area and over the fringe to maximise evaporation.

Factors that affect evaporation from these sprayers include wind, humidity, water temperature, water tension, temperature, dwell time and drop size. It is expected that approximately 5% to 15% of the total volume sprayed is evaporated rom the sprayer system alone.

The enhanced evaporative spray system on the CLP has been designed to evaporate approximately 10 m^3/day during optimal conditions. The pumping requirements have been split over two pumps to allow for adjustments or partial use of the system. Each pump on this system needs to supply approximately 190 l/min at 6.4 bar. An extra pump will be included in the system as stand-by. A 50 mm diameter HDPE pipe is required around the fringe with a 75 mm HDPE diameter feed pipe.

Associated with the evaporative system, is the potential issue of spray drift to the adjacent land surrounding the ponds. This drift is expected to be largely mitigated by the 12.5 m wide fringe and 1 m high berm surrounding the ponds. It is also recommended that the system be automated by linking it to an on-site weather station (included in the system costing). This setup should disable the system when wind speeds exceed a certain value to prevent drift. Further to this, the system may be split into “sectors” allowing for certain spray headers to be disabled or isolated if required.

Given that contaminated leachate will be sprayed onto the evaporative fringes, salts and other contamination have the potential to precipitate and accumulate on the fringes. As a result, a first flush system will be utilised. During rain events the salts and contamination will be mobilised. To prevent contamination to the immediate receiving environment surrounding the CLP, it is proposed that the first 10 mm of rainfall will be allowed to mobilise these accumulated salts and contamination and route it back into the CLP. Thereafter, by means of an adjustable weir system, further rainfall will be routed to the receiving environment.

2.2.4 Excess Water Abstraction (Leachate)

A dedicated gooseneck (standpipe) and pump will be installed near the CLP area to allow for the abstraction of excess water from the CLP as required. The gooseneck structure consists of a reinforced concrete base upon which a water truck or tanker is able to park while filling with water from the elevated pipe, supported by a steel structure. Given the contaminated nature of the leachate and potential increase in contamination due to enhanced evaporation, the leachate will then be transported by tanker to the Sasol water treatment works for further treatment.

Leachate will be abstracted from the CLP upon reaching 98% capacity and will be abstracted until the volume in the CLP is reduced to either 80% or 90%. It has been proposed that Sasol schedules two abstraction periods per year, abstracting a minimum of 35 m^3/day over 12 days. Ideally these periods should be scheduled immediately before and after the rain season (i.e. September/October and April/May).

2.2.5 Leachate Barrier Design

Based on leachate test sampling results, the leachate is a Type 3 waste which would typically require a Class C barrier system, the assumption has been made that the quality of the leachate will deteriorate as a result of the enhanced evaporation on the pond. This, along with the fact that this is a liquid containment facility and not a solid waste facility to which the Class C barrier system would strictly apply, a triple liner system or equivalent Class A system is proposed for the pond. The proposed liner design (refer to Figure 7), from the bottom up, is as follows:

- Subsoil drainage (Drainex DN110 HDPE slotted pipe set in herringbone trench system backfilled with sand);
- 150 mm base preparation layer, rip and recompact to 95% Proctor density;
- 200 mm compacted clay layer, compacted to 95% Proctor density;
- 1.5 mm HDPE geomembrane liner;
- Leakage detection layer (cuspated drainage sheet);
- 1.5 mm HDPE geomembrane liner;
- Leakage drainage layer (cuspated drainage sheet); and
- 2 mm HDPE geomembrane liner.

It is noted that the primary liner of a Class A barrier system would normally consist of an HDPE geomembrane overlying a compacted clay liner or geosynthetic clay liner (GCL) equivalent. However, in the case of a GCL being used, the GCL requires a permanent confining pressure of at least 35 KPa, which cannot be guaranteed in a liquid pond. Therefore the primary liner has been changed to a double geomembrane system with a leakage drainage layer between the two geomembranes, from which any leakage that occurs through the top geomembrane will be monitored, captured and returned into the leachate pond.

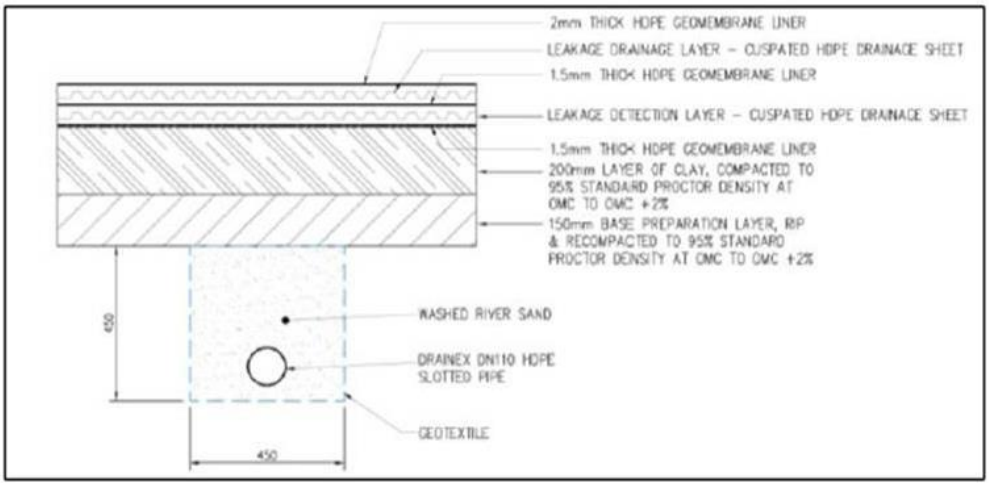


Figure 7: Proposed CLP liner system design

2.2.6 Leachate Leakage Detection and Drainage Sump

The leakage drainage and leakage detection layers described in the above barrier design, drain to a sump in CLP. The CLP has both a leakage drainage sump and a leakage detection sump due to its triple liner system. These sumps allow for collection and monitoring of leakage from the CLP.

The sumps are constructed on the CLP floor by excavating an area of approximately 4 m x 4 m, 0.6 m deep. This excavation, which is lined, is filled with stone around an HDPE drainage pipe which leads to a monitoring point (refer to Figure 8). In this case, the pipe penetrates the liner and drains to a manhole located adjacent to the pond.

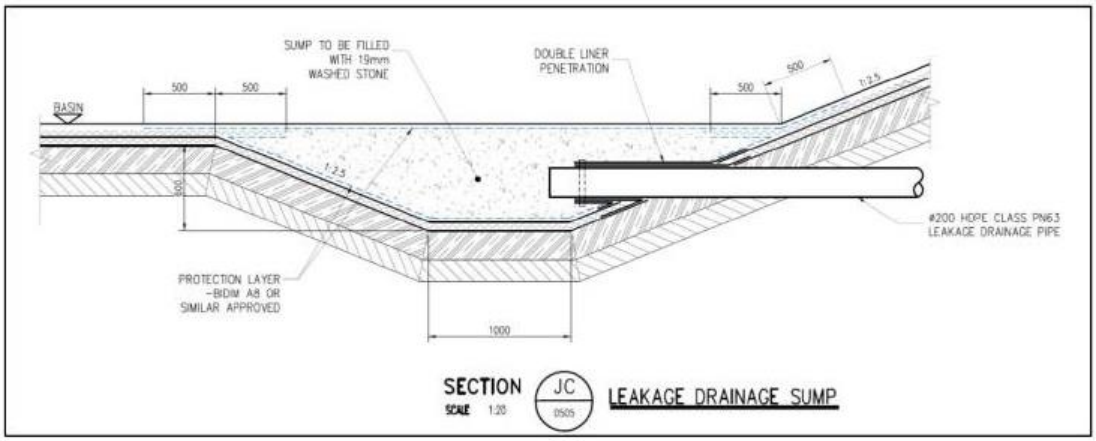


Figure 8: Pond leakage sump

The leakage monitoring sump associated with the CLP needs to be monitored on a regular basis. This monitoring includes the measurement of leakage flow rates into each monitoring manhole. These flow rates are to be compared with relevant regulatory standards to determine whether the liner installations are performing adequately. If excessive leakage is experienced, a leak detection survey may need to be performed in order to identify any problem areas within the pond and carry out repairs. Any leakage retrieved from these monitoring points is to be returned into the respective pond.

2.3 Contaminated Stormwater Management

2.3.1 Stormwater Interception and Management

Stormwater falling on the site is intercepted and prevented from leaving the site via a series of concrete v-drains along the boundary. Drains are proposed along the southern, western and northern site boundaries, while a diversion berm is to be constructed along the upslope eastern boundary of the site. This berm serves the purpose of preventing “clean” off-site run-off from entering the site and becoming contaminated (Figure 9).

The v-drains will be constructed from concrete filled geocells. This construction technique is proposed due to expected settlement associated with landfill ground conditions and the relative flexibility of the geocells. Two different sized v-drains are proposed, namely Type 1 and Type 2, based on expected flow rates in different areas:

- Type 1: 2.4 m wide, 0.6 m deep, 1:2 side slopes; and
- Type 2: 3.2 m wide, 0.8 m deep, 1:2 side slopes.

Type 1 drains will be used for the northern channel and the south-eastern channel while Type 2 will be used for the south-western drain.

2.3.2 Stormwater Collection, Routing and Impoundment

As described above, the stormwater will be collected by a series of concrete v-drains. These drains work on a gravity system which direct flow to a silt trap before spilling into the CSP. Stormwater diversion structures are to be constructed at strategic locations along these drains to allow for diverting of clean run-off from rehabilitated areas away from the site. The CSP, which is also lined with a geosynthetic liner system meeting regulatory requirements, has a capacity of 15000 m^3 while maintaining a freeboard of 0.5 m at all times.

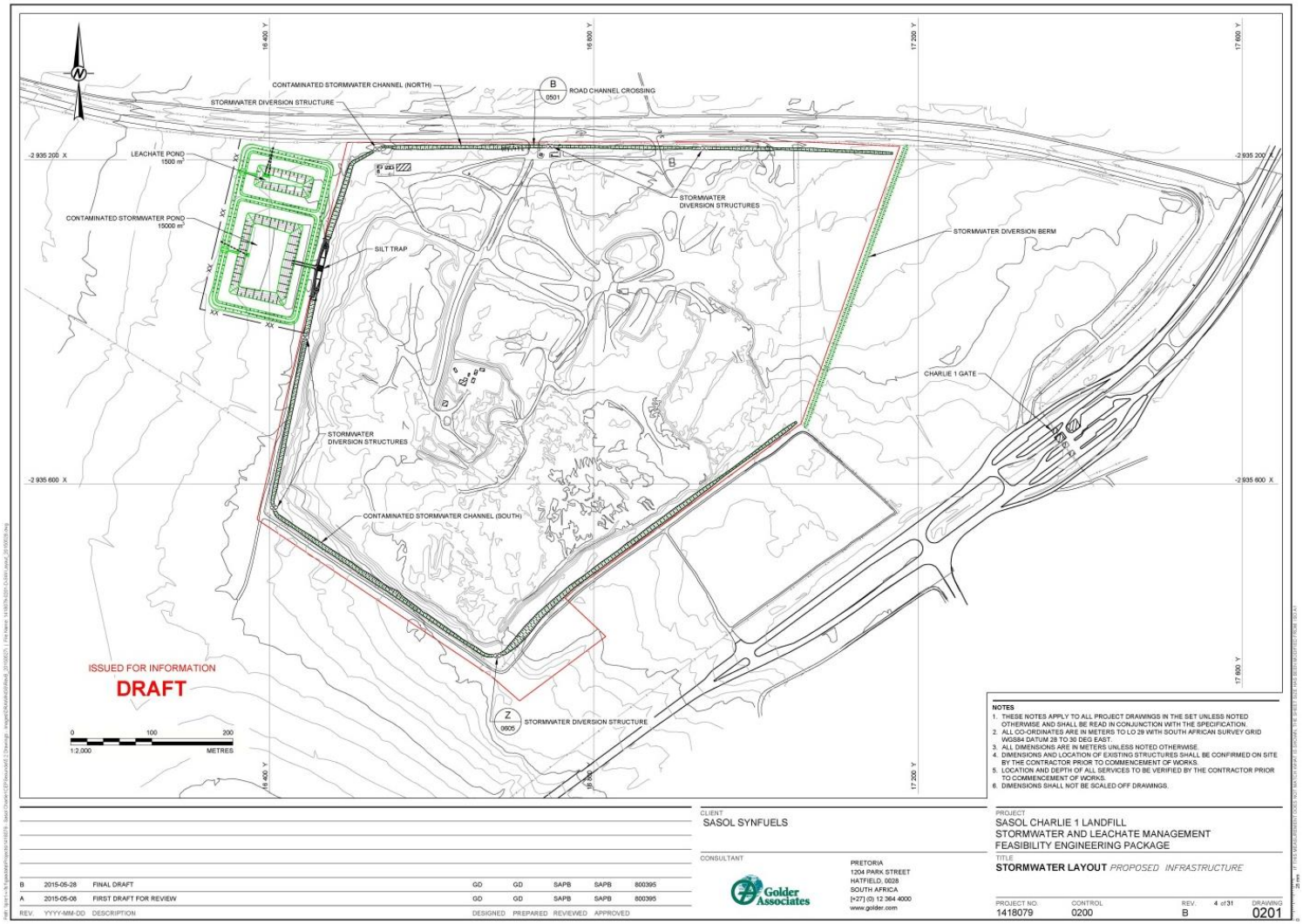


Figure 9: Stormwater system general arrangement

2.3.3 Stormwater Enhanced Evaporation

The enhanced evaporation system involves the combination of a 12.5 m evaporative fringe surrounding the CSP with a micro sprayer system to spray stormwater over the fringe for enhancing evaporation by at least 30%. The system has spray headers located at approximately 4.5 m intervals around the fringe, with isolation valves enabling sectors of the system to be enabled or disabled as required.

The fringe is inclined away from the pond to drain water towards a low point within the fringe from which point the water will gravitate towards an inlet point and back into the CSP. The water is therefore recirculated through the lined CSP area and over the fringe to maximise evaporation.

Factors that affect evaporation from these sprayers include wind, humidity, water temperature, water tension, temperature, dwell time and drop size. It is expected that approximately 5% to 15% of the total volume sprayed is evaporated rom the sprayer system alone.

The enhanced evaporative spray system on the CSP has been designed to evaporate approximately 30 m^3/day during optimal conditions. The pumping requirements have been split over two pumps to allow for adjustments or partial use of the system. Each pump on this system needs to supply approximately 317 l/min @ 6 bar. An extra pump will be included in the system as stand-by. A 63 mm diameter HDPE pipe is required around the fringe with a 110 mm HDPE diameter feed pipe.

Associated with the evaporative system, is the potential issue of spray drift to the adjacent land surrounding the ponds. This drift is expected to be largely mitigated by the 12.5 m wide fringe and 1 m high berm surrounding the ponds. It is also recommended that the system be automated by linking it to an on-site weather station (included in the system costing). This setup should disable the system when wind speeds exceed a certain value to prevent drift. Further to this, the system may be split into “sectors” allowing for certain spray headers to be disabled or isolated if required.

Given that contaminated stormwater will be sprayed onto the evaporative fringes, salts and other contamination have the potential to precipitate and accumulate on the fringes. As a result, a first flush system will be utilised. During rain events the salts and contamination will be mobilised. To prevent contamination to the immediate receiving environment surrounding the CSP, that the first 10 mm of rainfall will be allowed to mobilise these accumulated salts and contamination and route it back into the CSP. Thereafter, by means of an adjustable weir system, further rainfall will be routed to the receiving environment.

2.3.4 Excess Water Abstraction (Stormwater)

A dedicated gooseneck (standpipe) and pump will be installed near the CSP area to allow for the abstraction of excess water from the CSP as required. It has been proposed that Sasol schedules an abstraction once a year, abstracting 50 m^3/day over 4 days, immediately before and after the rain season (i.e. September/October and April/May). Stormwater contained in the CSP should be tested in the Basic Engineering Phase to determine where it will be discharged.

2.3.5 Stormwater Barrier Design

Based on the assumption that contaminated stormwater is of a significantly lower contamination level than the leachate, the following liner system design is proposed for the contaminated stormwater pond, which is equivalent to a Class B landfill barrier system. The proposed liner system comprises the following layers (refer to Figure 10), from bottom upwards:

- Subsoil drainage (Drainex DN110 HDPE slotted pipe set in herringbone trench system backfilled with sand);
- 150 mm base preparation layer, rip and recompact to 95% Proctor density;
- 200 mm compacted clay layer, compacted to 95% Proctor density;

- 1.5 mm HDPE geomembrane liner;
- Leakage detection layer (cuspated drainage sheet); and
- 2 mm HDPE geomembrane liner.

As with the leachate barrier design (Section 2.2.5), the primary liner consists of a double geomembrane system.

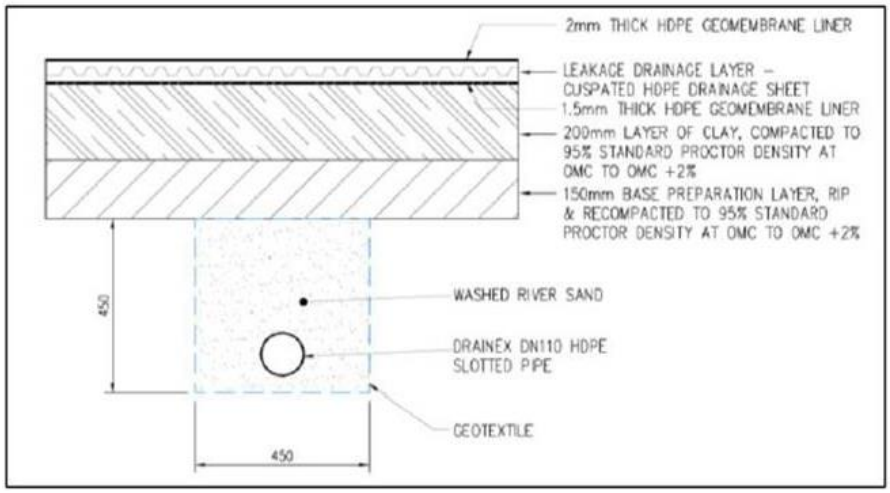


Figure 10: CSP liner system design

2.3.6 Stormwater Drainage Sump

The CSP has a leakage drainage sump while the CLP has both a leakage drainage sump and a leakage detection sump due to its triple liner system. The sump allows for collection and monitoring of leakage from the CSP.

The sump is constructed on the CSP floor by excavating an area of approximately 4 m x 4 m, 0.6 m deep. This excavation, which is lined, is filled with stone around an HDPE drainage pipe which leads to a monitoring point (refer to Figure 8 above). In this case, the pipe penetrates the liner and drains to a manhole located adjacent to the pond.

The leakage monitoring sump associated with the CSP needs to be monitored on a regular basis. This monitoring includes the measurement of leakage flow rates into each monitoring manhole. These flow rates are to be compared with relevant regulatory standards to determine whether the liner installations are performing adequately. If excessive leakage is experienced, a leak detection survey may need to be performed in order to identify any problem areas within the pond and carry out repairs. Any leakage retrieved from these monitoring points is to be returned into the respective pond.

2.4 Landfill Conceptual Development Plan

The conceptual development plan describes the proposed waste placement/deposition strategy to optimise operations and site life at the Charlie 1 Landfill site. Although the Charlie 1 Landfill has no clearly defined waste cells, the development plan has split the landfill site up into six separate areas.

The following general rules of sanitary landfilling (from the Minimum Requirements Series) should be followed during each of the steps described in the deposition sequence:

- Waste must be compacted. This is best achieved by spreading waste into thin layers and compacted with a landfill compactor; and

- Daily cover is to be applied at the end of each working day. The compacted thickness of this layer should be approximately 150 mm. Current incoming quantities of cover material at the Charlie 1 Landfill are more than sufficient to maintain a 1:5 (cover : waste) ratio. Surplus material is to be stockpiled on site for use in interim/final capping.

2.4.1 Proposed Methods of Landfilling

It is proposed that the standard cell operation method (Figure 11), as per the Minimum Requirements, should be used at the Charlie 1 Landfill[3]. The standard cell operation method requires the formation of smaller cells within the larger cell or area being utilised. The smaller cells are to be constructed by forming 1.5 m to 2 m high berms, constructed from soil, rubble or waste (covered). The working face (active part of the landfill where waste is deposited) is to be kept as small as possible for control and covering purposes, however, it should be wide enough to avoid traffic congestion. There should always be sufficient cell capacity to accommodate at least one week's waste. Waste should be deposited at the bottom of the working face and worked up a 1 in 3 slope. Cover material may then be deposited at the top of the cell during the day and extended to cover the working face at the end of the day.

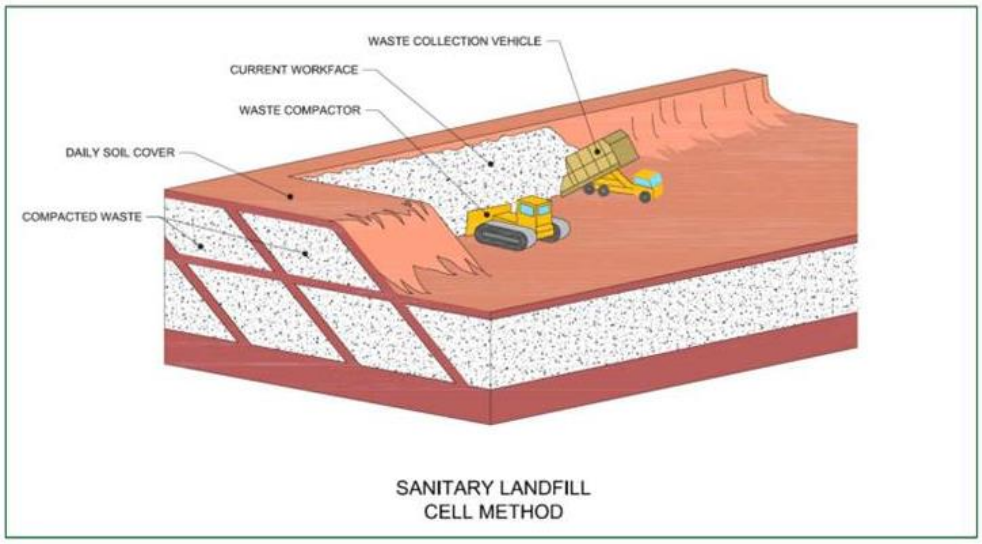


Figure 11: The standard cell operation method

A wet weather cell is to be formed close to the entrance of the larger cell/area in use. This cell is for use during or immediately after abnormally wet conditions and must have sufficient capacity to accommodate one week's waste. The wet weather cell should be operated in the same manner as the standard cell operation method. The wet weather cell shall operate on a surface which is of coarse material and well drained, such as builders' rubble, to ensure vehicle access in extreme wet conditions.

2.4.2 Cover Material Stockpile

High volumes of topsoil and other soils are received by the Charlie 1 Landfill; however the regularity of this inflow is unpredictable. For this reason it is proposed that separate stockpiles of cover material and topsoil be maintained on site. In this case, topsoil and cover material are defined as follows:

- Topsoil – clean, uncontaminated soil that is able to support vegetation growth and can therefore be used as final or interim cover; and

[3] Golder Associates (2015). Sasol Chemical Industries (Pty) Ltd: Feasibility Engineering Package (FEP) for the Stormwater and Leachate Management of Charlie 1 Landfill. Report Number: 1418079-13574-1.

- Cover material – mixed soil and construction rubble that would not normally support vegetation growth, but could however be used for daily cover operations as well as for interim cover material. Potential cover material should be scrutinised to ensure that it is not contaminated with hazardous substances such as hydrocarbons or the like, which would render it unsuitable for use on a general waste landfill.

The locations of these stockpiles should be strategically placed in order to optimise operations. It is recommended that the cover material stockpile be a "moving" stockpile located on or immediately adjacent to the active landfill area (refer to the areas specified in the deposition sequence), in close proximity to the working face. The topsoil stockpile should be located on a "clean" area of the site for use as interim of final cover.

The approximate volumes of interim/final cover required for each "Area" described in the deposition sequence are presented in Table 6. This volume should be maintained in the stockpile when the relevant landfill area approaches capacity (in this case, capacity refers to the end of the relevant phase of development as indicated in the deposition sequence).

Table 6: Interim/final cover volumes

Area	Required volume (m^3)
1	20000
2	18000
3	20000
A	18000
B	15000
C	10000

2.4.3 Proposed Deposition Sequence

The proposed deposition sequence begins with the shaping and interim covering of the southern half of the Charlie 1 Landfill while deposition continues on the northern half. As cells are covered, stormwater diversions may be implemented to divert clean run-off away from the site. Operational or uncovered cells will direct the contaminated run-off to the CSP.

Cells will become operational in an anti-clockwise direction, with the previously landfilled area being temporarily or permanently capped.

The proposed deposition sequence is provided in Section 15.5 of the Feasibility Engineering Package (**Appendix D**).

2.5 Fencing

A 1.8 m high perimeter fence surrounding the ponds area has been included in the design. The landfill site itself only requires a 1.2 m high perimeter fence, however it is noted that the ponds are liquid containment facilities which pose a potential health and safety risk. For this reason the fence height was increased to 1.8 m for the ponds area. The fence surrounding the ponds and landfill area is to be regularly inspected for damage and timeously repaired in order to restrict unauthorised access.

2.6 Rehabilitation

Interim cover is to be implemented by means of a 300 mm thick layer of soil / cover material.

Based on the fact that the current site is not equipped with bottom liners, the final capping requirements may involve a more robust, impermeable layer due to leachate generation.

The proposed capping design from the bottom up is as follows (refer to Figure 12):

- Compacted waste body;
- DN75 Drainex pipe for gas drainage within waste surface layer shaped and levelled;
- Geocomposite drain;
- 3 x 150 mm compacted clayey soil layers; and
- 150 mm top soil, grassed.

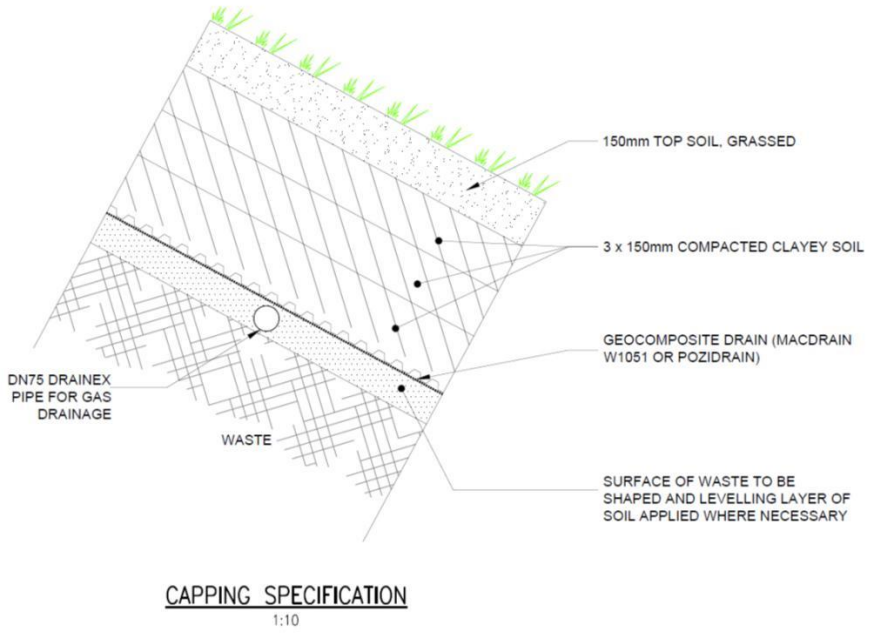


Figure 12: Final rehabilitation design

3 PROJECT ALTERNATIVES

In terms of the EIA Regulations (2014) GN R.982, Appendix 2: Section 2 (h) (i) all alternatives are required to be considered as part of the environmental investigations. In addition, the obligation that alternatives are investigated is also a requirement of Section 24(4) of the National Environmental Management Act (No 107 of 1998) (as amended). An alternative in relation to a proposed activity refers to the different means of meeting the general purpose and requirements of the activity (as defined in GN R.982 of the EIA Regulations, 2014), which may include alternatives to:

a) The property on which or location where it is proposed to undertake the activity – **Section 3.1**
b) The type of activity to be undertaken – **not applicable to this study**
c) The design or layout of the activity – **Section 3.2**
d) The technology to be used in the activity – **not applicable to this study**
e) The operational aspects of the activity – **not applicable to this study**
f) The option of not implementing the activity – **Section 3.3**

3.1 Site Alternatives

A site selection analysis was conducted in the Pre-Feasibility and Feasibility Phases for the proposed project to determine the site location of the pollution control pond area. Table 7 provides a description of the various alternatives considered and associated advantages and disadvantages.

Option 1 is the preferred location for the ponds as it is located at the lowest point topographically, allowing for simpler and cost effective implementation of the ponds by minimising pumping and earthworks requirements. This alternative also allows for expansion of the landfill to the maximum footprint as authorised, increasing the available airspace and hence remaining operation life.

Table 7: Site alternative options, advantages and disadvantages for the proposed project

Site Alternative Options	Location	Advantages	Disadvantages
Option 1 (Preferred) The location of the ponds in Option 1 is outside the property of the landfill, immediately adjacent to the north-western boundary.		▪ Situated at the closest low point to the Charlie 1 Landfill site. ▪ All surface water drainage can gravitate to this point, therefore no pumping is needed. ▪ Site capacity is maximised for landfilling. ▪ The ponds are positioned in the corner of the adjacent property. Therefore the landfill space is used optimally by utilising the minimal footprint. ▪ Easy access from the gravel road to the north of Charlie 1 Landfill. New roads will not have to be developed. ▪ Ground is relatively level and clear, making construction economical and simpler. ▪ There is no undermining at this proposed location that may influence geotechnical stability.	▪ Rezoning may be required.

Site Alternative Options	Location	Advantages	Disadvantages
Option 2 The location of the ponds in Option 2 is within the property boundary of the Charlie 1 Landfill. The ponds are located in the north-western corner of the landfill area. A large part of this location has already been landfilled, with some small structures also existing.		▪ No rezoning required purely on the basis that it is located within the bounds of the existing Charlie 1 permitted landfill footprint.	▪ Ponds are located on higher ground than the collection systems. This means that the stormwater will need to be collected and pumped upstream into the ponds, which will have cost implications. Pumping of stormwater run-off invariably poses challenges. ▪ The area is not level and will require additional earthworks. The process of levelling and clearing will also involve the moving and "re-landfilling" of waste. Thereby reducing the landfill capacity of Charlie 1 Landfill. ▪ Airspace loss at the landfill. ▪ Although not expected to be of concern, the geotechnical stability will need to be confirmed due to undermining at the proposed location. ▪ Limited surface infrastructure e.g. shed will have to be removed and relocated to other portions of the landfill site which will have an influence on cost.

Site Alternative Options	Location	Advantages	Disadvantages
Option 3 The location of the ponds in Option 3 is in the south east corner of the Charlie 1 Landfill site, inside the landfill property. A large part of this location has already been landfilled, although a section of the eastern extent is currently open.		▪ No rezoning required purely on the basis that it is located within the bounds of the existing Charlie 1 permitted landfill footprint. ▪ A large section of the proposed location is relatively level. ▪ This option presents the lowest loss of landfill capacity while keeping the ponds on the landfill property.	▪ Surface water will not gravitate to the pond location. Pumping, along with the construction of a collection sump will be required at a cost. The pumping requirements in this case, will be somewhat greater than those of Option 2. ▪ The process of levelling and clearing a small section of this location will involve the moving and "re-landfilling" of waste. Thereby reducing the landfill capacity of Charlie 1 Landfill. ▪ Airspace loss at the landfill site. ▪ New service roads would have to be constructed to the pond area. ▪ Although not expected to be of concern, the geotechnical stability will need to be confirmed due to undermining at the proposed location.
Option 4 The location of the ponds in Option 4 is in the north east corner of the site, within the boundary of the landfill property. A section of the ponds covers a currently landfilled area.		▪ No rezoning required purely on the basis that it is located within the bounds of the existing Charlie 1 permitted landfill footprint. ▪ A large section of the proposed location is relatively level. ▪ There is no undermining at this proposed location that may influence geotechnical stability.	▪ Surface water will not gravitate to the pond location. Pumping, along with the construction of a collection sump will be required at a cost. The pumping requirements in this case, will be somewhat greater than those of Option 2. ▪ The process of levelling and clearing a small section of this location will involve the moving and "re-landfilling" of waste. Thereby reducing the landfill capacity of Charlie 1 Landfill. ▪ Loss of airspace at the landfill.

Site Alternative Options	Location	Advantages	Disadvantages
Option 5 Option 5 involves the pumping of surface water and leachate to Sasol's sewage treatment plant. This is located approximately 2.5 km south west of the facility and would include a pipeline with a minimum of two road crossings and a river crossing.		▪ No rezoning required, (allowing for a quicker approval process). ▪ EIA and other relevant licencing for ponds are not required. ▪ Site capacity is maximised for landfilling (no airspace loss). ▪ All surface water drainage can gravitate to this point. ▪ Cost saving by not constructing the new ponds.	▪ Pipeline with large pumps would need to be constructed at a cost. ▪ Relevant licencing would be required for the pipeline (which includes at least two road crossings and a river crossing). This could be mitigated by using a pipeline not exceeding 360 mm, constructed within the road servitude. ▪ Mixing of contaminated surface run-off with potentially highly contaminated wastewater.
Option 6 Option 6 is essentially a combination of Options 1 and 5. It includes a leachate sump, located at an appropriate location along the lower western boundary of the site, which will collect leachate. The leachate will then be pumped from this sump to the sewage treatment plant as in Option 5. The leachate will add a small additional waste load to the large sewage stream at the sewage treatment plant. A dedicated stormwater dam will collect the relatively clean run-off from the site, which will be located outside the		▪ Potentially no rezoning required, allowing for a quicker approval process. ▪ EIA may not be required, if General Authorisation route may be taken for the dam. Sump does not constitute a "hazardous lagoon". ▪ Site capacity is maximised for landfilling (minimal airspace loss). ▪ Situated at the closest low point to the Charlie 1 Landfill, therefore all surface water drainage can gravitate to this point. ▪ Liner requirements for the new stormwater pond are likely to be significantly reduced since no leachate will enter the pond. ▪ Easy access from the gravel road to the north of Charlie 1. New roads will not have to be developed. ▪ Ground is relatively level and clear,	▪ Pipeline with pumps would need to be constructed at a cost for leachate routing, however much less than pumping stormwater. ▪ Relevant licencing would be required for the pipeline (which includes at least two road crossings and a river crossing). This could be mitigated by using a pipeline not exceeding 360 mm, constructed within the road servitude. In all likelihood the pipeline will be less than 100 mm in diameter.

Site Alternative Options	Location	Advantages	Disadvantages
property boundary, in the north-western corner, as in Option 1.		making construction economical and simpler. ▪ There is no undermining at this proposed location that may influence geotechnical stability.	

3.2 Design/Layout Alternatives

3.2.1 New Landfill

In 2012, SRK Consulting undertook a Pre-feasibility Study for a new co-disposal landfill for general and hazardous waste streams to be generated by the Synfuels over a 40 year operational life. Based on the results of the investigations undertaken, the following conclusions were drawn:

- A Class A (H:H) waste and Class C (G:L:B) disposal facility would be required in terms of legislation, waste streams, the size of the waste stream and the potential for leachate generation.
- Through a site selection matrix and a fatal flaw elimination assessment, the most preferred landfill site was identified to be next to Charlie 1. However, the waste load projections and conceptual design indicated that the single site footprint size available will not be large enough to accommodate waste for the expected 40 year period. This would indicate a preferred option of combining the development of a new site adjacent to Charlie 1 with the extension of the life of Charlie 1.
- To develop a co-disposal landfill would thus require approximately R364 million capital investment excluding operational costs.

3.2.2 Pollution Control Dam vs. Contaminated Leachate and Stormwater Ponds

During the Pre-feasibility Phase of the project, it was proposed that a Pollution Control Dam (PCD) of approximately 16000 m^3 would be constructed. The inflow to the PCD would mainly comprise of contaminated run-off from the active landfill cells as well as contaminated shallow seepage from the overall landfill footprint area which will then be controlled within the PCD by means of enhanced evaporation. It was further proposed that the PCD will have a separate cell which would house the leachate from the leachate system, ensuring that the contaminated stormwater and the leachate never mix in the PCD.

However, during the Feasibility Phase, it was concluded that the volume of leachate expected would require a separate pond. Hence, two separate ponds viz. CLP and CSP would be required for the storage of contaminated leachate and stormwater. The sizes of the ponds are as follows:

- CLP – ±1500 m^3.
- CSP – ±15000 m^3.

3.2.3 Landfill Height Alternatives

The Charlie 1 waste permit states no height restriction for the landfill site and the landfill needs to be extended in order to cater for the increased waste disposal needs of the Sasol operations. As part of the Feasibility Phase a viewshed analysis modelling was conducted for the unscreened heights of 5, 10, 15 and 20 m. The views from three key receptors were assessed *viz*;

- Charlie 1 Gate;
- Graceland Casino and Hotel; and
- Secunda Mall.

3.3 Do-nothing Alternative

Currently, the water management system at the Charlie 1 Landfill site is not in accordance with permit conditions. Due to the promulgation of the National Environmental Management: Waste Act, 2008 [NEM:WA] (No 59 of 2008) and the Waste Classification and Management Regulations, 2013 (GN R.634) as well as GN R.635 of 2013 (National Norms and Standards for Assessment of Waste for Landfill Disposal) and GN R.636 of 2013 (National Norms and Standards for Disposal of Waste to Landfill), there is a need to improve water management at the Charlie 1 Landfill site.

Should the status quo remain then Sasol will not be able to comply with the applicable legislation, guidelines, regulations and standards and the current situation will continue which includes:

- Inadequate stormwater management around the landfill site;
- Inadequate leachate management around the landfill site; and
- Inability of the current site to meet the airspace requirements for the remaining life of the landfill.

4 PROJECT NEED AND DESIRABILITY

The subsequent section addresses the project's need and desirability according to the DEA's Guideline on Need and Desirability[4]. A number of questions are presented in the Guideline, which assists in the identification of the project's need and desirability. These key questions and answers are presented in Table 8 and further serve as confirmation that the proposed project is in line with the planning requirement of the Municipality and that reasonable measures have been taken to determine the best practicable environmental option for the proposed site.

Table 8: Project needs and desirability

Need and Desirability
1. Is the activity permitted in terms of the property's existing land use rights? No
The contaminated leachate and stormwater ponds - will be constructed in a pollution control pond area adjacent to the western boundary of the existing landfill site on the farm Driehoek 275 IS, Portion 43. The overall footprint of the pollution control pond area is approximately 2 ha and the portion of the farm is currently zoned as agriculture. Whilst the activity is not permitted in terms of the property's current zoning, the proximity of the pollution control pond area to the existing Charlie 1 Landfill site and a consolidation of impacts on the farm Driehoek, and a discretionary zoning application will be lodged with the Municipality.
2. Will the activity be in line with the planning requirements (i.e. Integrated Development Plan – IDP and Spatial Development Framework - SDF)) of the Local Municipality? Yes
According to the Govan Mbeki Local Municipality (GMLM) SDF (2014), the proposed project is located within an area that is earmarked for the expansion of Sasol and related uses. Furthermore, light industrial and/ or commercial development is ear-marked for the area along the perimeter fence to the north (current airport/airfield and surrounding areas) of the Charlie 1 Landfill and pollution control pond area. The proposed activity is therefore in line with the GMLM planning requirements.
3. Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority (i.e. is the proposed development in line with the projects and programmes identified as priorities within the credible IDP)? Yes
According to the GMLM SDF (2014), the proposed project is located within an area that is earmarked for the expansion of Sasol and related uses. The proposed land use is therefore best suited to the area selected for the development of the pollution control pond area.
4. Would the approval of this application compromise the integrity of the existing environmental management priorities for the area and if so, can it be justified in terms of sustainability considerations? No
According to the GMLM EMF the Charlie 1 Landfill is located within the Industrial / Commercial Zone and does not conflict with the GMLM EMF. It should also be reiterated that the proposed project is located in an area that has been earmarked for the expansion of Sasol and related uses (GMLM SDF) and therefore the existing environmental priorities for the area will not be compromised.
5. Does the community/area need the activity and the associated land use concerned (is it a societal priority)? (This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate.) No
The GMLM IDP indicates that there are eight landfill sites in the Municipality, however four have been decommissioned. The general wastes (scrap rubber, office waste, tins, plastics, cardboard, wood, scrap metals etc.) generated at Sasol Synfuels Plant is disposed of at the Charlie 1 Landfill site which is located in the Sasol Synfuels Complex. The expansion of the Charlie 1 Landfill height will ensure that the remaining life of the landfill is extended and general waste generated at the plant will be disposed of within the complex and is not disposed of at the four remaining municipal landfill sites placing an additional burden on these landfills. The stormwater and leachate management system proposed for the project would further assist in increasing the life of the landfill.

[4] Department of Environmental Affairs. (2014). Guideline on Need and Desirability in terms of the Environmental Impact Assessment Regulations, 2010.

Need and Desirability
Therefore, the community does not need this activity, however, indirectly, the proposed project will ensure that the existing Charlie 1 Landfill site continues to service the Sasol Synfuels Plant for the disposal of general waste.
6. Are the necessary services with adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development? Yes
The necessary services (water, electrical etc.) and adequate capacity are currently available at the existing Charlie 1 Landfill site. No additional services are needed.
7. Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)? No
The proposed project is not specifically provided for in the IDP however, the proposed area for the project is indicated in the GMLM SDF as an area for the expansion of Sasol and related uses. The proposed project will be undertaken on Sasol property within the Sasol Synfuels Complex.
8. Is this project part of a national programme to address an issue of national concern or importance? No
The proposed project does not form part of a National programme. However, through the development of a pollution control pond area, the contaminated stormwater run-off and leachate will be intercepted, collected and treated in ponds to ensure an effective water management system at the Charlie 1 Landfill site preventing risks of contamination to water resources as well as potential health risks.
9. Do location factors favour this land use (associated with the activity applied for) at this place? (This relates to the contextualisation of the proposed land use on this site within its broader context.) Yes
As indicated in Point 2 above, the proposed project is located within an area that is earmarked for the expansion of Sasol and related uses. Furthermore, the project will ensure the effective management of contaminated stormwater and leachate, generated at the Charlie 1 Landfill site as well as increase the height of the landfill that will extend the life of the facility.
10. Is the development the best practicable environmental option for this land/site? Yes
A site selection analysis was conducted in the Pre-Feasibility and Feasibility Phases for the proposed project to determine the site location of the pollution control pond area. Having considered the advantages and disadvantages for the six site alternatives options as well as the option of creating a new co-disposal facility, the current site (Option 1) is the preferred location as it is located at the lowest point topographically, allowing for simpler and cost effective implementation of the contaminated stormwater and leachate ponds by minimising pumping and earthworks requirements. This site also allows for expansion of the landfill creating the required airspace for the its remaining operational life.
11. Will the benefits of the proposed land use/development outweigh the negative impacts of it? Yes
Should the Status Quo remain at the Charlie 1 Landfill site, then Sasol will not be able to comply with the National Environmental Management: Waste Act (No 59 of 2008) and Regulations (GN R.634-636) and the current situation will continue which includes: inadequate stormwater management around the landfill site; inadequate leachate management around the landfill site; and an inability of the current site to meet the airspace requirements for the remaining life of the landfill.
12. Will the proposed activity/ies contribute to any of the 17 Strategic Integrated Projects (SIPS)? No
Not applicable.
13. How does the project fit into the National Development Plan for 2030?
According to the National Development Plan 2030, water is a strategic resource critical for social and economic development and there is growing concern about the potential impact of water-related risks. There is an urgent need for a coherent plan to ensure the protection of water resources and the environment in the Mpumalanga Highveld coalfields. Management of South Africa's limited water resources must become more effective. This includes involving users so that they understand and can respond to emerging constraints; systematic monitoring to ensure effective water-supply planning, development and operation; and regulating water's various uses (including for disposal of wastewater) to ensure sustainability. This proposed project is therefore in line with the objectives, presented above as it will ensure that potential impact to surface and groundwater resources are not contaminated by the Charlie 1 Landfill site.

Need and Desirability
14. Have the general objectives of Integrated Environmental Management as set out in section 23 of NEMA have been taken into account. Yes
The EIA study for the proposed project, had the following key objectives: ▪ Undertake an assessment of the social and biophysical environments of the affected area by the proposed project; ▪ Undertake a detailed assessment of the site alternatives in terms of environmental criteria including the rating of significant impacts as well as cumulative impacts (Section 9); ▪ Identify and recommend appropriate mitigation measures (included in **Appendix I**- EMPr) for potentially significant environmental impacts; and ▪ Undertake a fully inclusive public participation process to ensure that Interested and Affected Party (I&AP) issues and concerns were recorded and commented on and addressed in the EIA process (refer to **Appendix E**). All of these objectives have been met and this has culminated in the formulation of an Environmental Impact Statement by the EAP.
15. Describe how the principles of environmental management as set out in section 2 of NEMA have been taken into account.
▪ Regulatory and statutory compliance: the objectives of the proposed project are to ensure compliance with applicable legislation, guidelines, regulations and standards. Should the status quo prevail, there will inadequate stormwater management around the landfill; inadequate leachate management around the landfill site; and the inability of the current site to meet the airspace requirements for the remaining life of the landfill. ▪ Environmentally: The results of the impact assessment indicate that the most significant impacts as a result of the proposed project would include impacts on geohydrology, hydrology and visual. These impacts can be successfully mitigated through the measures and recommendations proposed by the various specialist disciplines and the EMPr (refer to Section 8 and **Appendix I**). ▪ Public Participation (PP) - One of the general objectives of integrated environmental management laid down in Section 23(2)(d) of NEMA is to "ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment". A comprehensive PP process has been undertaken for the project (refer to **Appendix E**) that started during the Scoping Study and carried through to the EIA Study, to meet this objective.

5 LEGISLATION

In order to protect the environment and ensure that this development is undertaken in an environmentally responsible manner, there are a number of significant pieces of environmental legislation that will need to be complied with. They include the following:

5.1 National Environmental Management Act (No 107 of 1998)

The National Environmental Management Act (No 107 of 1998) [NEMA] as amended provides the overarching legislative framework for environmental governance in South Africa. Several Specific National Environmental Management Acts (SEMAs) have now been promulgated, all of which fall under the overarching NEMA (discussed below). The point of departure of NEMA is a set of National Environmental Management Principles that inform any subsequent environmental legislation, implementation of that legislation and formulation and implementation of environmental management plans at all levels of government.

NEMA gives expression to the Bill of Rights, within the Constitution of South Africa (No 108 of 1996), which states that everyone has a right to a non-threatening (safe and healthy) environment and requires that reasonable measures are applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development. These principles are embraced in NEMA and given further expression.

5.1.1 EIA Regulations (2014)

In December 2014, the new EIA Regulations were promulgated in order to revise the procedure and criteria relating to environmental authorisations for the commencement of activities in order to avoid detrimental impacts on the environment or, where it cannot be avoided, to mitigate and effectively manage these impacts and optimise positive environmental impacts. These Regulations and a revised set of Listed Activities (Listing Notices 1, 2 and 3) came into force on 08 December 2014.

The proposed project does not trigger any EIA Regulation (2014) listed activities.

5.2 National Environmental Management: Waste Act (No 59 of 2008)

The National Environmental Management: Waste Act (No 59 of 2008) and Regulations, reforms the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures; to provide for the licencing and control of waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith.

On 03 July 2009, under section 19 (1) of the National Environmental Management: Waste Act (No 59 of 2008), a list of waste management activities (GN 921) which have, or are likely to have a detrimental effect on the environment were published in November 2013. No person may commence, undertake or conduct a waste management activity listed GN 921 unless a licence is issued in respect of that activity. GN 921 makes reference to three categories of licencing i.e. Category A, B and C. Category A activities require a Basic Assessment, Category B activities require a full scoping and EIA. Category C activities do not require a Waste Management Licence but must be registered with the Competent Authority and must comply with relevant requirements or standards determined by the Minister.

This list of applicable waste activities requiring a Waste Management Licence for this project, in terms of the NEM: WA is presented in Table 9.

Table 9: Listed activities according to Category A and B of NEM:WA, GN 921

Category & Activity	Description	Applicability
Category A, 13	The expansion of a waste management activity listed in Category A or B of this Schedule which does not trigger an additional waste management activity in terms of this Schedule.	The footprint of the landfill will be increased to allow for the construction of the contaminated leachate and contaminated stormwater ponds.
Category B, 1	The storage of hazardous waste in lagoons excluding storage of effluent, wastewater or sewage.	The storage of hazardous waste i.e. contaminated leachate and contaminated stormwater generated from the Charlie 1 Landfill, in ponds, adjacent to the existing landfill site. The proposed pond size is as follows: Contaminated leachate pond – 1500 m^3 and contaminated stormwater pond – 15000 m^3.
Category B, 5	The treatment of hazardous waste in lagoons, excluding the treatment of effluent, wastewater or sewage.	The contaminated leachate and stormwater, would undergo enhanced evaporation in the ponds, the latter is considered a form of treatment.
Category B, 10	The construction of a facility for a waste management activity listed in Category B of this schedule (not in isolation as associated waste management activity).	The construction of the contaminated leachate pond and contaminated stormwater pond to ensure effective management of leachate and stormwater generated from the Charlie 1 Landfill site.

The project is also required to comply with the Waste Classification and Management Regulations, 2013 (GN R.634) as well as GN R.635 of 2013 (National Norms and Standards for Assessment of Waste for Landfill Disposal) and GN R.636 of 2013 (National Norms and Standards for Disposal of Waste to Landfill).

5.3 National Water Act (No 36 of 1998)

The National Water Act (NWA) is a legal framework for the effective and sustainable management of water resources in South Africa. Central to the NWA is recognition that water is a scarce resource in the country which belongs to all the people of South Africa and needs to be managed in a sustainable manner to benefit all members of society. The NWA places a strong emphasis on the protection of water resources in South Africa, especially against its exploitation, and the insurance that there is water for social and economic development in the country for present and future generations.

The Department of Water and Sanitation (DWS) is responsible for ensuring the protection of South Africa's water resources. In order to ensure this, the NWA provides decision-making tools to achieve a balance between protecting and utilising water resources. Water Use in South Africa is managed through a water use authorisation process, which requires that every water use is authorised by the DWS or an established Catchment Management Agency (CMA), once the water requirements for the Reserve have been determined. A water use must be licenced unless it is listed in Schedule 1, is an existing lawful use, is permissible under a general authorisation, or if a responsible authority waives the need for a licence.

Subsequent to a discussion and site visit conducted with the Department of Water and Sanitation (DWS), Solid Waste Management on 28 October 2015, it was indicated that Sasol would not require a WUL as the DWS would provide a Record of Decision to the DEA Waste Licencing Directorate that would be incorporated into the WML.

5.4 Other Relevant Acts, Guidelines, Department Policies and Environmental Management Instruments

Table 10: Legislative requirements in terms of other Acts, Policies and Plans

Legislation	Consideration
National Environmental Management: Air Quality Act (No 39 of 2004)	Potential impacts on air quality during the project life-cycle.
National Heritage Resources Act (No 25 of 1999)	Protection of heritage and archaeological resources, artefacts and graves.
National Environmental Management Biodiversity Act (No 10 of 2004) and Regulations	Potential impacts on indigenous vegetation and sensitive geographical areas triggering Listing Notice 3 activities.
Other Acts, Provincial Policies and Guidelines	
Gert Sibande District Municipality Spatial Development Framework (2009) **Gert Sibande District Municipality IDP (2012-13 – 2016-17)** **Govan Mbeki Municipality Local Municipality IDP (2014-2015)** **Govan Mbeki Municipality By-Laws** **Sasol Safety, Health and Environmental Policy**	

6 PUBLIC PARTICIPATION

One of the general objectives of integrated environmental management laid down in Section 23(2)(d) of NEMA is to "*ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment*". An inadequate and non-transparent Public Participation Process (PPP) has the potential to provide a negative decision and perception regarding the proposed project.

The EIA Regulations (2014) places a lot of emphasis on the public participation process and have been revised to contain comprehensive guidelines to involve the public in the EIA study.

The primary aims of the public participation process include:

- Meaningful and timeous participation of Interested and Affected Parties (I&APs);
- Identification of issues and concerns of key stakeholders and I&APs with regards to the proposed development, i.e. focus on important issues;
- Promotion of transparency and an understanding of the proposed project and its potential environmental (social and biophysical) impacts;
- Accountability for information used for decision-making;
- Serving as a structure for liaison and communication with I&APs;
- Assisting in identifying potential environmental (social and biophysical) impacts associated with the proposed development; and
- Inclusivity (the needs, interests and values of I&APs must be considered in the decision-making process).

The minimum requirements for public participation as contained in Chapter 6 of the EIA Regulations (2014) are contained hereunder and are discussed in detail in subsequent sections:

Public Participation Requirements according to Section 40 - 44 of GN R.982	Specific Actions to Ensure Compliance
Section 41 (2) (a) – Fixing a notice board at a place conspicuous to and accessible by the public at the boundary, on the fence of the site or any alternative site applicable to the application	The notice board according must – (a) give details of the application subject to public participation (b) state – i. whether basic assessment or scoping procedures are being applied for ii. the nature and location of the activity to which the application relates iii. where further information on the application can be obtained iv. the manner in which and the person to whom representation in respect of the application may be made The notice board must be – (c) of a size of at least 60cm by 42cm (d) Display the required information in lettering and in a format as may be determined by the competent authority
Section 41 (2) (b) – The person conducting a public participation process must give written notice to the occupiers of the site and the owner or person in control of the site; owners and occupiers of land adjacent to the site; municipal councillor; municipality; municipality having jurisdiction; and any organ of state having jurisdiction in respect of any aspect of the activity	Compile introductory letters to adjacent landowners, municipal councilor/s, municipality and organs of state
Section 41 (2) (c) & (d) – Place an advert in one local newspaper or official Gazette and or placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an	An advert will be placed in the local newspapers (the Echo and Ridge Times) to advertise the availability of the ESR and EIR for review and public meetings as well as advertising the waste management licence (once received)

Public Participation Requirements according to Section 40 - 44 of GN R.982	Specific Actions to Ensure Compliance
impact that extends beyond the boundaries of the metropolitan or district municipality	
Section 42 (1) – A proponent or applicant must ensure the opening and maintenance of a register of interested and affected parties and submit such a register to the competent authority, which register must contains the names, contact details and addresses of – (a) All persons who as a consequence of the PPP have submitted written comments or attended meetings with proponent, applicant or EAP (b) All persons who have requested the proponent or applicant in writing for their names to be placed on a register (c) All organs of state which have jurisdiction in respect of the activity to which the application relates	Comprehensive I&AP database/register will be opened and maintained
Section 43 (1) a registered I&AP is entitled to comment, in writing, on all reports or plans submitted to such party during the PPP and to bring to the attention of the proponent or applicant any issues which that party believes may be of significance to the consideration of the application, provided that the I&AP discloses any direct business, financial, personal or other interest which that party may have in the approval or refusal of the application	According to Section 40 (1) a period of 30 days is provided to I&APs to submit comments on the ESR as well as the report contemplated in regulation 32 if such reports or plans are submitted at different times
Section 43 (2) any State department that administers a law relating to a matter affecting the environment must be requested to comment within 30 days	According to Section 40 (1) a period of 30 days is provided to State Departments to submit comments on the ESR as well as the report contemplated in regulation 32 if such reports or plans are submitted at different times

6.1 Consultation with Competent Authorities

The competent authority and commenting authorities issuing decisions regarding the project as well as consultation to date are presented inTable 11 below.

Table 11: Competent and Commenting Authority associated with the Project

Authority	Role	Licence / Approval	Consultation to date
Department of Environmental Affairs (DEA)	Competent Authority for waste licencing process	Waste Management Licence	▪ Waste licence application form received on 17 August 2015 ▪ Submission of the Final Consultation ESR on 21 September 2015 ▪ Approval of the Final Consultation ESR on 07 December 2015
Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA)	Commenting Authority for waste licencing process	(Comments on the documentation, no formal approval given)	▪ Submission of the ESR on 14 August 2015 for comment
Department of Water and Sanitation (DWS)	Competent Authority for water use licencing	Water Use Licence	▪ Discussion with Kevin Legge held on - 09 July 2015 ▪ Submission of the ESR on 14 August 2015 for comment.

Authority	Role	Licence / Approval	Consultation to date
			▪ Discussion and site visit with Thya Pather (DWS Solid Waste Management)
SAHRA	Authority for protection of South Africa's cultural heritage	(Confirmation that a Heritage Assessment is needed)	▪ Heritage Request Letter submitted on 02 October 2015 ▪ Response to NID (Notification of Intent to Develop) received on 28 October 2015

6.2 Consultation with other Relevant Authorities and Key Stakeholders

Consultation with other relevant authorities and key stakeholders was undertaken through telephone calls and written correspondence in order to actively engage these stakeholders from the outset and to provide background information about the project. A list of these stakeholders is provided in **Appendix E1**.

6.3 I&AP Database

All I&AP information (including contact details), has been recorded within a database (**Appendix E1**). This database is being updated on an on-going basis throughout the project, and acts as a record of the communication/involvement process.

6.4 Identification of Interested and Affected Parties

I&APs and key stakeholders were identified during the ESS phase of the project. The identification of I&APs and key stakeholders continued in the EIA phase of the project as the PPP is a continuous process that runs throughout the duration of the EIA study.

6.5 Advertising

Advertisements on the availability of the EIR and draft EMPr for public review and the public meetings will be placed in the *Ridge Times* and *Echo* newspapers (**Appendix E2**).

6.6 Issues Trail

All issues, comments and concerns raised during the public participation process to date are included in **Appendix E3**.

A summary of the issues raised during the Scoping Study is presented in Table 12.

Table 12: Summary of issues raised during the Scoping Study

Issue raised	Response
The project must comply with the Govan Mbeki Municipality (GMM) Land Use Scheme by making application for Utility Land Use to ensure the following objectives is met in the process: to ensure that land used for service provision is appropriately located away from residential or other land uses where they detract from levels of amenity or safety; to protect residential areas, health and educational facilities	The Charlie 1 landfill is located within Sasol SA (Pty) Ltd's property and is located away from residential areas (e.g. Secunda and Embalenhle). Access to the Charlie 1 landfill is security controlled and no member of the public will be able to enter the facility without going through the Charlie 1 security entrance. Furthermore, the proposed area for the pollution control ponds will be incorporated into the

Issue raised	Response
from any potential negative impacts or health hazards and to ensure that any disruption to natural areas and watercourses by adhering to environmental management principles.	Charlie 1 permitted footprint.
The applicant should comply with legislative prescripts and by-laws related to General Work/s.	Sasol will comply with all legislation, guidelines and by-laws as identified in Chapter 5 of this report.
Is the capacity of the proposed ponds sufficient to handle the stormwater generated by a 1:50 year storm event or will Sasol create an overflow into the adjacent stream?	The landfill will be divided and operated in different sections / cells. There might be six (6) cells overall however only one cell will be operational at any given time. Deposition will only occur in that one cell and once the height has been reached, the cell will be capped and rehabilitated. There will never be an instance where run-off from the entire landfill site will be channelled to the ponds. Therefore there will be sufficient capacity in both ponds to handle a 1:50 year storm event. A landfill conceptual deposition plan is included in the FEP (**Appendix D**).
A buffer must be created between the landfill site and the Secunda Airfield.	As the Charlie 1 landfill is an existing landfill site, the existing buffer will be maintained.
Due to the fact that the height of the Charlie 1 landfill will increase, potential visual impacts could occur. What mitigation measures are proposed to deal with these impacts?	A visual impact assessment has been conducted to determine the different receptors (for example the Graceland Hotel and the Secunda Mall) and various mitigations measures have been proposed. Visual modelling has been utilised to determine where the different receptors are located and how they will be affected by the increased height of the Charlie 1 landfill. The main mitigation measure is the utilisation of vegetation / tree as a screening measure which would limit the receptor's view of the landfill. Refer to Section 8.2 and **Appendix H**.
The construction of suitable infrastructure to accommodate the newly developed environmental footprint in terms of the atmospheric pollution for the minimisation of airborne nuisance and or health impacts.	Dust generation has a potential impact on air quality at the Charlie 1 landfill site. The site's operational plan and the Environmental Management Programme (**Appendix I**) make further recommendations for the management of dust and/or any associated health impacts.
We want to bring under your attention the importance of protecting our natural resources (in this case water) for food security in future. Please be responsible in the total process of research (EIA study) as well as in putting together the ESR and Environmental Impact Assessment Report (EIR) that will be submitted to DEA.	Through the development of a pollution control pond area, the contaminated stormwater run-off and leachate will be intercepted, collected and treated in ponds to ensure an effective water management system at the Charlie 1 landfill site preventing risks of contamination to water resources as well as potential health risks.

6.7 Public Review of the Environmental Impact Assessment Report and Draft Environmental Management Programme

The EIR and draft EMPr will be made available for public review for a 30 day review period from **11 December to 01 February 2016**. All I&APs registered on the proposed project's database will be notified of the availability of the EIR and draft EMPr.

The report will be available in electronic format on the Royal HaskoningDHV's website (http://www.rhdhv.co.za/pages/services/environmental/current-projects.php). Hard copies of the report will be made available for review at the following public places:

- Secunda Municipal Library;
- Embalenhle Municipal Library;
- Offices of Royal HaskoningDHV (78 Kalkoen Street, Monument Park, Pretoria); and

- Royal HaskoningDHV website (http://www.rhdhv.co.za/pages/services/environmental/current-projects.php).

Hard copies of the reports will be forwarded to:

- Department of Water and Sanitation;
- Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA);
- Govan Mbeki Local Municipality; and
- Gert Sibande District Municipality.

6.8 Public Meeting

During the EIR and draft EMPr review period, a public meeting will be held with the broader public and community members interested in the proposed project. The public meeting will provide I&APs with the opportunity to be informed of the environmental findings as per the EIR, the mitigation measures proposed and allowing them the opportunity to raise any issues / concerns on the project.

6.9 Submission of the Final Consultation Environmental Impact Assessment Report for Decision-making

After the public review period, the Final Consultation EIR document will be finalised and submitted to DEA for review and decision-making. The DEA has 107 days to grant or refuse authorisation of the application.

6.10 Announcement of Decision

On receipt of the Waste Management Licence (WML) for the project, I&APs registered on the project database will be informed, through letters and media advertisement, within 14 days of the acquisition.

7 DESCRIPTION OF THE RECEIVING ENVIRONMENT

7.1 Topography and Land Use

The region is characterised by gently rolling hills that are broken by drainage lines, with an average elevation of 1520-1640 m above mean sea level (mamsl). The pollution control pond site is mostly flat with a slight 1° northern slope.

The Secunda area is surrounded by a number of different land uses i.e. industrial, residential, commercial and agricultural. The Sasol Synfuels plant is 1.3 km south of the proposed project area. The middle to high-income residential area of Secunda is located approximately 3 km north east of the site and includes a variety of commercial activities. In turn, the low cost housing development of Embalenhle is located 8 km north-west of the project area. Due to the highly industrialised nature of the area there is extensive infrastructural development including an extensive road and rail network.

The proposed project area is located on transformed agricultural land which is currently being used for pasture cultivation. The area surrounding the site has a mixed land use (industrial, mining and agriculture) and includes:

- Charlie 1 Landfill site;
- Open veld and light aircraft landing strip to the north;
- Old quarries and borrow pit areas to the east; and
- Agricultural areas to the west and south.

7.2 Geology

The geology of the Sasol Secunda plant area comprises sandstones, siltstones and shales of the Vryheid Formation of the Karoo Super Group sequence, which comprises a succession of alternating layers of sandstone and siltstones, intruded by dolerite sills and dykes. The Vryheid Formation consists of the following sedimentary sequences from the surface downwards[5]:

- A highly weathered zone of sandstone and/or siltstone extending to depths ranging between 4 and 30 m deep below the surface;
- A 20 m thick laminated to fine bedded siltstone/shale layer, underlying alternating layers of sandstone and siltstone - referred to as the siltstone layer;
- Of the various dolerite sills and dykes intruding the Vryheid Formation, one sill forms a prominent E-W striking feature and has a thickness varying between 5 and 25 m. This sill outcrops in the central part of the project area, and occurs approximately 24 m below the surface elsewhere. Besides this main dolerite sill, the area is intruded by other dykes and sills of which the geometries and thickness vary greatly;
- A prominent geological feature in the area is a 350 m wide, E-W striking graben (trough-fault) structure which is situated in the southern part of the Secunda Complex area; and
- A coal seam is present at a depth of approximately 100 m below surface.

[5] SRK Consulting (2012). Sasol Synfuels Co-disposal Waste Landfill Facility Pre-feasibility.

7.2.1 Shallow Geology

The shallow geology information is based on observations during test pitting procedures carried out as part of this Feasibility Study[6]. A total of 9 test pits were excavated at various points along the southern and western (downslope) boundaries of the landfill (Figure 13).

Figure 13: Test pit locations

The following is a summary of the shallow geology observed in the test pits along the western boundary of the site (Test Pits 1 to 5):

- The upper layer (varying from 0.3 m to 1.3 m depth) generally consists of loose fill such as ash or waste;
- This overlies a moist clayey silt layer (in some areas a transported back clay) approximately 1 m thick;
- Very moist or wet silty sand which varies between pits as residual/weathered sandstone/dolerite is then encountered until refusal on weather dolerite or sandstone;
- Refusal depth varies from 4.9 m in the north to 3.2 m in the south-west corner; and
- The observed seepage depth varies from 3.9 m to 0.4 m – it should also be noted that seepage assumed to be from the slopes of the landfill is present in areas on the surface.

The shallow geology observed in the test pits along the southern boundary is as follows (Test Pits 6 to 9):

- The upper layer (varying in depth from 0.6 m to 1 m) consists of moist fill or transported black clay;
- This overlies a soft, silty clay or residual clay in some areas of 1 to 2 m;
- Weathered sandstone or dolerite is encountered underneath this layer to depths of approximately 3 m;
- Refusal is encountered at depths varying from 2.2 m (Test Pit 9) to 3.2 m (Test Pit 6) on residual sandstone or hard rock dolerite (Test Pit 6); and
- Seepage depths in Test Pits 6 and 7 varied from 1.5 to 1.7 m below ground level, while no seepage was encountered in Test Pits 8 and 9.

It should be noted that caving was encountered in Test Pit 1 (located in the upper north-west corner of the site) and Test Pit 6 (south-west corner) from about 1 m depth.

[6] Golder Associates (2015) Feasibility Engineering Package (FEP) for the Stormwater and Leachate Management of Charlie 1 Landfill.

7.3 Soils

Most of the soils on the Charlie site are clays, sandy clays, sand clay loams and sandy loams. Water content from the soils in the area ranges from 28 – 47% and the average Soil Horizontal Hydraulic conductivity (K) was established as 0.0128 m/d.

During the design or assessment of any existing landfill, the hydraulic properties of soil are very important to determine the rate at which contaminated water or leachate will move downward or be retarded in the subsurface, thus quantifying the threat of groundwater contamination. The data from the soil analysis indicate that soils in the vicinity of the Charlie 1 Landfill site have a high clay content, high porosity values (associated with clays) and low horizontal hydraulic conductivity values. These factors indicate that the transport of contaminants from the site will be retarded.

7.4 Geohydrology (Groundwater) Baseline

There are two aquifer systems (upper weathered Ecca aquifer system and lower fractured rock Ecca aquifer system) on and in the surrounding area of the project site. The upper weathered Ecca aquifer system is associated with the uppermost weathered horizon, mainly comprising weathered Ecca sediments and quaternary deposits. This aquifer is directly recharged by rainfall infiltrating through the weathered zone until it reaches the underlying impermeable solid rock. Thereafter groundwater movement occurs on the contact zone between the weathered part and the underlying consolidated sediments following their slope. Where barriers exist (dykes, sill, etc.), obstructing the flow, this water is discharged on surface as fountains or springs. The aquifer has low yields (+/- 0.1 l/s) with shallow water tables. Most of the groundwater from this aquifer is discharged into surrounding rivers and streams.

Immediately below the upper weathered horizon is the lower fractured Ecca aquifer system, which is mainly composed of well-cemented sediments with little or no groundwater movement. All groundwater movement is associated with secondary structures (fractures, faults, dykes, etc.). Borehole yields in Karoo aquifers are generally low (+/- 1 l/s), with regional flow resembling flow in the porous medium. This implies that formations contain large quantities of water that cannot be released readily on a small scale.

7.4.1 Quaternary Catchment and Groundwater Flow

The Sasol Secunda area falls within quaternary catchment C12D in the Upper Vaal River catchment area, which forms a border with the Olifants River catchment. The landscape is characterised by low-gradient streams meandering over small alluvial plains.

Since groundwater elevation follows topography, groundwater flows along the site drainage pattern (i.e. north-west in the north of the site and south-west in the west and south of the site).

7.4.2 Magnetic Traverses

A magnetic survey was conducted to identify structures that leachate from the site, could potentially use as conduits or pathways. The results of the magnetic survey in the immediate western and southern regions of the Charlie 1 Landfill site indicate that no major structural features were encountered in those regions.

7.4.3 Resistivity

The resistivity method is widely used for groundwater exploration, but also used in groundwater pollution studies to determine the presence of zones saturated with highly conducting leachate. The result of the resistivity survey indicates that a contamination plume emanates from the landfill site, and it is mostly concentrated on the upper weathered soil and/or clay zone. The depth of the plume can be estimated to be

deeper closer to the landfill site and shallow moving away from the site. The contaminant plume is primarily located within the immediate vicinity of the site.

7.4.4 Hydrocensus and Water Level

Ten boreholes are monitored as part of the groundwater monitoring programme (Table 13). The monitoring frequency is twice a year (May and November) for all boreholes except REGM-98 and REGM-229, which are sampled annually (November). The variables that are measured are included in Table 14. The Secunda Airfield obtains water from the Municipality. Only Sasol boreholes are in the area.

Table 13: Boreholes monitored at the Charlie 1 landfill

BH number	Coordinates		Aquifer measured	Monitoring Purpose/Position	BH depth	BH diameter
REGM-22	26°31'37"S	29°10'13"E	Deep	Down-gradient	30	105
REGM-98	26°31'43"S	29°10'25"E	Deep	Up-gradient	30	110
REGM-213D	26°31'55"S	29°09'58"E	Deep	Down-gradient	NA	NA
REGM-214D	26°31'52"S	29°09'52"E	Deep	Down-gradient	NA	NA
REGM-215D	26°31'45"S	29°09'51"E	Deep	Down-gradient	NA	NA
REGM-216D	26°31'40"S	29°09'52"E	Deep	Down-gradient	NA	NA
REGM-228S	26°31'33"S	29°10'12"E	Shallow	Down-gradient/Background	NA	NA
REGM-228D	26°31'33"S	29°10'12"E	Deep	Down-gradient/Background	NA	NA
REGM-229S	26°31'33"S	29°10'05"E	Shallow	Down-gradient/Background	NA	NA
REGM-229D	26°31'33"S	29°10'05"E	Deep	Down-gradient/Background	NA	NA

*Deep = Fractured *Shallow = Weathered NA = Information not available

Table 14: Important variables measured

Indicators	Cations	Anions	Metals & Others
pH	Ca	Cl	Al
EC	Mg	SO_4	Mn
TDS	Na	NO_3 & NO_3 as N	Fe
Total Alkalinity	K	NH_4 as N	Si
COD		PO_4 as P	B
		F	

Figure 14: Borehole positions at the Charlie 1 landfill site

Two boreholes, REGM-22 and REGM-98, were initially monitored at this site (Figure 14). Four new boreholes (REGM-213D-216D) were introduced into the monitoring program during November 2006, and another four during 2007 (REGM- 228S&D and REGM-229S&D). REGM-98, REGM-229S&D were not monitored during the reporting period.

The water levels are all shallow (<4m – except REGM-219D & REGM 98) and have a seasonal pattern with higher levels during summer and deeper levels during winter.

Boreholes REGM-22, REGM-213D, REGM-229D&S illustrated a downward trend since May 2010 until November 2012 after which water levels started to rise again (Figure 15). Borehole REGM-98 indicates a downward trend since May 2010.

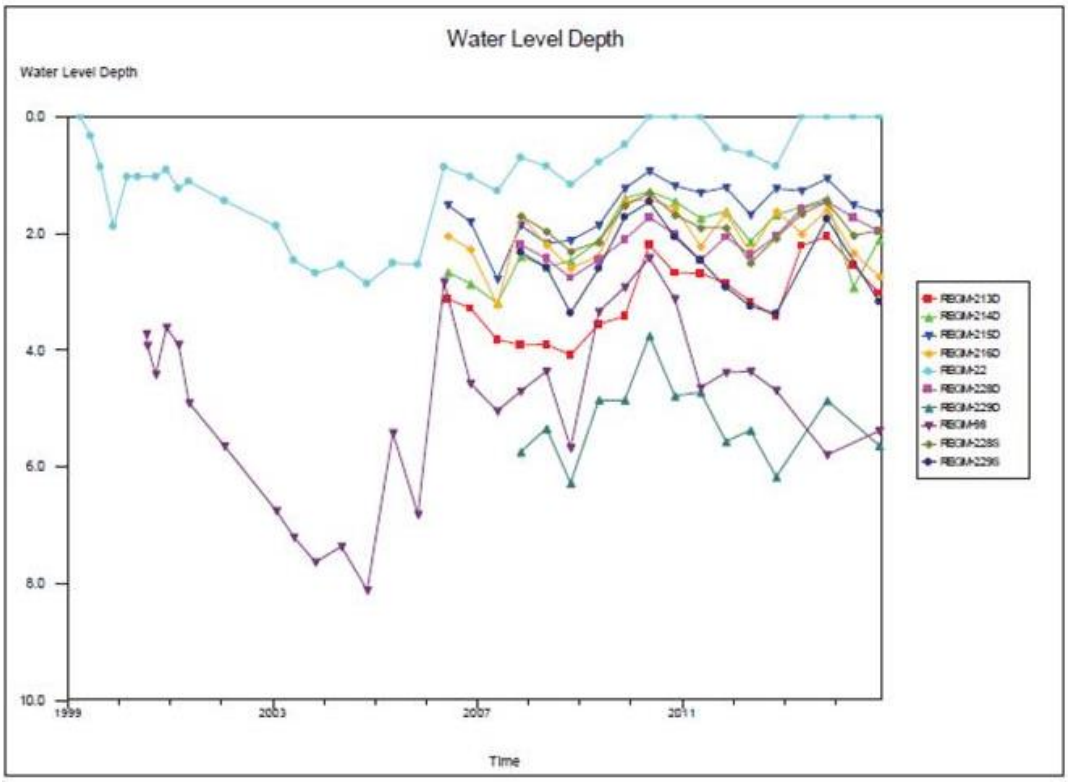


Figure 15: Water level depths at the Charlie 1 landfill

7.4.5 Water Quality

A comparison of the analysis for the November 2013 and November 2014 sampling is illustrated in Table 15 and Table 16. The criteria used for inorganic sampling is the SANS 241:2006, and for organic analysis the USEPA Standards. Inorganic water samples are classified as:

- Class I – acceptable (colour coded green)
- Class II - allowable (colour coded yellow)
- Above – not allowable (colour coded red)

The values coloured in red are not allowable for drinking standards, while those coloured in yellow classified as Class II (allowable). The water quality has not changed significantly during the year between the sampling runs.

Table 15: Chemical analysis of the Charlie 1 landfill, November 2013

Site Name	EC mS/m	pH	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	PAlk mg/L	MAlk mg/L	F mg/L	Cl mg/L	NO3(N) mg/L	PO4 mg/L	SO4 mg/L	Al mg/L	Fe mg/L	Mn mg/L	B mg/L	Si mg/L	TDS mg/L	NH4(N) mg/L
REGM-22	229	7.8	198	119	129	10	0	321	0.19	256	0.56	<1	697	0.024	0.054	0.962	0.36	16.18	1735	0.18
REGM-98	102	7.4	105	46	51	12	0	481	0.22	9	3.50	<1	76	0.021	0.040	0.016	0.03	17.49	795	0.26
REGM-213	79	8.3	40	35	81	4	0	289	0.03	71	0.14	<0.1	33	0.017	0.051	0.073	0.02	4.51	555	0.16
REGM-214	100	8.2	51	38	112	5	0	279	0.01	186	0.12	<0.1	4	0.019	0.073	0.086	0.01	6.21	678	0.12
REGM-215	83	8.3	58	51	49	4	0	289	<0.01	110	<0.05	<0.1	4	0.021	0.051	0.124	0.02	7.58	567	0.18
REGM-216	36	8.3	10	16	37	3	3	171	0.02	14	<0.05	<0.1	1	0.016	0.048	0.100	0.01	5.50	253	0.80
REGM-228D	35	8.0	16	12	29	4	0	95	0.06	39	<0.05	<0.1	27	0.019	0.066	0.008	0.09	1.86	222	0.20
REGM-228S	78	8.1	42	39	61	4	0	247	0.03	97	<0.05	<0.1	1	0.024	0.056	0.159	0.02	7.46	517	0.18
REGM-229D	21	8.6	3	4	33	3	0	98	0.02	9	<0.05	<0.1	1	0.024	0.077	0.007	0.04	1.10	151	0.28
REGM-229S	55	7.6	41	27	20	3	0	94	0.02	32	<0.05	<0.1	139	0.024	0.059	0.719	0.00	3.16	358	0.32

Table 16: Chemical analysis of the Charlie 1 landfill, November 2014

Site Name	EC mS/m	pH	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	PAlk mg/L	MAlk mg/L	F mg/L	Cl mg/L	NO3(N) mg/L	PO4 mg/L	SO4 mg/L	Al mg/L	Fe mg/L	Mn mg/L	B mg/L	Si mg/L	TDS mg/L	NH4(N) mg/L
REGM-22	242	7.8	207	117	130	11.6	0	377	<0.1	270	<0.5	<1	924	0.010	0.038	0.937	0.194	17.79	2098	0.14
REGM-98	187	7.9	110	51	45	8.9	0	444	0.40	9	0.47	<0.1	80	0.078	0.117	0.094	<0.05	17.49	753	0.11
REGM-213	58	8.1	46	22	66	4.6	0	269	0.25	59	0.05	<0.1	2	0.200	0.072	0.079	0.123	5.04	470	0.12
REGM-214	74	8.0	64	30	77	4.6	0	284	0.27	104	<0.05	<0.1	1	0.189	0.073	0.112	<0.05	6.04	571	0.10
REGM-215	77	7.9	66	53	41	4.2	0	297	0.17	100	0.18	<0.1	8	0.203	0.064	0.100	0.112	8.22	573	0.09
REGM-216	34	8.4	10	15	40	3.6	5	179	0.20	16	0.05	<0.1	1	0.192	0.084	0.019	0.087	5.26	268	0.92
REGM-228D	31	8.3	19	11	27	4.8	1	117	0.28	39	0.06	<0.1	2	0.183	0.073	0.025	0.151	1.80	222	0.15
REGM-228S	83	8.1	63	51	59	6.8	0	252	0.14	138	<0.05	<0.1	20	0.193	0.069	0.058	0.049	9.99	593	0.12
REGM-229D	54	8.1	42	31	44	6.1	0	285	0.04	16	0.08	2.89	18	0.198	0.088	0.021	0.175	1.10	447	0.31
REGM-229S	37	8.1	25	17	29	3.6	0	171	0.04	18	0.06	<0.1	20	0.196	0.064	0.024	<0.05	3.16	285	0.12

- The general trend for the more polluted borehole REGM-22 is sideways, with elevated calcium, magnesium, manganese, chloride, and sulphate.
- Boreholes REGM 213D-216D and REGM 228&229 show very little pollution. REGM-214D is slightly elevated in relation to the other boreholes drilled at the same time but indicates an improving trend since then.
- Most boreholes have slightly elevated manganese, which is probably geology related.
- The electrical conductivity of Borehole REGM-22 is higher than the acceptable standard, but is still allowable, as illustrated in Figure 16, while that of the other boreholes is acceptable.

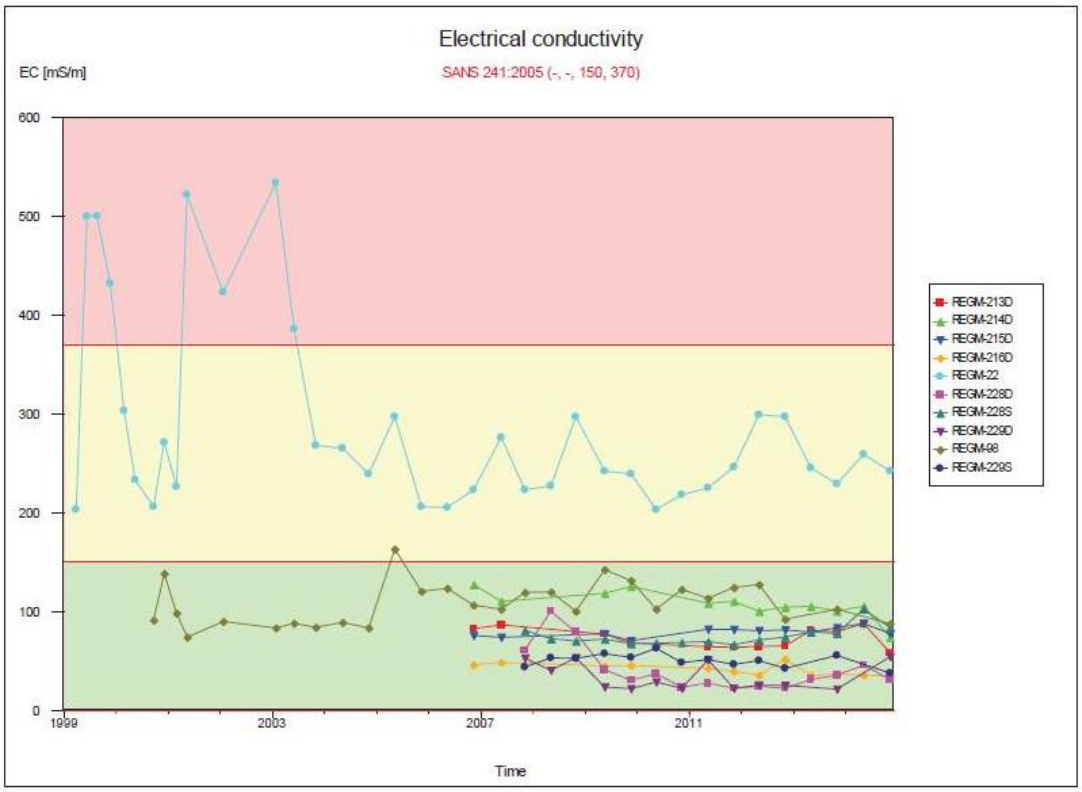


Figure 16: Time graph of electrical conductivity

The results of the groundwater monitoring undertaken conclude that:

- The water level in this area is shallow, and mostly <4m.
- The polluted water of REGM-22, which is situated near the dump, indicates movement in this direction (surface seepage can be seen) – ash filling on the road next to the borehole may also influence the water quality (elevated magnesium, manganese, chloride and sulphate). The general water quality trend for REGM-22 has improved since 2002 (Figure 16).
- REGM-98 is mostly sideways. The boreholes introduced in 2006 and 2007 indicate that the landfill site has no influence on the groundwater to the west, north-west and the south.

7.5 Hydrology

The project area is located between two tributaries, the Klipspruit in the south and Trichardspruit in the north-west (Figure 17). The general flow trend of these tributaries is towards the south-west which converge into the Grootspruit Stream and flows into the Waterval River, the major tributary of the Vaal River in the region. Surface run-off from the Charlie 1 Landfill site flows north and north-west toward the tributary of the Trichardtspruit.

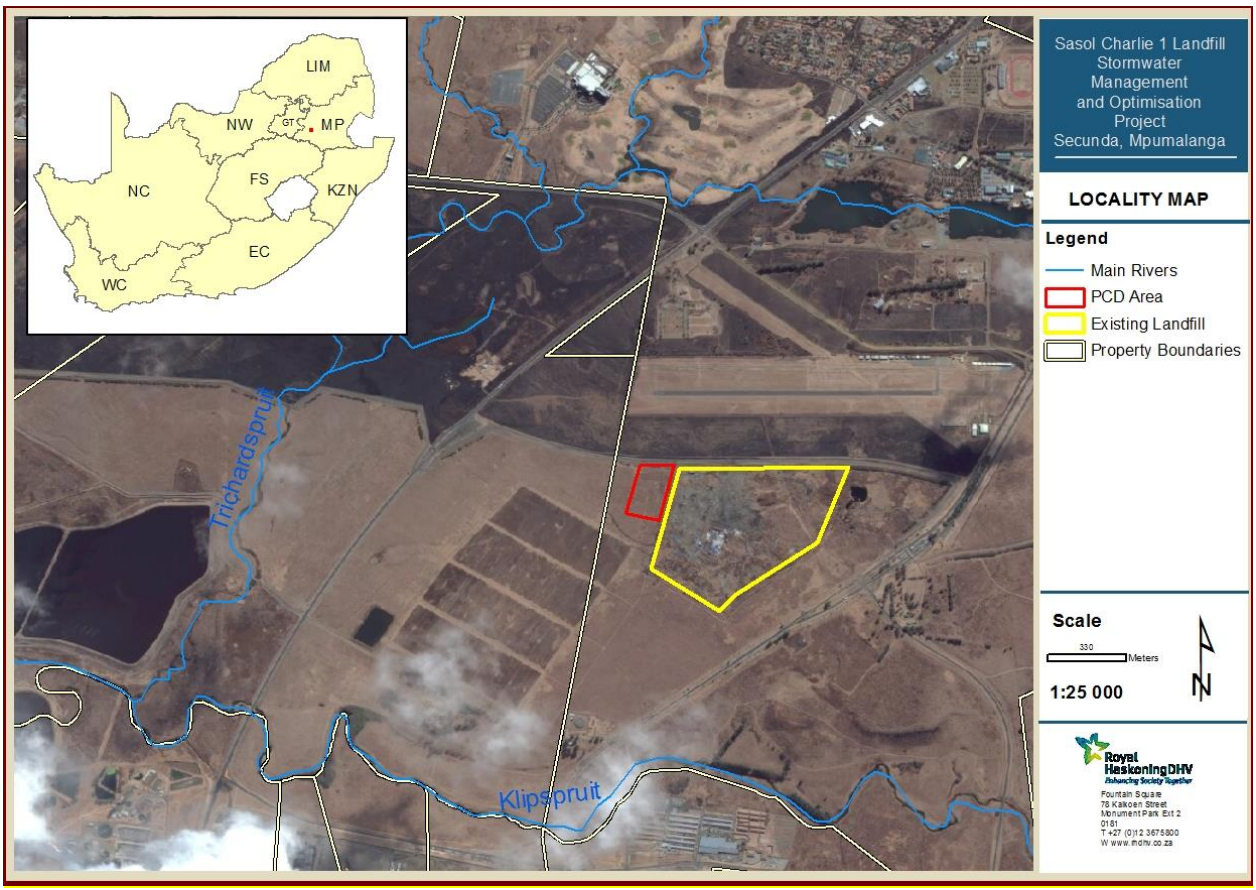


Figure 17: Tributaries in the project area

7.5.1 Surface Water Quality

The precipitation that falls or seepage water that flows into a landfill, collectively with any disposed liquid waste, results in the extraction of the water-soluble compounds of the waste, and the subsequent formation of leachate. The leachate that is formed at the site seeps out as leachate springs on the south-western edges of the site (Figure 18). This runs off in a contaminated canal and the rate of production is dependent on rainfall. During dry winter months, less leachate is discharged by the site, thus salt precipitation takes place on the perimeter of the site. However, the smaller contaminated canal that is more observable during rainfall months continues flowing at a lower rate (Figure 18).

Figure 18: Seepage water (contaminated canal) from leachate springs west of the Charlie 1 landfill site

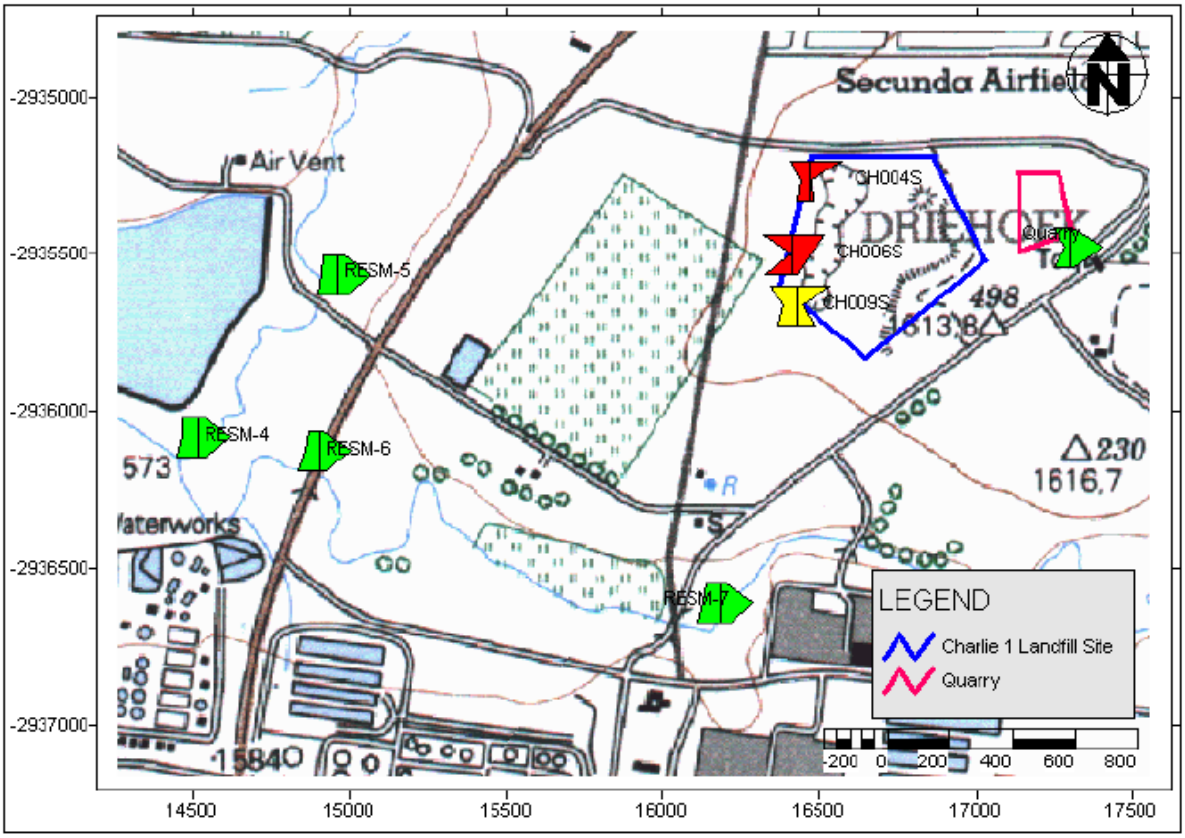


Figure 19: Surface water and leachate sampling points

In 2008, IGS collected surface water and leachate samples from the following locations to determine the surface water quality of the project area (Figure 19):

- Three (3) samples along the western boundary of the Charlie 1 Landfill site;
- One sample for the quarry and further; and
- Four (4) samples from the rivers down-gradient.

The three (3) leachate samples show higher concentrations for electrical conductivity (EC), Mg, Na, F, Cl, and SO_4 compared to the background surface water concentrations obtained from the quarry which was located next to the site (Note: that the quarry used as background was rehabilitated since and is no longer present). The leachate quality does however show low levels of NO_3^-, NH_4, Mn, Fe and higher levels SO_4^{2-}.

The water quality of the stream samples is compliant with SANS 241:2005 and indicates normal levels of all major ions. Low concentrations of trace metals were found in the water samples taken.

Low concentrations (USEPA Water Quality Standards) of organic contaminants were detected on leachate samples.

The routine groundwater quality monitoring also indicates that there is no direct influence from the Charlie 1 site on the streams.

7.5.2 Surface Water Quality Monitoring

Three types of water quality monitoring are being undertaken, namely regular compliance monitoring, continuous monitoring, and investigative monitoring:

- Compliance monitoring is conducted by regularly analysing samples taken from surface water features (by the SGS Laboratory).
- An on-line continuous monitoring system has been implemented at certain surface water monitoring locations (e.g. RESM 7), to act as an early warning system, in order to detect possible incidents of contamination as a result of increases in Electrical Conductivity ("EC"). It is linked to an alarm system, which is monitored by the Main Control Room managed by Process Integration. Should the EC exceed a pre-determined limit value ("Alarm Limit Value", or "ALV"), an alarm is triggered, upon which the Environmental Department will be contacted, who will initiate an investigation, which could include investigative monitoring.
- Investigative monitoring entails the taking of samples in order to determine the cause of an incident that resulted in the ALV being exceeded. This enables the Environmental Department to investigate possible causes and implement rectification measures before the limit values in applicable licences are exceeded.

Surface water monitoring locations close to the Charlie 1 landfill site are included in Table 17.

Table 17: Surface water monitoring locations close to the Charlie 1 landfill site

Monitoring Station (RESM)	Latitude	Longitude	Water Resource	Monitoring Frequency
RESM 7	26°32'24.7"S	29°09'42.4"E	Klip Spruit	Weekly and Continuous Alarm Limit Value ("ALV") = 75 mS/m (wet season) and 200mS/m (dry season)
RESM 6	26°32'08.3"S	29°08'58.6"E	Klip Spruit	Weekly
RESM 5	26°31'51.4"S	29°08'58.8"E	Trichardt Spruit	Weekly and Continuous
RESM 4	26°32'4.8"S	29°08'38.2"E	Trichardt Spruit	Weekly

7.6 Climate

Local meteorological data was obtained from the South African Weather Services (SAWS) in Secunda for the period January 2010 – December 2013 to determine the atmospheric dispersion potential of the area. Wind roses from the SAWS station were compared to the Sasol monitoring stations; Langverwacht and Club monitoring stations for the January 2010 – December 2013 monitoring period.

7.6.1 Wind

Wind roses comprise of 16 spokes which represents the direction from which the winds blew during the period under review. The colours reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. Based on an evaluation of the site specific meteorological data obtained from the SAWS in Secunda, Mpumalanga, the following deductions regarding the prevailing wind direction and wind frequency can be presented.

Based on Figure 20 below, the predominant wind direction for the area under review is multidirectional, with primary winds originating from the north-north east (13% of the time) and north-north west regions (9% of the time). Secondary winds were noted mainly from the south west region, which occurred for 7% of the time.

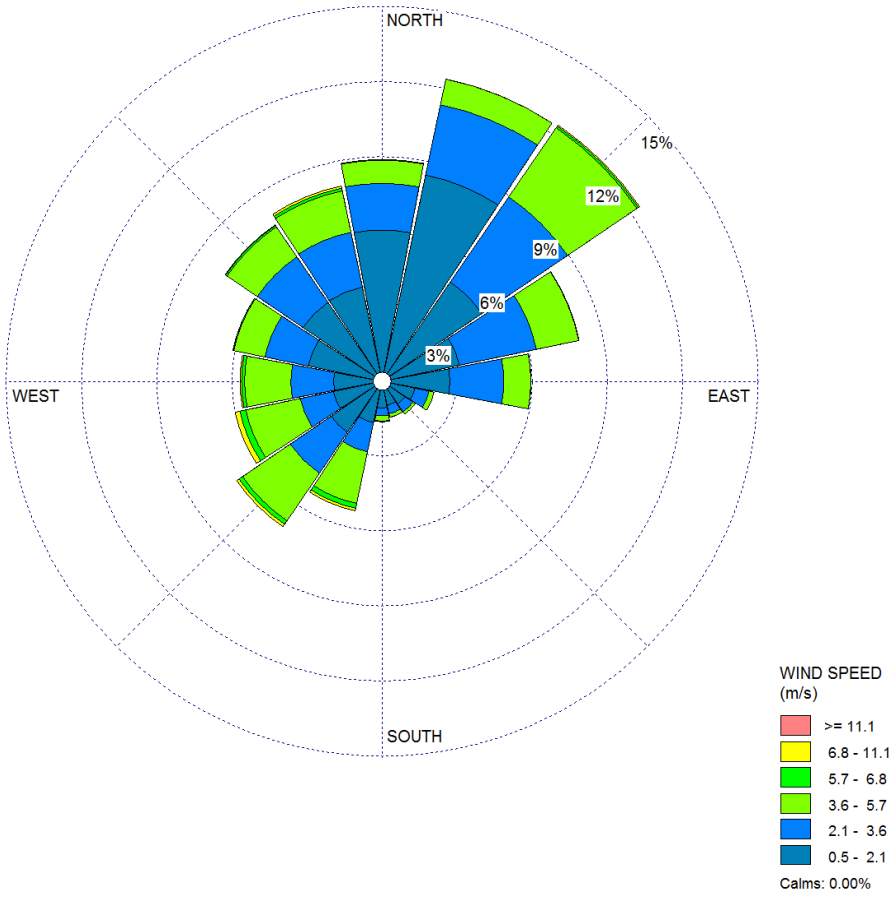


Figure 20: Period wind rose from the Secunda monitoring station for the Jan 2010 – Dec 2013 monitoring period

The wind class frequency distribution for the period under review. 48.5% of the total wind speeds fell within the 0.5 – 2.1 m/s wind class, while 28.1% of the total winds experienced, fell within 2.1 – 3.6 m/s. The site is characteristic of moderate to low winds.

7.6.2 Temperature and Humidity

The average monthly temperature and relative humidity for the period Jan 2010 – Dec 2013 is presented in Figure 21 below with the average humidity indicated with the blue line. Daily average summer temperatures ranged between 19 - 21ºC while the average winter temperatures ranged between 9 - 12ºC. Relative humidity for the period Jan 2009 – Dec 2013 was highest during the summer months and lowest during the winter months.

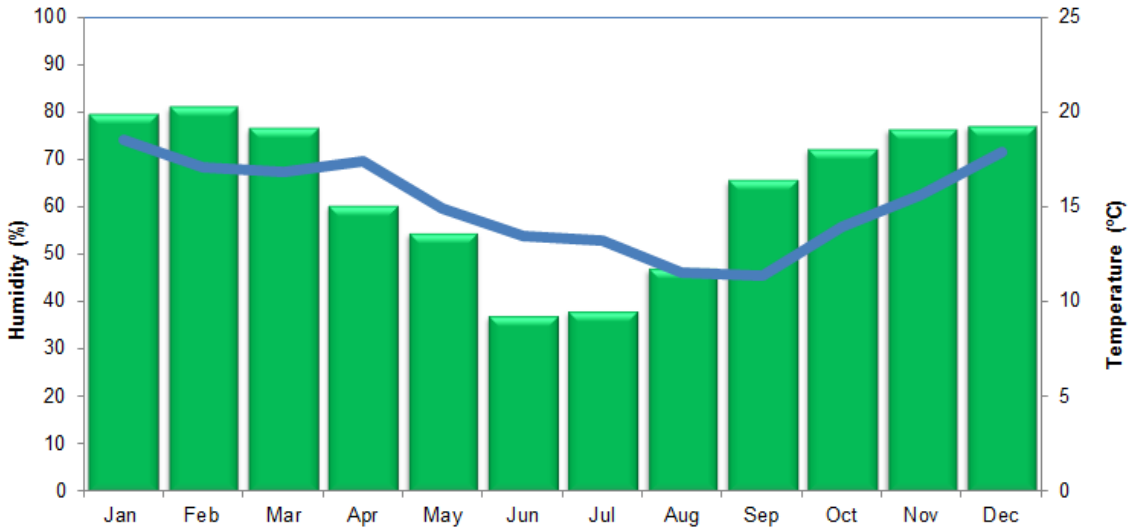


Figure 21: Average monthly temperature and relative humidity for the Jan 2010 – Dec 2013 monitoring period

7.6.3 Precipitation

Rainfall data for the project area was sourced through the Design Rainfall Estimation Program[7] and the Daily Rainfall Data Extraction Utility[8]. Station 0412875W (Goedgevonden) was selected for use in the study. The rainfall gauge metadata is presented in Table 18. The selection is based on the station being the closest station to the site with a reasonably long and reliable record.

Table 18: Metadata for the Goedgevonden rain gauge

Station Name	Station No	Distance (km)	Lat	Long	Record	Reliable	MAP	Altitude
Goedgevonden	0412875W	10.5	27°00'	29°09'	103	59	605	1542

The cumulative distribution function of annual rainfall is presented in Figure 22. The analysis of annual rainfall shows that:

- The Mean Annual Precipitation (MAP) for the selected portion of data is 630 mm/annum. 50% of the years receive between 545 mm/annum and 720 mm/annum; and

[7] Smithers, J.C. and Schulze, R.E. (2002). Design rainfall and flood estimation in South Africa. WRC Project No. K5/1060. Draft final report (Project K5/1060) to Water Research Commission, Pretoria, RSA. 155 pp.

[8] Kunz, R.P. (2004). Daily Rainfall Data Extraction Utility: User Manual v 1.0. Institute for Commercial Forestry Research, Pietermaritzburg, RSA.

- The annual rainfall on record varies significantly year to year. The annual rainfall varies between 343 mm/annum and 1139 mm/annum. A dry year (defined as the 5th percentile) will receive 427 mm/annum. A wet year (defined as the 95th percentile) can receive 920 mm/annum.

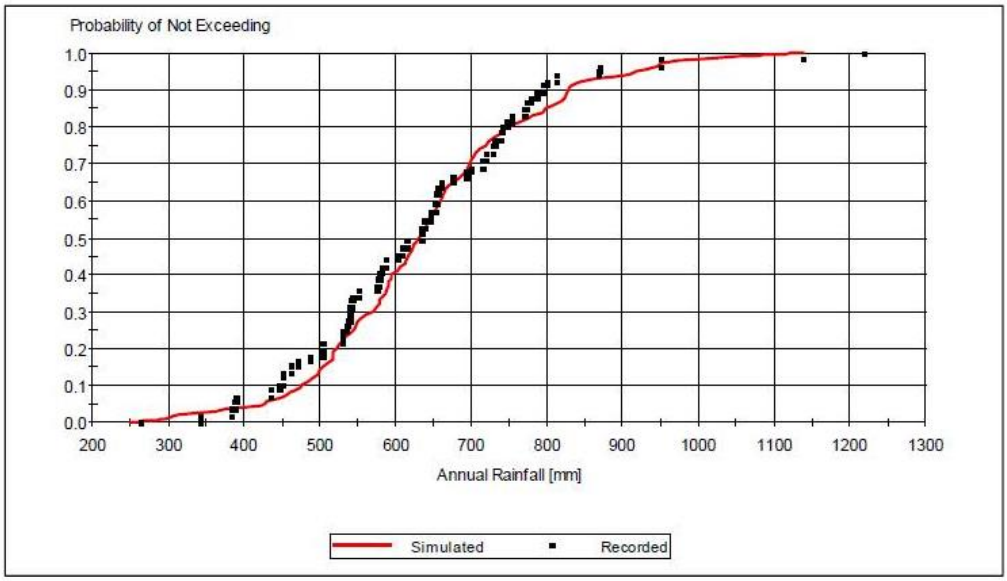


Figure 22: Cumulative distribution function of annual rainfall recorded at the Goedgevonden station[9]

7.6.4 Evaporation

The project area has a Mean Annual Symons S-Pan evaporation of 1360 mm/year and a corresponding average potential lake evaporation of 1140 mm/year. The average monthly evaporation rates are indicated in Figure 23.

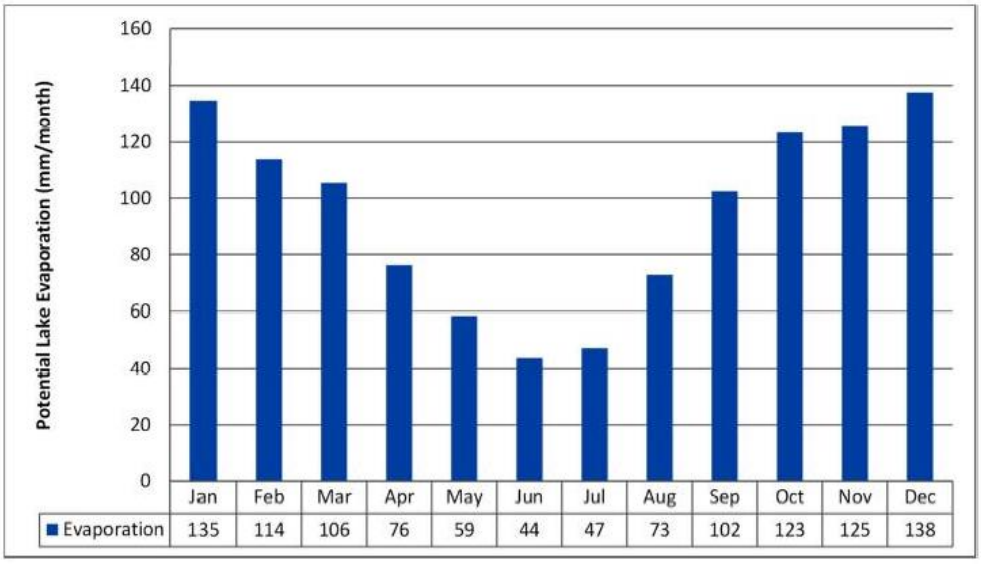


Figure 23: Mean monthly potential lake evaporation for the site

[9] *Ibid* Footnote 6.

7.7 Wetlands

The NFEPA database indicates that no wetland resources are present within the project area (Figure 24) as well as the 500 m buffer. In addition, the Mpumalanga Biodiversity Sector Plan (MBSP) database was consulted in order to determine site-specific issues and areas within the project area considered sensitive with regards to any wetland resources which may be present. This database indicates that a portion of the project area is located within a heavily or moderately modified area and no wetlands are indicated by the MBSP database.

Figure 24: Study area (pollution control pond area) for the wetland verification study

No vegetation associated with wetlands was encountered within the site or within 32 m thereof, indicating that insufficient water is present to support vegetation typically adapted to life in saturated soil as per the definition of a wetland according to the National Water Act (NWA) (No 36 of 1998) and the National Environmental Management Act (NEMA) (No 107 of 1998).

Two areas were identified using digital satellite imagery which may potentially have been wetlands. One is located in the northern portion and the second is located approximately 200 m south of the project area (i.e. west of the Charlie 1 Landfill site). Upon investigation however, neither of these areas displayed any wetland characteristics as described by DWAF[10]. The area in the northern section contained only terrestrial floral species. In addition the soil samples taken in this area did not show any gleying or mottling which would indicate that this could be considered as wetland resources.

[10] Department of Water Affairs and Forestry [DWAF] (2005). A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones.

The channel-like feature identified to the south of the project area was found to be un-vegetated, and soil samples taken within this area did not display gleying or mottling which would be indicative of wetland conditions. The channel-like formation is deemed likely to be have been formed as a result of seepage originating from the Charlie 1 Landfill. It is also possible that the area has been cleared of vegetation for agricultural purposes. Representative photographs of this channel-like formation are presented in Figure 25.

Figure 25: Photograph of an area resembling a constructed channel, situated approximately 200m south of the project area

Wetlands within 500 m of the area proposed for the pollution control ponds were investigated, and approximately 100 m north-east of the project area, a poorly defined mosaic patch of temporary wetland and moist grassland was identified. This area showed minimal wetland characteristics and the boundary was not clearly discernible and difficult to delineate (Figure 26). Vegetation indicators were also minimal and vegetation such as *Helichrysum kraussii* and *Haplocarpha scaposa* were observed.

Figure 26: A mosaic of temporary wetland and moist grassland located north-east of the project area

7.8 Vegetation

The vegetation of the project site consists entirely of Soweto Highveld Grassland (Gm8). Soweto Highveld grasslands are considered to be Endangered. The conservation target is 24%.

Large areas of the vegetation on the site have been transformed during previous and current agricultural activities. The majority of the site has been annually ploughed and planted with planted *Setaria pallide-fusca* pastures. The dumped soil piles and disturbed areas are dominated by pioneer weedy plant species such as *Rumex crispus, Lepidium bonariense, Cosmos bipinnatus, Chenopodium album, Tagetes minuta, Gomphocarpus fruticosus, Conyza bonariensis* and *Flaveria bidentis, Cyperus esculentus, Verbena bonariensis, Cirsium vulgare* and weedy grasses such as *Hyparrhenia hirta Eragrostis curvula, Cynodon dactylon, Polypogon monspeliensis, Echinochloa pyramidalis*. The highly invasive Kikuyu (*Pennisetum clandestinum*) is also present on old soil dumps and disturbed areas.

7.9 Social

The Sasol Secunda area falls within the Govan Mbeki Local Municipality (GMLM) which is located in the north-west of the Gert Sibande District Municipality (GSDM). The GMLM has the most diversified economy within the GSDM, dominated by the petrochemical industry (Sasol II and III complexes) and coal and gold mining. Secunda and Embalenhle are the closest town / communities to the project area.

From a social perspective, the Govan Mbeki Municipality consists of Secunda, Embalenhle, Kinross, Evander, Trichardt, Charl Cilliers, Leslie / Leandra, Lebohang, Eendracht, Bethal and eMzinoni. The Govan Mbeki Local Municipality has the largest number of people (24.6% or 221 745) and highest level of employment within the District. This could be attributed to the fact that the GMLM is one of two local municipalities that hosts the majority of all the mining, manufacturing and agricultural activity taking place within the District.

7.10 Noise

The noise generated from vehicles depositing waste on to the Charlie 1 Landfill site is the main source of noise near the project site. The Sasol Synfuels Complex is located 1.3 km from the project site and is an existing source of noise as a result of current industrial processes that are taking place.

7.11 Health and Safety

The nature of Sasol's business brings with it substantial inherent safety, health and environmental (SH&E) risks. Sasol's Safety and Health Essential Requirements are compulsory and applicable to all new projects such as the proposed project.

7.12 Heritage

The project site is located within the Sasol Synfuels Complex property boundary which is a highly developed industrial area that has been in operation for more than 50 years. The landscape has been changed by the development as well as mining activities in the area. None of the structures have aesthetic, historic, research or historical significance. There are no sites of archaeological or cultural significance known on the proposed site.

Sasol will ensure that all requirements of Chapter II, Section 38 of the National Heritage Resources Act, Act 25 of 1999, are complied with should any sites of heritage or archaeological significance are unearthed during construction. This will be considered in more detail during the EIA phase.

7.13 Palaeontology

The region around Secunda is predominantly Jurassic dolerite dykes that are intruding into the Lower Permian, Ecca Group Vryheid Formation. These rocks comprise dolerite that contains no fossiliferous material as it would have been destroyed by the dykes, and sandstones, shales and coals of the Vryheid Formation (Figure 27, Table 19). This region is in the Highveld Coalfield where the No 4 seam is the most productive (used as feedstock for the indirect liquefaction by Sasol) and is thus overlain by the much less productive No 1 and 2 seams[11].

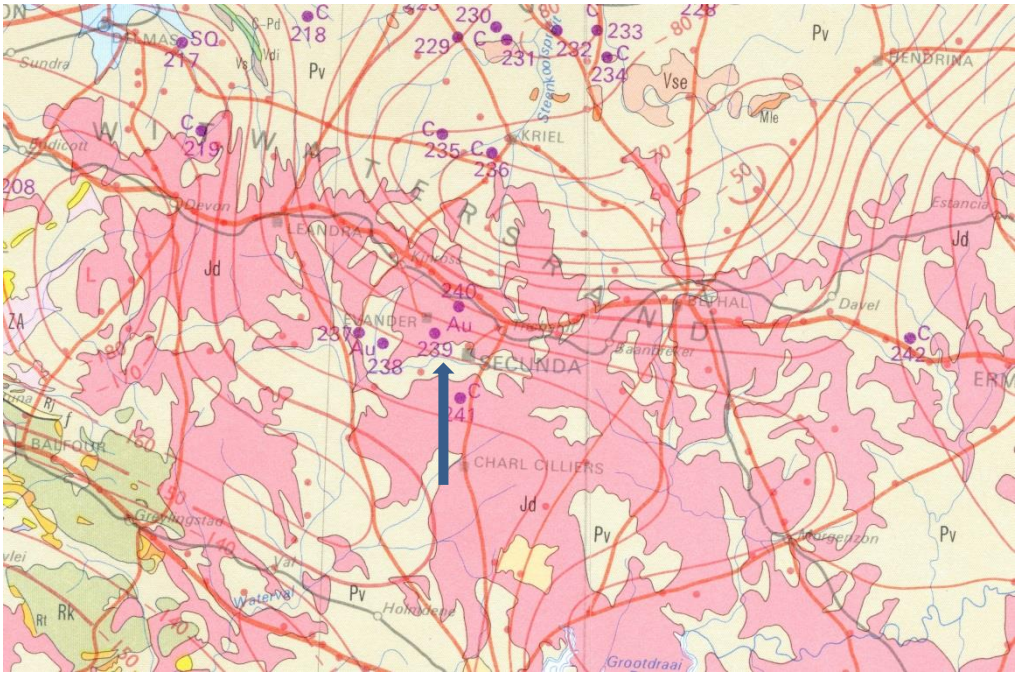


Figure 27: Geological map of the study area (approximate location of the ponds is indicated by the arrow)

Abbreviations of the rock types are explained in Table 19. Map enlarged from the Geological Survey 1: 1 000 000 map (1984).

[11] Snyman, C.P. (1998). Coal. In: Wilson, M.G.C., and Anhaeusser, C.P., (Eds). The Mineral Resources of South Africa: Handbook, Council for Geosciences 16, 136-205.

Table 19: Explanation of symbols for the geological map and approximate ages[12][13]

Symbol	Group/Formation	Lithology	Approximate Age
Jd	Jurassic	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pa	Adelaide and Estcourt	Mudstone, sandstone	Beaufort
Pvo	Volksrust	Shale	Middle Permian, Upper Ecca
Pv	Vryheid	Shales, sandstone, coal	Lower Permian, Middle Ecca
C-Pd	Dwyka	Tillite, sandstone, mudstone, shale	Upper Carboniferous to Lower Permian
ZB	unnamed	Potassic granite and granodiorite	Basement, >3000 Ma

Coals are formed by the burial of peats and over time the compaction and alteration of the organic material caused by increasing temperatures and pressures. Coals, therefore, are the product of fossil plants but within the coal seams the plant material is unrecognizable. In the shales and mudstones closely associated with the coal seams it is possible to find fossilized wood, leaf impressions, insect impressions, cuticle and pollen. The distribution of the fossils, however, is very patchy and unpredictable. Vertebrate fossils very seldom occur within the plant fossils.

7.14 Road Network

The Charlie 1 Security Entrance is immediately east of the project site, with the Primary Sasol Plant access road on the east and south. A secondary road runs east to west on the northern edge of the site, along the main plant security fence. All waste delivery vehicles enter the Charlie 1 Landfill site on this road, from the west.

[12] Cadle, A.B., Cairncross, B., Christie, A.D.M., Roberts, D.L. (1993). The Karoo Basin of South Africa: the type basin for the coal bearing deposits of southern Africa. International Journal of Coal Geology 23, 117-157.

[13] Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G. (2006). Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

8 SUMMARY OF SPECIALIST FINDINGS

8.1 Ecology

8.1.1 Vegetation of the Study Area

Two vegetation units were identified during the ecological survey namely: 1) Pasture field; and 2) Degraded area. Refer to **Appendix F** for the Ecological Study.

- Pasture Fields

  Pasture fields is the most predominant vegetation unit in the southern section of the project site (Figure 28). The vegetation is dominated by the grass, *Setaria pallide-fusca* which is harvested for pasture purposes. The pioneer forb, *Solanum panduriforme* is prominent in some areas where few grasses grow. Other species present include the grasses: *Hyparrhenia hirta, Cynodon dactylon, Eragrostis curvula* and the forbs*: Amaranthus hybridus, Tagetes minuta, Plantago lanceolata and Oenothera rosea.*

  The alien invasive grass *Pennisetum clandestinum* is sporadically disbursed within this unit while large numbers of the declared Category 1 weed, *Cirsium vulgare,* is present throughout this unit.

  No Red Data plant species or suitable habitat for such species was observed in this vegetation unit.

Figure 28: Pasture fields present on site

- Degraded Area

  The degraded area unit is located in the northern and eastern side of the proposed area for pollution control ponds (Figure 29). The unit has a patchy vegetation cover comprising of grasses, forbs, and open or barren soils (Figure 29). The forb layer is the most conspicuous with the forb *Rumex crispus* and the alien invasive weed (Category 1) *Cirsium vulgare* is dominant. Other species present include the grasses: *Eragrostis curvula, Cynodon dactylon, Polypogon monspeliensis, Echinochloa pyramidalis* and the forbs: *Lepidium bonariense, Cosmos bipinnatus, Chenopodium album, Tagetes minuta, Gomphocarpus fruticosus, Conyza bonariensis,* and *Flaveria bidentis*. Alien invasive species include declared Category 2 invader tree, *Casuarina cunninghamiana*, the grass, *Pennisetum clandestinum* and the forbs: *Cirsium vulgare* and *Datura stramonium*.

Two medicinal plant species were found to be present in this vegetation unit namely the forbs *Datura stramonium* and *Gomphocarpus fruticosus*. Both species are pioneer weeds with *Datura stramonium* declared as a Category 1 invasive weed.

No Red Data plant species or suitable habitat for such species was observed in this vegetation unit.

Figure 29: Degraded area present on site

8.1.2 Protected Tree Species

In terms of the National Forests Act 1998 (No 84 of 1998) certain tree species can be identified and declared as protected. The Department of Agriculture (now Department of Agriculture, Forestry and Fisheries) developed a list of protected tree species. In terms of Section 15 (1) of the National Forests Act, 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilization. No protected tree species or indigenous tree species were observed or occur on the proposed site.

8.1.3 Red Data/Endemic Species

No red listed or endemic plant species have been listed for the 2629 CB Quarter Degree area of the study site. Three red listed Declining plant species have been observed within the adjacent Secunda-Evander areas during previous surveys. These include the Cape Poison Bulb (*Boophone disticha*), African Potato (*Hypoxis hemerocallidea*) and River Lily (*Crinum macowanii*).

8.1.4 Alien Vegetation

A single individual of the declared alien invasive tree *Casuarina cunninghamiana* was found to be present on the site (vegetation unit 2), together with the declared Category 1 weeds *Cirsium vulgare* (vegetation units 1 & 2) and *Datura stramonium* (vegetation unit 2). The highly invasive alien grass *Pennisetum clandestinum* (kikuyu) was present in both vegetation units on the site.

8.1.5 Land Degradation

The Sasol Secunda is an area where soil erosion is regarded as insignificant with large areas used for mining and agricultural activities. Cattle grazing has also had a significant effect on large areas with heavy and mild overgrazing leading to degradation of the natural land.

8.1.6 Vegetation and Faunal Habitat Availability

The following faunal micro-habitats were identified in the study area during the field investigation:

- Moist Soweto Highveld Grassland

  Remnant patches of moist grasslands occur adjacent to the channelled valley bottom wetland approximately 1 km to the north of the proposed site. The moist grasslands are in various stages of degradation.

Figure 30: Patches of moist grassland 1 km north of the proposed site

  The moist grasslands in the Secunda area represent important habitat for a variety of grassland dependant Red Data faunal species such as, Southern Bald Ibis, Secretarybird, South African Hedgehog and African Grass Owl. No suitable habitat remains on the proposed site due to the high levels of habitat and vegetation transformation and degradation.

- Transformed Agricultural Lands

  The current and historic agricultural lands represents suitable foraging areas for certain rodent species such as African Molerat, Highveld Gerbil and Multimammate Mouse through the tilling opening up the soil surface, making many insects, seeds, bulbs and other food sources suddenly accessible. Rodents construct burrows in the sandier soils and attract other predators such as the Slender Mongoose. Certain threatened species such as Southern Bald Ibis are often located foraging in transformed secondary grasslands (especially after burning) and Blue Cranes and Secretarybirds foraging on grasshoppers in old maize lands. The planted *Setaria pallide-fusca* pastures offer suitable foraging areas for several granivorous bird species.

- Wetlands

  A channelled valley bottom wetland occurs approximately 1 km to the north of the proposed project site. A seasonally inundated depression occurs approximately 4 km to the south-east of the proposed site.

  Several mammal species including Vlei Rats, Cape Clawless Otter and Marsh Mongoose could still possibly occur along the margins of the channelled valley-bottom wetland as well as using the dense reed beds in the artificially created dams for foraging and refuge habitat. Waterbirds, which were formerly restricted to high rainfall areas with natural wetland habitat, make use of man-made dams, and surrounding seasonally inundated wetland areas, for feeding, roosting and breeding.

  The rank vegetation along certain sections of the adjacent valley bottoms as well as dense sedge and grass vegetation around the seasonally inundated depressions offers favourable rooting and possible nesting habitat for African Grass Owls. The vegetation adjacent to valley bottom wetlands and seasonally inundated depressions has been transformed and dominated by dense pioneer weedy plant and grass species such as *Paspalum urvillei Imperata cylindrica*, *Verbena bonariensis* and the forbs *Typha capensis, Senecio inornatus* and *Cosmos bipinnatus*. The majority of amphibian species in the Secunda area will utilize the shallow seasonally inundated depressions, margins of the dams or seasonal pools in the valley bottoms for breeding purposes.

  Species recorded during previous surveys included Several Cape River Frogs (*Amietia fusgicula*), Common Caco (*Cacosternum boettgeri*) and Common Platanna (*Xenopus laevis*). Amphibian diversity on and surrounding the site will depend on the water quality of the adjacent valley bottoms as well as any seasonal wetland habitats including the old borrow pits. Reptile species such as the Dusky or Brown Water Snake, Herald Snake, Green Water Snake, Nile or Water Monitor, Marsh Terrapin are associated with wetland habitats including permanent dams. Low reptile and amphibian diversity is expected on the actual site due to extensive habitat transformation and degradation.

8.1.6.1 Mammals

Limited animal burrows (Highveld Gerbil, Multimmamate Mouse) and African Molerat were observed within the grasslands adjacent to the site. A single Scrub Hare was flushed from an uncut patch of *Setaria pallide-fusca* planted pastures. A scat of a Slender Mongoose was observed on the dumped soil piles on the northern portion of the site. Species likely to occur include urban exploiters such as Feral cats, House rat and House mouse.

No sensitive or endangered mammals were recorded within the project site or are likely to occur on the site and in the adjacent areas.

8.1.6.2 Avifauna

Fifteen bird species were recorded on the site during the field survey. Species recorded were all common and widespread species indicative of transformed agricultural lands and degraded grasslands. All species recorded were granivorous species feeding of the *Setaria pallide-fusca* seeds.

Table 20 presents the Red Data List bird species previously recorded from the 2630_2910 pentad during the South African Bird Atlas Project 1 and 2 within which the project site is situated, and that occur or could possibly within or in the vicinity of the site.

Table 20: Red Data List bird species previously recorded from the 2630_2905 pentad

Robert's Nr.	Common Name	Scientific Name	Regional Red List Status (2014)	Habitat Requirements
92	Southern Bald Ibis	*Geronticus calvus*	Vulnerable	High altitudinal short grassland and cultivated lands. Forages in recently burned grasslands.
96	Greater Flamingo	*Phoenicopterus ruber*	Near-Threatened	Highly nomadic and partially migratory and favours saline or brackish shallow waterbodies such as salt pans, large dams and coastal mudflats.
165	African Marsh Harrier	*Circus ranivorus*	Endangered	Inland and coastal freshwater wetlands and adjacent moist grassland. Require large (>100 ha) wetlands in which to breed.
208	Blue Crane	*Anthropoides paradiseus*	Near-Threatened	Mostly found in natural grasslands but also in freshwater wetlands, cultivated pastures and croplands.
393	African Grass Owl	*Tyto capensis*	Vulnerable	African Grass Owls are found exclusively in rank grass, typically, although not only, at fair altitudes. African Grass Owls are secretive and nomadic breeding in permanent and seasonal vleis, which it vacates while hunting or post-breeding, although it will breed in any area of long grass and it is not necessarily associated with wetlands.
118	Secretarybird	*Saggitarius serpentarius*	Vulnerable	Favours open grassland with scattered trees or shrubs. They are territorial with home ranges of 20-230 km^2 around the nest, usually an area of between 50-60 km^2, is defended against other Secretarybirds. Nests are usually placed on top of a thorny tree, frequently in Black Thorn *Acacia melifera*, Umbrella Thorn *Acacia tortilis*, Sweet Thorn *Acacia karroo*, Common Hook Thorn *Acacia caffra*. They may also nest in exotic species such as Black Wattle *Acacia mearnsii* or Pine (*Pinus* sp.).

No threatened bird species were observed on site. The project site does not provide a suitable habitat for the threatened bird species due to high levels of habitat transformation as well as anthropogenic activities in the adjacent landfill site.

8.1.6.3 Reptiles

Due to human presence in the adjacent landfill and dumping site; coupled with increased habitat destruction and disturbances around the site are all causal factors in the alteration of reptile species occurring on the site and surrounding areas. There is a lack of arboreal reptiles (chameleons, snakes, agamas, geckos and monitors) on site.

No threatened reptile species were recorded in the project site which is attributed to the transformed and degraded habitat on site.

8.1.6.4 Amphibians

No frog species were recorded in the project site. Four frog species were recorded from the channelled valley bottom wetland approximately 1 km to the north of the Charlie 1 Landfill site during a previous study. Species recorded included Drakensberg River Frog (*Amietia quecketi*); Cape River Frog (*Amietia (Afrana) fuscigula),* Guttural Toad (*Amietophrynus (Bufo) gutturalis*) and several calling Common Caco males (*Cacosternum boettgeri*).

No threatened species have been recorded on site due to anthropogenic activities and the adjacent Charlie 1 Landfill site.

8.1.7 Existing Impacts on the Proposed Project Site

- The site occurs adjacent to the Sasol Charlie 1 Landfill within completely transformed agricultural lands. Previous as well as current agricultural activities have occurred on and surrounding the site has transformed the majority of the remaining moist grasslands. The site is currently used for pasture cultivation.
- No Moist Soweto Highveld Grassland occurs on the site or adjacent areas.
- The remaining grassland habitat to the north and west of the site is in various stages of degradation due to poor veld or grassland management and livestock grazing and trampling along the channelled valley bottom wetland.
- Invasion of exotic tree species (Syringa, *Melia azedarach*, Black Wattle, *Acacia mearnsii* and *Eucalyptus sp.*) and plant/grass species including kikuyu (*Pennisetum clandestinum*), *Solanum mauritanium*, *Pyracantha sp*. on the adjacent properties to the east. No alien tree species were observed on the actual site. A few *Cassuarina cunninhamiana* have been planted on the eastern boundary fence.
- The site is completely fenced-off, restricting access. Fences along the entire Charlie 1 area severely restrict the migratory movement of larger animal species.
- Frequent fires; at the incorrect time of the year (spring, summer and winter burns) has disturbed the underlying grass and forb vegetation layer as well as trampling by cattle and is now dominated by weedy species. Massive stands of Black-Jacks (*Bidens pilosa*), Khaki Weed (*Tagetes minuta*), *Cosmos bipinnatus* are found within the heavily degraded and disturbed sections along the channelled valley bottom wetland to the north of the site. Frequent burning of remaining grasslands reduces refuge habitat as well as potential foraging habitat for remaining animal species.
- Surrounding main roads with high vehicular traffic as well as secondary dirt roads increase the possibility of road fatalities of migrating species and especially nocturnal species such as Owls and Bullfrogs, which are attracted to the open roads. Secondary roads are located around the entire site.
- Previous and current agricultural activities have transformed the entire site and large areas to the west of the site. Agricultural activities place pressure on the environment in the following ways:
  - Change in land use: natural grasslands containing a diversity of vertebrate and invertebrate fauna are converted to monocultures of one particular crop leading to considerable loss of faunal biodiversity.
  - Small tracts of indigenous grassland become surrounded by monocultures causing fragmentation of previously intact natural habitats.
- Current and previous mining activities occurred in the surrounding areas. Drainage waters from the mines have serious effects on receiving water quality (both surface and ground water) and thus on aquatic ecosystems.

8.1.8 Sensitive Habitats on the Site and Adjacent Areas

From the desktop study using *inter alia* aerial photographs and Google Earth™ imagery as well as a site investigation, the following four sensitivity categories of areas were identified:

- **High**: Areas with high species richness and habitat diversity comprising natural indigenous plant species. These areas are ecologically valuable and important for ecosystem functioning.
- **Medium-High**: An area with a relatively natural species composition; a threatened or unique ecosystem; moderate species and habitat diversity. These areas are ecologically valuable and important for buffering adjacent ecosystem functioning (valley bottom wetlands).
- **Medium**: An area with a relatively natural species composition; not a threatened or unique ecosystem; moderate species and habitat diversity but is currently degraded. Could be developed with mitigation and expected low impact on adjacent ecosystems.
- **Low**: A totally degraded and transformed area with a low habitat diversity and ecosystem functioning; no viable populations of natural plants. Development could be supported with little to no impact on the adjacent natural vegetation / ecosystem.

The Mpumalanga Biodiversity Sector Plan (MBSP), 2014 is a spatial biodiversity plan for Mpumalanga that is based on scientifically determined and quantified biodiversity objectives, intended to guide conservation and land-use decisions in support of sustainable development.

The entire site and adjacent areas are classified as “Modified-Old Agricultural Lands” according to the MBSP.

Vegetation unit 1 (Pasture Field) has been used as a planted pasture for many years. As a result the land has previously been ploughed and disked and grass seeds sown. The natural vegetation has been displaced with no remnants of the original vegetation remaining. The few natural species present are all pioneer and weedy species while many individuals of alien invasive weeds are present as would be expected on pasture lands where continuous disturbance takes place. The area has low species richness and is uneven in terms of species diversity with *Setaria pallide-fusca* dominant. The planted pastures and adjacent dumping site have a low faunal component due to the impoverished habitats on the site and adjacent areas. From a vegetation and faunal perspective the site has a low sensitivity and conservation value as well as ecosystem functioning.

Vegetation unit 2 (Degraded Area) is influenced by various factors namely dumping of soil, ploughing, and a rubble heap bordering onto it in the east. These effects has led the area to become totally degraded with pioneer weedy and declared invasive weeds dominating the vegetation. There is no resemblance to natural vegetation and the area is transformed. Low faunal diversity is expected from these heavily degraded areas on the site. From vegetation and faunal perspective the site and adjacent areas have a low sensitivity and conservation potential/value as well as ecosystem functioning.

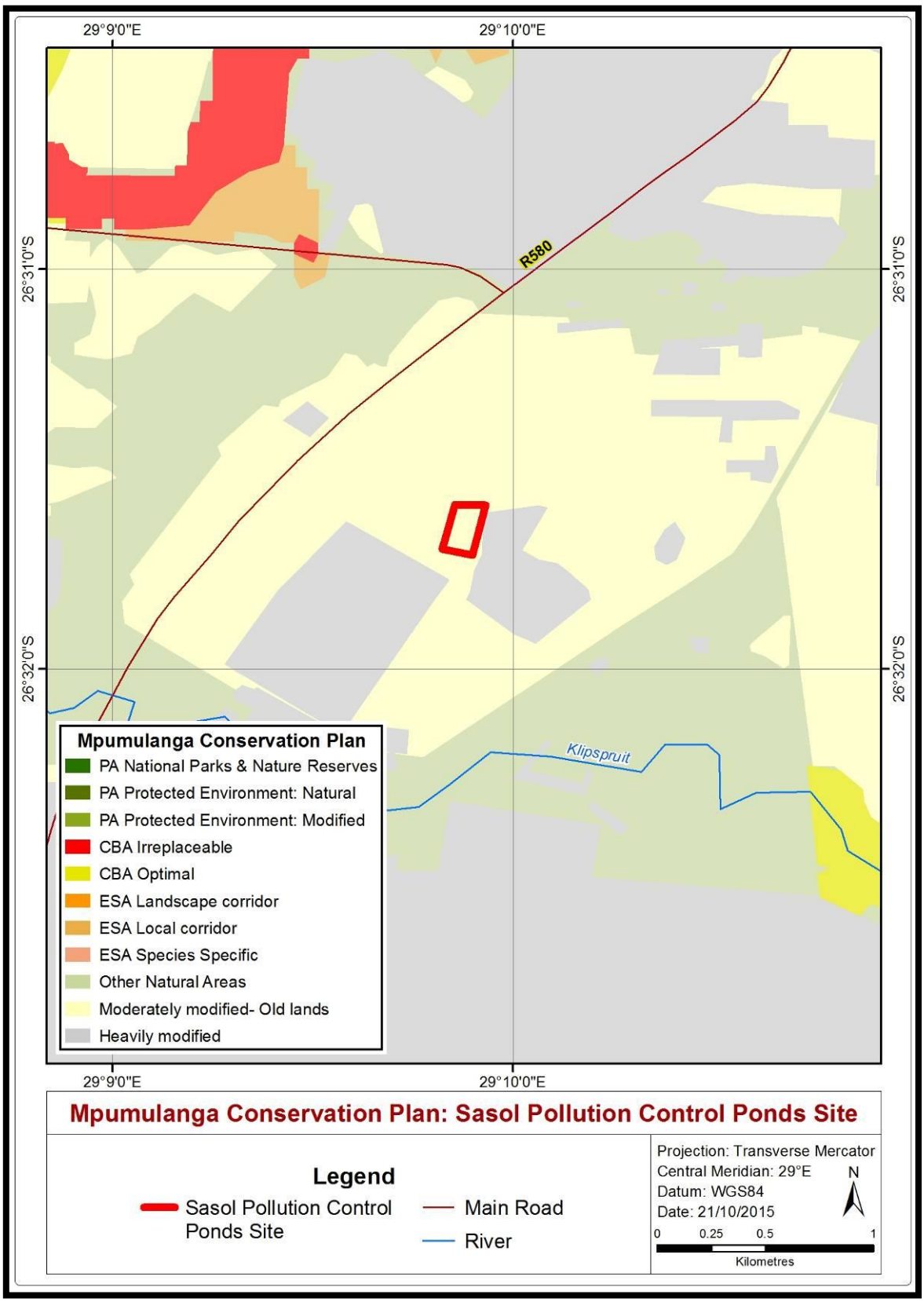


Figure 31: MBSP for the pollution control pond area

8.1.9 Potential Impacts

The potential impacts of the proposed project on the immediate and surrounding environment include:

8.1.9.1 Loss of Faunal Habitats

Development of the proposed 2 ha site will most likely have an impact on the remaining (albeit limited) faunal component, residing in or utilising the transformed agricultural lands on the site. The entire site and adjacent areas to the west of the site consists of transformed agricultural lands. An existing dumping site occurs immediately to the east of the site. The high level of human disturbances within the adjacent dumping site and agricultural lands significantly reduces the potential impacts due to the alteration of the majority of habitats within these transformed areas on the site and ultimately the displacement of species with narrow tolerance limits.

Alteration of the transformed agricultural lands within the proposed site will directly, and indirectly, impact on the smaller sedentary species (insects, arachnids, reptiles, amphibian and mammals) adapted to their ground dwelling habitats. Larger, more agile species (birds) will try and re-locate in suitable habitats away from the development during the construction phase of the ponds. In addition, heavy construction machinery, vehicles and the anticipated increased human population density, will most likely directly and indirectly result in the short and long-term alteration of the faunal composition of the site. A further indirect, moderate to high, long term, negative impact, which is likely to affect the remaining fauna, is possible uncontrolled hunting ("poaching") around the site. This will naturally have the effect of reducing affected animal species around the site.

8.1.9.2 Surface Run-off: Erosion (Sedimentation) and Possible Siltation

Run-off from the construction site for the Charlie 1 pollution control pond area could potentially result in deterioration of water quality and increased siltation and sedimentation of the adjacent lower-lying valley bottom wetlands.

8.1.9.3 Surface and Groundwater

Provision of adequate sewerage and wastewater facilities must be implemented throughout all stages of development to prevent the possible contamination of surface and ground (borehole) water. All construction machinery must be regularly serviced and checked for oil and fuel leaks.

8.1.9.4 Migratory Routes (Fencing)

The migratory movements of several animal (frog, reptile and mammal) species are completely disrupted by numerous walls, fences (current Sasol Charlie 1 fence) and road networks, which restrict natural movements between suitable foraging and breeding areas. This is especially prevalent for highly mobile species, such as Giant Bullfrogs, which can migrate up to six kilometres from suitable foraging areas (open grassland) to favourable breeding areas (seasonal pans or ponds). Fencing off of the Charlie 1 site plays a critical role in impeding the natural migration of the majority of larger animal species in the area. A trade off thus exists between safety and security on the one hand and movement of animal species on the other.

8.1.9.5 Artificial Lighting

Numerous species will be attracted towards the light sources and this will result in the disruption of natural cycles, such as the reproductive cycle and foraging behaviour. The lights may destabilise insect populations, which may alter the prey base, diet and ultimately the well being of nocturnal insectivorous fauna. The lights may attract certain nocturnal species to the area, which would not normally occur there, leading to competition between sensitive and the more common species.

8.2 Visual

Sasol proposes to increase the height of the Charlie 1 Landfill by 20 m to achieve the required airspace for the remaining life of the landfill.

During the pre-feasibility study, viewshed analysis modelling[14] was conducted for unscreened landfill heights of 5, 10, 15 and 20 m. A 5 km radius around the landfill footprint was utilised as it is unlikely that the landfill will have a significant visual impact beyond this distance.

The results for all the options were largely similar, with the landfill expected to be visible from more than 80% of the study area for all unscreened options, including from the casino, mall and most of the surrounding residential neighbourhoods (Figure 31).

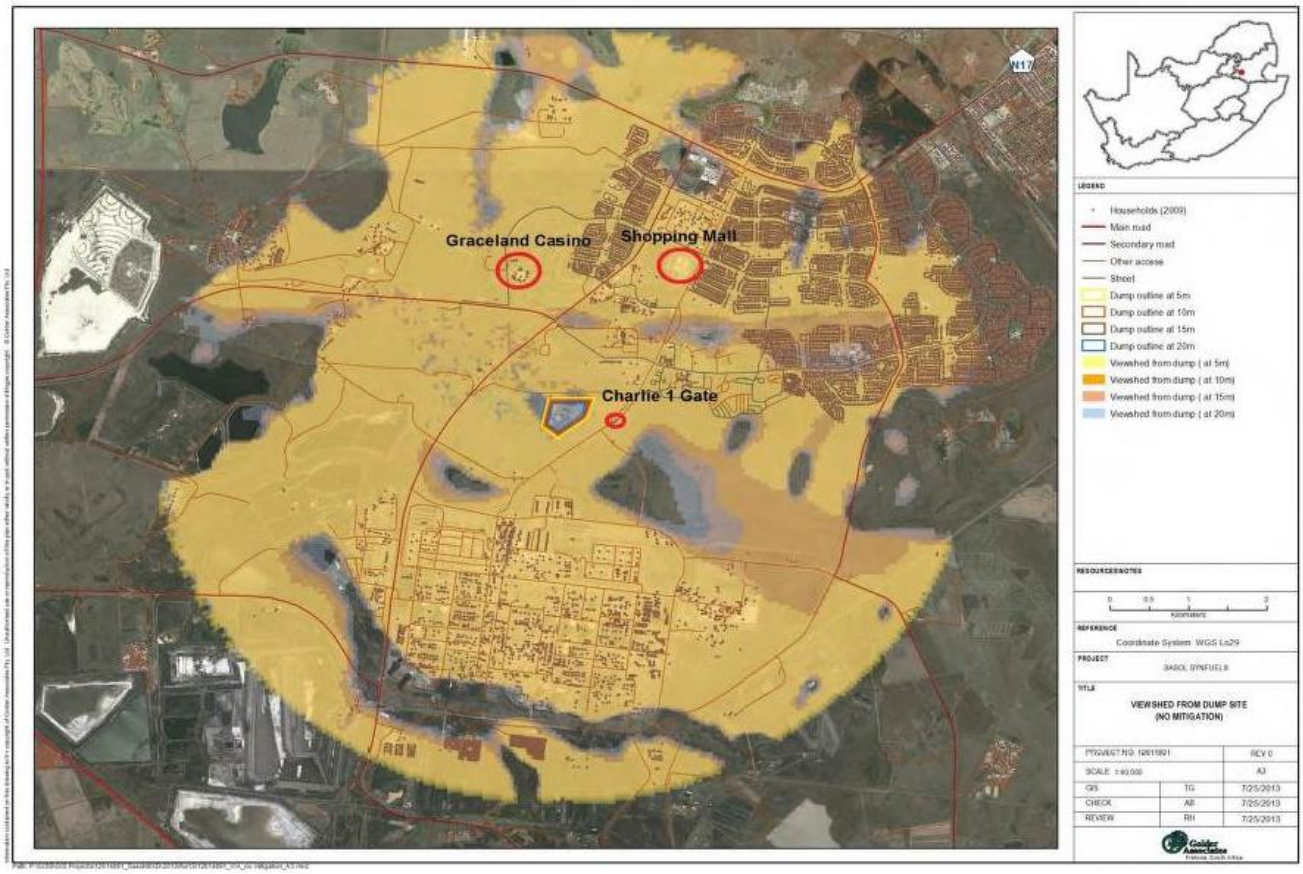


Figure 32: Theoretic visibility of unmitigated landfill (all landfill height situations)

Taking the above into consideration, separate mitigation options were generated for the 5 m and 20 m landfill heights, i.e. with a line of trees placed along the:

- Northern and eastern boundaries of the landfill site; and
- Southern boundary of the casino golf course.

The results of the viewshed analysis indicated that by placing a tree screen along the eastern site boundary, the visual impact from the Charlie 1 Gate could be significantly mitigated for all landfill heights. Placing a similar tree screen along the northern site boundary would to some extent screen the landfill from view from the Secunda Mall and Graceland Casino golf course, for a landfill height of 5 m. However, the tree screen

[14] Golder Associates (2013). Sasol Synfuels Charlie 1 Dump: Viewshed Analysis to determine visibility of various dump heights and initial screening options. Reference No 12614891_TechMem_002.

would not be effective at screening a landfill with a 15 m or 20 m height, especially when viewed from an elevated location.

It was therefore recommended that further visual assessment of various tree screen and landfill height combinations be conducted in order to verify and substantiate the results of the viewshed analysis. Refer to **Appendix G** for the Visual Modelling Assessment.

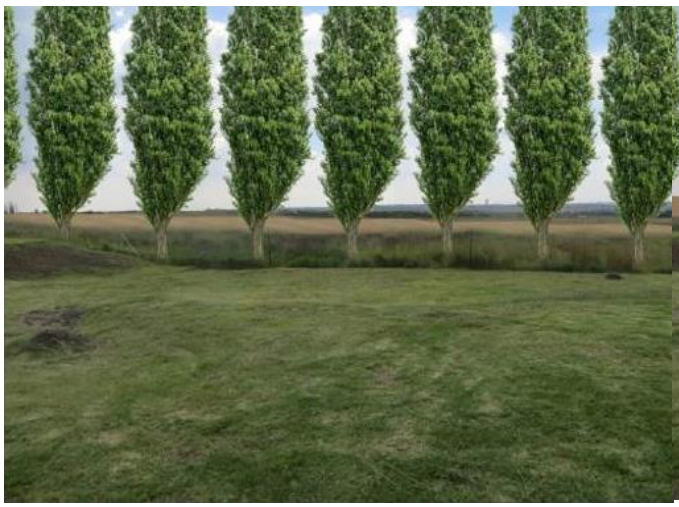
8.2.1 Charlie 1 Security Entrance

Charlie 1 Gate is noted as one of the most sensitive visual receptor locations in terms of the planned expansion of the landfill, as it is located directly adjacent to the existing landfill site. However, the existing landfill is not highly visible, due to its relatively low height.

It is therefore recommended that vegetative visual screening be implemented. Two options were assessed, namely a tree screen only (Figure 33) and combination of trees and shrubs (Figure 34).

From the visual modelling it can be seen that the tree-only screen provides a somewhat limited degree of screening regardless of the landfill height, due to the fact that the landfill is partially visible between the tree trunks and underneath the tree canopy. While the degree to which this will occur is partially dependant on the growth form and spacing of the specific tree species that is chosen, it is unlikely that the full screening of the landfill will be achieved using a tree screen only. Nevertheless, the trees tend to focus the attention of the viewer on the foreground of the view, thereby lessening the visual impact of the landfill itself. In addition, once profiled, capped and vegetated, the visual impact of the landfill in conjunction with the tree screen is expected to be significantly mitigated, regardless of its final height.

Conversely, the combination of trees and dense shrubs as a screen is expected to significantly screen the landfill from view, especially for the 5 m and 10 m landfill heights. While the top of the landfill will be partially visible at 15 m and 20 m the actual visual impact will be further reduced due to the appearance of the vegetative screen.



Tree screen only, 5 m landfill height

Tree screen only, 10 m landfill height

Tree screen only, 15 m landfill height

Tree screen only, 20 m landfill height

Figure 33: View from Charlie 1 security entrance – tree screen only[15]

[15] Golder Associates (2015). Sasol Synfuels Charlie 1 Landfill: Visual assessment modelling to determine potential screening effectiveness of vegetative barriers. Reference No 1418079_TechMem_006_Rev1.

Tree and shrub screen, 5 m landfill height

Tree and shrub screen, 10 m landfill height

Tree and shrub screen, 15 m landfill height

Tree and shrub screen, 20 m landfill height

Figure 34: View from the Charlie 1 security entrance – tree and shrub combination screen[16]

8.2.2 Graceland Casino and Hotel

Currently the degree of visibility of the landfill from the Graceland Casino is limited due to the presence of existing trees located in the area between the landfill and casino. The visual impact is further reduced due to the distance between the landfill and the casino. As a result only the western half of the landfill is exposed to view.

The visibility of the landfill increases significantly when its height is increased, due to the fact that the casino is located in a slightly elevated position in relation to the landfill. This occurrence will be more pronounced when viewed from the higher storeys of the casino hotel, as viewers would effectively look over the existing vegetation onto the landfill. While the existing vegetation still offers some degree of screening at a height of 5 m and 10 m, more than half of the facing landfill side slope will be visible at a height of 15 m and especially at 20 m.

By establishing a tree screen along the western half of the northern site boundary, the landfill can still be significantly screened from view at a landfill height of 5 m. This is no longer the case at a landfill height of 10 m as the upper half of the landfill will be visible above the existing trees in the left hand half of the view and

[16] *Ibid* Footnote 15.

also protrudes above the tree screen. The level of visibility of the landfill is especially higher at heights of 15 m and 20 m, as the tree screen is no longer expected to obscure the top half of the landfill. However, the distance between the landfill and the casino is expected to mitigate the visual impact to some extent, especially once the landfill has been re-profiled and vegetated. In addition, the landfill will effectively screen much of the Sasol infrastructure behind it as its heights increases.

These aspects are illustrated by Figure 35.

Tree screen and 5 m landfill height

Tree screen and 10 m landfill height

Tree screen and 15 m landfill height

Tree screen and 20 m landfill height

Figure 35: View from Graceland Casino[17]

8.2.3 Secunda Mall

Currently the degree of visibility of the landfill from the Secunda Mall is low due to the distance between the two areas and the presence of significant existing vegetation. In addition, the backdrop of the existing Sasol plant infrastructure and ash dams result in the landfill site not being visually intrusive.

[17] *Ibid* Footnote 15.

By establishing a tree screen along the northern and eastern site boundary, the landfill is effectively completely screened from view. At a height of 10 m the topmost part of the dump protrudes above the tree screen but is still not expected to be visually prominent as it will likely be overshadowed by the infrastructure behind it.

Whilst the level of visibility of the landfill increases more significantly with a height increases to 15 m and 20 m, the resultant visual impact is still largely mitigated as indicated above. The landfill is also not expected to significantly screen any of the existing Sasol infrastructure, at least not from elevated positions along the upper levels of the mall complex.

The above options are illustrated on Figure 36.

Tree screen and 5 m dump height

Tree screen and 10 m dump height

Tree screen and 15 m dump height

Tree screen and 20 m dump height

Figure 36: View from Secunda Mall

8.2.4 Potential Impacts

The most sensitive visual receptor anticipated to be impacted by the increase in the Charlie 1 Landfill height is expected to be Charlie 1 security entrance, as it is located directly adjacent to the existing landfill and hence has the highest visual exposure to the proposed landfill expansion. However, it is expected that the visual impact can be significantly mitigated by planting a tree and shrub screen along the perimeter of the site, regardless of the final height of the landfill.

For the Graceland Casino and Hotel as well as the Secunda Mall, in most instances the viewer will be able to see over a vegetative screen than is planted alongside the landfill, especially at a final height of 15 m or 20 m. However, the severity of the visual impact is reduced due to the distance between the landfill and these receptor locations; and is expected to be further mitigated once the landfill has been re-profiled and vegetated.

8.3 Heritage

8.3.1 Potential Impact

The Secunda area has been a prime development area for mining and industries. These developments would have destroyed possible heritage sites in the area.

The heritage specialist does not expect any important heritage sites to be present on the proposed development site. If during development any heritage remains or graves are found all work has to stop till the site has been mitigated by a heritage specialist.

The desktop heritage assessment is attached as **Appendix H**.

8.4 Palaeontology

Based on the geology of the area and the palaeontological record, it can be assumed that the formation and layout of the coal seams and associated shales are typical of other deposits in the Karoo Basin, so no fossil animals will occur there. Coal is made from fossil plants but compressed and altered to such an extent that the original plant material is unrecognisable. Fossil plants may be associated with the adjacent shales and shale lenses but are assumed to be the same as other coal deposits and therefore very common. Until the coal seams and shales are exposed and examined, this remains an uncertainty, but a minor one.

The SAHRIS palaeosensitivity map for the site indicates red (very sensitive and very high probability of fossils occurring) occurring around the Winkelhaak Mines and along the small river that feeds into the Evander Dam. The rest of the area is grey (insignificant to zero chance of finding fossils). Although there are coal seams below ground there are no published or published records of fossils plants from this area, most likely because the deposits are far below the surface.

8.4.1 Potential Impact

The surface activities would not impact on the fossil heritage as the coals and any associated fossil plants are below ground. While it is possible that plant fossils occur in the proposed pond area they will not be detected until excavations begin.

The desktop palaeontological assessment is attached as **Appendix H**.

9 POTENTIAL IMPACTS ASSOCIATED WITH THE PROJECT

It should be noted that the recommendations of the specialists have been incorporated in this chapter.

9.1 Impact Assessment Methodology

The potential environmental impacts associated with the project will be evaluated according to it nature, extent, duration, intensity, probability and significance of the impacts, whereby:

- Nature: An overview of the impact and defines it as being beneficial, neutral or detrimental in its impact on the environment;
- Spatial Extent: Defines physical extent or range of the impact. It will be indicated whether the impact will be limited to the site of the development activity specifically, limited to the immediate surroundings (local), the regional area, and/or the national area;
- Duration: Indicates the lifetime of the impact as a result of the proposed activity;
- Probability: Describes the likelihood of an impact actually occurring;
- Cumulative: Describes the cumulative effect of the impacts on the environmental and social parameter; and
- Severity: Scientifically evaluates how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system or a particular affected party.

Table 21: Rating criteria

Criteria	Description			
Spatial Extent	**National (4)** The whole of South Africa	**Regional (3)** Provincial and parts of neighbouring provinces	**Local (2)** Within a radius of 2 km of the construction site	**Site (1)** Within the construction site
Duration	**Permanent (4)** Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient	**Long-term (3)** The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory	**Medium-term (2)** The impact will last for the period of the construction phase, where after it will be entirely negated	**Short-term (1)** The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase
Probability Of Occurrence	**Definite (4)** Impact will certainly occur	**Highly Probable (3)** Most likely that the impact will occur	**Possible (2)** The impact may occur	**Improbable (1)** Likelihood of the impact materialising is very low
Severity	**Very Severe (4)** Irreversible and permanent change to the environment which cannot be mitigated	**Severe (3)** Long-term impacts on the environment that could be mitigated	**Average (2)** Medium impacts on the environment. Mitigation is easy, cheap, less time consuming as the impact is partially reversible.	**Negligible (1)** Environment is marginally affected by the proposed development. Completely reversible with implementation of minor mitigation measures
Cumulative	**High (4)** Impact will result in significant cumulative impacts	**Medium (3)** Impacts will result in medium significant cumulative impacts	**Low (2)** Impact will result in Low cumulative impacts	**Negligible (1)** Impact will result in negligible to no cumulative impacts

Significance is determined through a synthesis of the various impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the social parameter.

The calculation of the significance of an impact uses the following formula:

(Extent + Duration + Probability + Cumulative effect) x Severity

The status of the impact determines whether the value is positive (beneficial) or negative (detrimental).

The summation of the different criteria produces a non-weighted value. By multiplying this value with the severity rating, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

The impact is rated in terms of the criteria presented in Table 22 below.

Table 22: Significance rating of classified impacts

Impact	Rating	Description	Quantitative Rating
Positive	High	Of the highest positive order possible within the bounds of impacts that could occur.	+46 to +64
	Medium	Positive impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. Other means of achieving this benefit are approximately equal in time, cost and effort.	+21 to +45
	Low	Positive impacts are of a low order and therefore likely to have a limited effect. Alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming.	+5 to +20
Negligible impact	Negligible impact	Zero (or effective neutral) impact.	+4 to -4
Negative	Low	Impact is of a low negative order and therefore likely to have little real effect. In the case of adverse impacts, mitigation will be required, or both. Social, cultural, and economic activities of communities can continue unchanged.	-5 to -20
	Medium	A negative impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and fairly possible. Social cultural and economic activities of communities are changed but can be continued (albeit in a different form). Modification of the project design or alternative action(s) may be required to avoid or minimise such impacts.	-21 to -45
	High	Of the highest negative order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming, or a combination of these. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt or modified beyond recognition.	-46 to -64

The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented. Mitigation measures identified as necessary will be included in an EMPr. The EMPr will form part of the EIR.

9.2 Geotechnical

<table>
<tr><td rowspan="8">Construction</td><td colspan="7">Potential Impacts</td></tr>
<tr><td colspan="7">▪ Earthworks and construction of infrastructure.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance before mitigation</td></tr>
<tr><td>-2</td><td>-2</td><td>-2</td><td>-2</td><td>-2</td><td>-16</td><td>Low</td></tr>
<tr><td colspan="7">Mitigation</td></tr>
<tr><td colspan="7">▪ Earthworks should be carried out as stipulated in the guidelines provided in SANS 1200 (Standardised Specification for Civil Engineering Construction).
▪ Earthworks and drainage measures should be designed in such a way as to prevent ponding of, or high concentrations of, stormwater or groundwater anywhere on the sites.
▪ Onsite inspections and evaluations should be conducted regularly.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance after mitigation</td></tr>
<tr><td>-1</td><td>-2</td><td>-1</td><td>-2</td><td>-1</td><td>-6</td><td>Low</td></tr>
<tr><td rowspan="8">Operation</td><td colspan="7">Potential Impacts</td></tr>
<tr><td colspan="7">▪ Increase in landfill height resulting in potential stability impacts.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance before mitigation</td></tr>
<tr><td>-2</td><td>-3</td><td>-2</td><td>-3</td><td>-3</td><td>-30</td><td>Medium</td></tr>
<tr><td colspan="7">Mitigation</td></tr>
<tr><td colspan="7">▪ Earthworks and drainage measures should be designed in such a way as to prevent ponding of, or high concentrations of, stormwater or groundwater anywhere on the sites.
▪ Concurrent capping/rehabilitation activities are to be carried out in order to protect the side slopes of the Charlie 1 Landfill from erosion, reduce stormwater collection volumes and to lessen the visual impact of the ash dump.
▪ The maximum final finished capped side slope of the Charlie 1 Landfill should not be steeper than 1V:3H to ensure long term stability of the slope.
▪ The Charlie 1 Landfill should be monitored on a regular basis for possible movement and slope failure. The amount of movement that is likely to occur before failure determines the sensitivity of the monitoring equipment required. Movement varies with the type of material disposed, the disposal facility height and the location at which monitoring will be done.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance after mitigation</td></tr>
<tr><td>-1</td><td>-2</td><td>-2</td><td>-2</td><td>-2</td><td>-14</td><td>Low</td></tr>
</table>

9.3 Soils

<table>
<tr><td rowspan="8">Construction</td><td colspan="8">Potential Impacts</td></tr>
<tr><td colspan="8">▪ Removal and compaction of soil during construction activities.
▪ Erosion, degradation and loss of topsoil due to construction activities as well as surface and stormwater run-off.
▪ Potential contamination of soils due to spillage, leakage, incorrect handling of fuel and other hazardous materials.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance before mitigation</td></tr>
<tr><td>-1</td><td>-2</td><td>-2</td><td>-1</td><td>-1</td><td>-6</td><td>Low</td></tr>
<tr><td colspan="8">Mitigation</td></tr>
<tr><td colspan="8">▪ Disturbed areas of natural vegetation as well as excavation areas must be rehabilitated immediately to prevent soil erosion.
▪ Remove and store topsoil separately in areas where excavation/degradation takes place. Topsoil should be used for rehabilitation purposes in order to facilitate re-growth of species that occur naturally in the area.
▪ Secondary containment for all fuel stored on site.
▪ Accurate oil records must be kept.
▪ Ensure clean up protocols are in place and followed.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance after mitigation</td></tr>
<tr><td>-1</td><td>-2</td><td>-1</td><td>-1</td><td>-1</td><td>-5</td><td>Low</td></tr>
<tr><td rowspan="8">Operation</td><td colspan="8">Potential Impacts</td></tr>
<tr><td colspan="8">▪ Improper management of the leachate and stormwater run-off from the Charlie 1 Landfill site could potentially contaminate soils.
▪ Potential contamination of soils (lateral movement of the leachate in the upper soil zone) during operations and maintenance due to:
– accidental release of the leachate and stormwater from the ponds;
– damage of the ponds lining system;
– lack of maintenance of stormwater and leachate drains; and
– silt traps that are not de-silted regularly.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance before mitigation</td></tr>
<tr><td>-1</td><td>-2</td><td>-2</td><td>-1</td><td>-2</td><td>-12</td><td>Low</td></tr>
<tr><td colspan="8">Mitigation</td></tr>
<tr><td colspan="8">▪ Effective monitoring and maintenance of stormwater management system in accordance to the stipulations in the EMPr (Appendix I) to ensure there are no leakages of contaminated leachate and stormwater into the soil.
▪ All leakages onto soils should be cleaned immediately.
▪ Drains and silt traps must be de-silted regularly.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance after mitigation</td></tr>
<tr><td>-1</td><td>-2</td><td>-1</td><td>-1</td><td>-1</td><td>-5</td><td>Low</td></tr>
</table>

Decommissioning	Potential Impacts						
	▪ Increased erosion due to decommissioning activities. ▪ Refer to construction phase impacts.						
	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	-1	-2	-1	-1	-1	-5	Low
	Mitigation						
	▪ Concurrent rehabilitation of the Charlie 1 Landfill should be carried out in accordance with the Feasibility Engineering Package (FEP) (**Appendix D**). ▪ Rehabilitation of areas affected by construction and operation activities should ideally commence at the start of the rainy season. ▪ All areas where topsoil was removed should be landscaped in order to reflect surrounding conditions. ▪ Refer to construction phase mitigation.						
	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-1	-2	-1	-1	-1	-5	Low

9.4 Geohydrology

Construction	Potential Impacts						
	▪ Contamination of groundwater due to spillage, leakage, and incorrect handling of fuel and other hazardous materials. ▪ Lack of provision of ablutions may lead to the creation of informal ablutions.						
	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	-2	-2	-2	-2	-2	-16	Low
	Mitigation						
	▪ Secondary containment for all fuel stored on site. ▪ Accurate oil records must be kept. ▪ Ensure clean up protocols are in place and followed. ▪ Temporary ablutions must be provided for construction employees.						
	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-1	-2	-1	-1	-1	-5	Low
Operation	Potential Impacts						
	▪ Improper management of the leachate and stormwater run-off from the Charlie 1 Landfill site allows rainwater to pond in areas on the surface and side areas of the landfill. These ponds allow for artificial hydraulic heads to form which force water into the body of the landfill, to percolate through, and contribute to the potential for leachate generation that could potentially contaminate groundwater resources. ▪ Improper design of the lining system for the ponds could provide a pathway for the contamination of the groundwater resources.						

- Potential contamination of groundwater during operations and maintenance due to:
  - accidental release of the leachate and stormwater from the ponds;
  - damage of the ponds lining system;
  - lack of maintenance of stormwater and leachate drains; and
  - silt traps that are not de-silted regularly.

Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
-2	-3	-2	-3	-3	-30	Medium

Mitigation

- Effective monitoring and maintenance of the leachate interception and stormwater management system according to the stipulations in the EMPr (**Appendix I**) to ensure that leachate and stormwater run-off does not pond on the surface and side areas of the landfill.
- Sizing of ponds - designed to accepted standards and norms.
- Lining of the CLP and CSP as per the recommendations of the FEP (**Appendix D**) where it is proposed that a triple liner system or equivalent Class A barrier system be installed for the CLP. It is also proposed that the primary liner be changed to a double geomembrane system with a leakage detection layer between the two geomembranes, from which any leakage that occurs through the top geomembrane will be monitored, captured and returned to the leachate pond.
- For the CSP, it is proposed that a Class B barrier system is installed. It is also proposed that the primary liner be changed to a double geomembrane system with a leakage detection layer between the two geomembranes, from which any leakage that occurs through the top geomembrane will be monitored, captured and returned to the stormwater pond.
- In the maintenance of the two ponds, care must be taken not to damage any HDPE (black plastic) liners. Personnel should avoid walking on the liners. Scratches can compromise the service life of a liner. Tears or deep scratches to the exposed liner should be noted and repaired where necessary by a specialist Contractor. It is possible to have patches welded over damaged areas of liner. Regular inspections of the exposed liners should be carried out as part of routine maintenance. For both ponds, should desilting or removal of precipitated solids be required, absolute care must be taken not to damage the liners. Only plastic spades should be used. Care must also be taken not to damage the HDPE liners with herbicides or “weedeaters” and other grass cutting machines. Where damage is noted, the operator should call in a professional liner installer to repair the damage. The liners are UV resistant and resistant to most chemicals. However, as the quality of the leachate can vary with time, the ponds should be monitored for unexpected degradation.
- Maintenance of the both the stormwater and leachate drains should be carried out on a regular basis. The v-drains associated with stormwater management require simple desilting. This may be achieved manually without any additional equipment. The silt trap will also require regular desilting which may be done by hand or with a skid steer via the access ramp. Leachate drains should be monitored by regular inspections of the manholes located every 100 m. If blockages occur, specialist rodding equipment may be required for unblocking. A standby borehole pump may be kept on site in case of significant blockages requiring extraction of leachate.
- Pumps must be maintained as per their specifications. This may require periodic servicing and possible replacement. The enhanced evaporation system is designed and includes accessories to minimise operational maintenance. The nozzles specified on the sprayers are self-cleaning to prevent blockages while an “auto-flush” strainer bank is also included. Overall configuration and adjustments to the system will be an ongoing process until optimal outcomes are achieved. Once optimised, the system should be largely automated by linking it to a weather station. The site operator or responsible party will however have to monitor and make adjustments to the system on a daily basis.
- Two abstraction periods should be scheduled per year for the CLP. Ideally these periods should be scheduled immediately before and after the rain season (i.e. September/October and April/May).

<table>
<tr><td rowspan="4"></td><td colspan="7">▪ Abstraction should be scheduled once a year for the CSP. Ideally these periods should be scheduled immediately before and after the rain season (i.e. September/October and April/May).
▪ The leakage monitoring sumps associated with each pond also need to be monitored on a regular basis. This monitoring includes the measurement of leakage flow rates into each monitoring manhole. These flow rates are to be compared with relevant regulatory standards to determine whether the liner installations are performing adequately. If excessive leakage is experienced, a leak detection survey may need to be performed in order to identify any problem areas within the pond and carry out repairs. Any leakage retrieved from these monitoring points is to be returned into the respective pond.
▪ Implementation of a groundwater monitoring programme:
– Ten boreholes are monitored as part of the groundwater monitoring programme. The monitoring frequency is twice a year (May and November) for all boreholes except REGM-98 and REGM-229, which are sampled annually (November).
– 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.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance after mitigation</td></tr>
<tr><td>-2</td><td>-3</td><td>-1</td><td>-1</td><td>-2</td><td>-14</td><td>Low</td></tr>
<tr><td></td></tr>
<tr><td rowspan="8">Decommissioning</td><td colspan="7">Potential Impacts</td></tr>
<tr><td colspan="7">▪ Groundwater contamination due to decommissioning activities.
▪ Refer to impacts on groundwater resources during the construction phase.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance before mitigation</td></tr>
<tr><td>-2</td><td>-2</td><td>-2</td><td>-2</td><td>-2</td><td>-16</td><td>Low</td></tr>
<tr><td colspan="7">Mitigation</td></tr>
<tr><td colspan="7">▪ Ongoing groundwater monitoring of the Charlie 1 Landfill and pollution control pond area should be conducted.
▪ Refer to mitigation measures proposed in the construction phase.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance after mitigation</td></tr>
<tr><td>-1</td><td>-2</td><td>-1</td><td>-1</td><td>-1</td><td>-5</td><td>Low</td></tr>
</table>

9.5 Hydrology and Stormwater

<table>
<tr><td rowspan="6">Construction</td><td colspan="7">Potential Impacts</td></tr>
<tr><td colspan="7">▪ Contamination of surface water resources due to spillage, leakage, and incorrect handling of fuel and other hazardous materials.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance before mitigation</td></tr>
<tr><td>-2</td><td>-2</td><td>-2</td><td>-2</td><td>-2</td><td>-16</td><td>Low</td></tr>
<tr><td colspan="7">Mitigation</td></tr>
<tr><td colspan="7">▪ In the event of a spill of potential pollutants that would be at risk of entering any nearby surface water feature, the spill must be fully remediated and all</td></tr>
</table>

<table>
<tr><td></td><td colspan="7">pollutants removed. Should pollutants enter a surface water feature, full remediation of the polluted area within the surface water feature must be undertaken.
▪ Contaminated water should be directed into the correct disposal system and none should go into the stormwater system.
▪ Wastewater must not be allowed to come into direct contact with exposed soils or run across the plant site. All wastewater must be collected and disposed of in a correct and environmentally suitable manner.
▪ Machinery may not be washed on site.</td></tr>
<tr><td></td><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance after mitigation</td></tr>
<tr><td></td><td>-1</td><td>-2</td><td>-1</td><td>-1</td><td>-1</td><td>-5</td><td>Low</td></tr>
<tr><td rowspan="6">Operation</td><td colspan="7">Potential Impacts</td></tr>
<tr><td colspan="7">▪ Improper management of the leachate and stormwater run-off from the Charlie 1 Landfill site due to an absence of clean and dirty water segregation exacerbating the magnitude of contaminated run-off potential, rather than effective diversion of clean run-off from the landfill surface.
▪ Improper surface water management arising from rainfall falling on the landfill so as to prevent all such surface water becoming contaminated, and/or contributing to leachate potential by infiltrating through the landfill due to ponding on the surface of the landfill rather than freely draining.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance before mitigation</td></tr>
<tr><td>-2</td><td>-3</td><td>-3</td><td>-3</td><td>-2</td><td>-22</td><td>Medium</td></tr>
<tr><td colspan="7">Mitigation</td></tr>
<tr><td colspan="7">▪ The landfill should be shaped in a manner that run-off will be channelled away from the site.
▪ Sizing of ponds - designed to accepted standards and norms.
▪ Contaminated stormwater from the landfill site must be captured in perimeter drains along the northern, western and southern boundary. This water is then gravity fed via a silt trap to the CSP. Upslope clean stormwater should be diverted away from the site by a berm located along the eastern boundary.
▪ Due to the standard cell operation method used for the landfill which stipulated that only one cell will be operational at any given time, stormwater will be minimal.
▪ A surface water monitoring programme is currently taking place around the Sasol Industrial complex. RESM 4, 5, 6 and 7 are the nearest surface water monitoring points to the Charlie 1 Landfill site. 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.
▪ Regular maintenance of stormwater management system should be undertaken in accordance to the maintenance requirements (EMPr - Appendix I) to ensure that leachate and stormwater run-off is effectively diverted and contained on site.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance after mitigation</td></tr>
<tr><td>-1</td><td>-3</td><td>-2</td><td>-1</td><td>-1</td><td>-7</td><td>Low</td></tr>
<tr><td rowspan="2">Decommissioning</td><td colspan="7">Potential Impact</td></tr>
<tr><td colspan="7">▪ Continued stormwater flows of polluted water.
▪ Surface water contamination due to decommissioning activities.
▪ Refer to impacts on surface water resources during the construction phase.</td></tr>
</table>

	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	-2	-2	-2	-2	-2	-16	Low
	Mitigation						
	▪ Concurrent rehabilitation of the Charlie 1 Landfill should be carried out in accordance with the FEP (**Appendix D**). ▪ Ongoing surface water monitoring. ▪ Refer to mitigation measures proposed in the construction phase.						
	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-1	-2	-1	-1	-1	-5	Low

9.6 Ecology

Construction	Potential Impacts						
	▪ Impact on the remaining (albeit limited) faunal component, residing in or utilising the transformed agricultural lands on the site. ▪ Alteration of the transformed agricultural lands will directly, and indirectly, impact on the smaller sedentary species (insects, arachnids, reptiles, amphibian and mammals) adapted to their ground dwelling habitats. ▪ Disruption of natural faunal cycles, such as the reproductive cycle and foraging behaviour due to artificial lighting.						
	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	-1	-2	-1	-1	-1	-5	Low
	Mitigation						
	▪ Workers must be limited to areas under construction and access to neighbouring agricultural lands must be strictly regulated (“no-go areas” through all stages of the project), preventing uncontrolled hunting and poaching. ▪ Construction should be limited, where practical, to the daylight hours preventing disturbances to the nocturnal activities of certain species and nearby human populations. ▪ Weeds and alien vegetation should be removed and prevented from spreading into newly disturbed areas or areas cleared of vegetation. Where lighting is required for safety or security reasons, this should be targeted at the areas requiring attention. Yellow sodium lights should be prescribed as they do not attract invertebrates at night and will not disturb the existing wildlife. Sodium lamps require a third less energy than conventional light bulbs.						
	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-1	-2	-1	-1	-1	-5	Low
Operation	Potential Impacts						
	▪ There are no operation phase ecological impacts associated with this project.						
Decommissioning	Potential Impacts						

	▪ There are no decommissioning phase ecological impacts associated with this project.

9.7 Visual

Construction	Potential Impacts						
	▪ There are no construction phase visual impacts associated with this project.						
Operation	Potential Impacts						
	▪ Due to the proposed height increase at the Charlie 1 Landfill, 80% of the study area (including key receptors: Charlie 1 Security Entrance, Graceland Casino, and Secunda Mall) will be visual impacted by the landfill.						
	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	-2	-4	-4	-3	-3	-39	Medium
	Mitigation						
	▪ The landfill conceptual deposition plan as proposed in the FEP (**Appendix D**) must be implemented. ▪ Utilise trees and shrubs as a screening method. ▪ A botanist should be consulted to determine the most suitable tree and shrub species to be used for screening. ▪ Employ concurrent rehabilitation methods to limit visual impact.						
	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-2	-4	-3	-1	-2	-20	Low
Decommissioning	Potential Impacts						
	▪ Positive visual impact as the landscape could be returned to a more natural appearance.						
	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	+2	+4	+2	+1	+2	+18	Low
	Mitigation						
	▪ No mitigation required.						

9.8 Heritage and Palaeontology

Construction	Potential Impacts					
	▪ Potential impact on archaeological and palaeontological resources.					
	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	-1	-4	-1	-1	-2	-14	Low

	Mitigation						
	▪ If during development any heritage remains or graves are found all work has to stop till the site has been mitigated by a heritage specialist. ▪ If fossil plant material is discovered during the excavation and construction of the development, then it is strongly recommended that a professional palaeontologist, preferably a palaeobotanist, be called to assess the importance and to rescue them if necessary (with the relevant SAHRA permit). ▪ If the fossil material is deemed to be of scientific interest then further visits by a professional palaeontologist would be required to collect more material and house it in a recognised institution.						
	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-1	-4	-1	-1	-1	-7	Low
Operation	Potential Impacts						
	▪ No operational impacts envisaged.						
Decommissioning	Potential Impacts						
	▪ No decommissioning impacts envisaged.						

9.9 Social

Construction	Potential Impacts						
	▪ Contractors and labour will be sourced locally as far as possible for the proposed project.						
	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	+1	+2	+3	+1	+1	+7	Low
	Mitigation						
	▪ No mitigation required.						
Operation	Potential Impacts						
	▪ There are no operational phase social impacts associated with this project.						
Decommissioning	Potential Impacts						
	▪ There are no decommissioning phase social impacts associated with this project.						

9.10 Air Quality

<table>
<tr><td rowspan="11">Construction</td><td colspan="7">Potential Impacts</td></tr>
<tr><td colspan="7">▪ Potential air pollution due to vehicle movement within the project area.
▪ Dust generation due to set up and removal of construction equipment; and truck transport.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance before mitigation</td></tr>
<tr><td>-1</td><td>-2</td><td>-3</td><td>-1</td><td>-2</td><td>-14</td><td>Low</td></tr>
<tr><td colspan="7">Mitigation</td></tr>
<tr><td colspan="7">▪ There should be strict speed limits on site to prevent the liberation of dust into the atmosphere.
▪ Dust must be suppressed at the construction site and temporary dirt roads and during the transportation of material during dry periods by the regular application of water or binding chemicals. Water used for this purpose must be used in quantities that will not result in the generation of run-off.
▪ All site workers during construction will need to wear the appropriate PPE to avoid excessive exposure to dust particles.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance after mitigation</td></tr>
<tr><td>-1</td><td>-2</td><td>-2</td><td>-1</td><td>-1</td><td>-6</td><td>Low</td></tr>
<tr><td rowspan="11">Operation</td><td colspan="7">Potential Impacts</td></tr>
<tr><td colspan="7">▪ Dust generation during operations.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance before mitigation</td></tr>
<tr><td>-1</td><td>-3</td><td>-3</td><td>-3</td><td>-2</td><td>-20</td><td>Low</td></tr>
<tr><td colspan="7">Mitigation</td></tr>
<tr><td colspan="7">▪ There should be strict speed limits on site roads to prevent the liberation of dust into the atmosphere.
▪ Dust must be suppressed on the site during the transportation and handling of material during dry periods by the regular application of potable water. Water used for this purpose must be used in quantities that will not result in the generation of run-off.
▪ All waste contractors will need to wear the appropriate PPE to avoid excessive exposure to dust particles.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance after mitigation</td></tr>
<tr><td>-1</td><td>-3</td><td>-2</td><td>-1</td><td>-1</td><td>-7</td><td>Low</td></tr>
<tr><td rowspan="5">Decommissioning</td><td colspan="7">Potential Impacts</td></tr>
<tr><td colspan="7">▪ Refer to construction phase impacts.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance before mitigation</td></tr>
<tr><td>-1</td><td>-2</td><td>-3</td><td>-1</td><td>-2</td><td>-14</td><td>Low</td></tr>
<tr><td colspan="7">Mitigation</td></tr>
</table>

	▪ Refer to construction phase mitigation measures.						
	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-1	-2	-2	-1	-1	-6	Low

9.11 Noise

Construction	Potential Impacts						
	▪ Noise generation during the construction phase at the proposed site.						
	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	-2	-2	-2	-1	-2	-14	Low
	Mitigation						
	▪ All construction vehicles and equipment are to be kept in good repair. ▪ Construction activities, and particularly the noisy ones, are to be contained to reasonable hours during the day and early evening. ▪ Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum. ▪ In general, operations should meet the noise standard requirements of the Occupational Health and Safety Act (No. 85 of 1993). ▪ Construction staff working in areas where the 8-hour ambient noise levels exceed 75 dBA should wear ear protection equipment.						
	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-2	-2	-2	-1	-1	-7	Low
Operation	Potential Impacts						
	▪ There are no operational phase noise impacts associated with this project.						
Decommissioning	Potential Impacts						
	▪ Refer to construction phase impacts.						
	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	-2	-2	-2	-1	-2	-14	Low
	Mitigation						
	▪ Refer to construction phase mitigation.						
	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-2	-2	-2	-1	-1	-7	Low

9.12 Traffic

Construction	Potential Impacts						
	▪ Increase in traffic due to construction activities.						
	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	-1	-2	-3	-2	-2	-16	Low
	Mitigation						
	▪ No person is allowed to drive more than 20 km/h on the gravel access road. This is applicable only to the access roads on site. All areas within the site itself, has a reduced speed limit of 50 km/h. This is communicated to all persons by means of National Speed Signs. ▪ When using heavy or large vehicles / equipment, “spotters” are to be present to assist the driver with his blind spots. ▪ Any incident or damage to a vehicle must be reported immediately as per Sasol Policies and Procedures.						
	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-1	-2	-2	-1	-1	-6	Low
Operation	Potential Impacts						
	▪ Operational phase traffic.						
	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	-1	-3	-2	-1	-1	-7	Low
	Mitigation						
	▪ Refer to construction phase impacts.						
	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-1	-3	-1	-1	-1	-6	Low
Decommissioning	Potential Impacts						
	▪ Increase in traffic due to decommissioning activities.						
	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	-1	-2	-3	-2	-2	-16	Low
	Mitigation						
	▪ No person is allowed to drive more than 40 km/h on a gravel road. This is applicable only to the access roads on site. All areas within the site itself, has a reduced speed limit of 30 km/h. This is communicated to all persons by means of National Speed Signs. ▪ When using heavy or large vehicles / equipment, “spotters” are to be present to assist the driver with his blind spots. ▪ Any incident or damage to a vehicle must be reported immediately as per Sasol Policies and Procedures.						

	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-1	-2	-2	-1	-1	-6	Low

9.13 Waste

Construction	Potential Impacts						
	▪ General waste generated includes domestic waste and small amounts of building rubble. ▪ Hazardous waste generated through the spillage of oil/diesel/chemicals used during construction.						
	Extent	Duration	Probability	Cumulative	Severity	Significance before mitigation	
	-1	-2	-2	-1	-2	-12	Low
	Mitigation						
	▪ Where possible, construction waste on site must be reused or recycled. ▪ Disposal of waste must be in accordance with relevant legislative requirements. ▪ General waste can be disposed of at the Charlie 1 disposal site with prior permission from the Operations Manager. All waste must be weighed and recorded prior to disposal. ▪ The Contractor must familiarise themselves with the definitions of waste and the handling, storage and transport of waste as prescribed in the applicable environmental legislation. ▪ Burning of waste will not be permitted.						
	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-1	-2	-2	-1	-1	-6	Low
Operation	Potential Impacts						
	▪ No operational waste impacts are envisaged.						
Decommissioning	Potential Impacts						
	▪ Refer to construction phase impacts.						

9.14 Health and Safety

<table>
<tr><td rowspan="8">Construction</td><td colspan="7">Potential Impacts</td></tr>
<tr><td colspan="7">▪ Potential health and safety impacts during construction which may include exposure to dust during windy periods.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance before mitigation</td></tr>
<tr><td>-1</td><td>-2</td><td>-2</td><td>-1</td><td>-2</td><td>-12</td><td>Low</td></tr>
<tr><td colspan="7">Mitigation</td></tr>
<tr><td colspan="7">▪ The vehicle speed limits at the landfill must be adhered to and the access of vehicles should be strictly controlled.
▪ Staff working at the landfill and pollution control pond area must be trained in basic safety procedures.
▪ All staff working should wear the appropriate PPE at all times.
▪ Occupational health practices and operating procedures which have been in existence should be maintained and continually improved in keeping with the current approach. Requirements of the Occupational Health and Safety Act (No. 85 of 1993) and its Regulations will apply to the project.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance after mitigation</td></tr>
<tr><td>-1</td><td>-2</td><td>-1</td><td>-1</td><td>-1</td><td>-5</td><td>Low</td></tr>
<tr><td rowspan="8">Operation</td><td colspan="7">Potential Impacts</td></tr>
<tr><td colspan="7">▪ Potential contamination of groundwater resources affecting human health.</td></tr>
<tr><td>Extent</td><td>Duration</td><td>Probability</td><td>Cumulative</td><td>Severity</td><td colspan="2">Significance before mitigation</td></tr>
<tr><td>-2</td><td>-3</td><td>-2</td><td>-2</td><td>-3</td><td>-18</td><td>Low</td></tr>
<tr><td colspan="7">Mitigation</td></tr>
<tr><td colspan="7">▪ Effective monitoring and maintenance of the leachate and stormwater management system according to the stipulations in the EMPr (Appendix I) to ensure that leachate and stormwater run-off does not pond on the surface and side areas of the landfill.
▪ Lining of the CLP and CSP as per the recommendations of the FEP (Appendix D) where it is proposed that a triple liner system or equivalent Class A barrier system be installed for the CLP. It is also proposed that the primary liner be changed to a double geomembrane system with a leakage detection layer between the two geomembranes, from which any leakage that occurs through the top geomembrane will be monitored, captured and returned to the leachate pond.
▪ For the CSP, it is proposed that a Class B barrier system is installed. It is also proposed that the primary liner be changed to a double geomembrane system with a leakage detection layer between the two geomembranes, from which any leakage that occurs through the top geomembrane will be monitored, captured and returned to the stormwater pond.
▪ In the maintenance of the two ponds, care must be taken not to damage any HDPE (black plastic) liners. Personnel should avoid walking on the liners. Scratches can compromise the service life of a liner. Tears or deep scratches to the exposed liner should be noted and repaired where necessary by a specialist Contractor. It is possible to have patches welded over damaged areas of liner. Regular inspections of the exposed liners should be carried out as part of routine maintenance. For both ponds, should desilting or removal of precipitated solids be required, absolute care must be taken not to damage the liners. Only plastic spades should be used. Care must also be taken not to damage the HDPE liners with herbicides or “weedeaters” and other grass cutting machines. Where damage is noted, the operator should call in a professional liner installer to repair the damage. The liners are UV resistant and resistant to most chemicals. However, as the quality of the leachate can vary with time, the ponds should be monitored for unexpected</td></tr>
</table>

	degradation. ▪ Maintenance of the both the stormwater and leachate drains should be carried out on a regular basis. ▪ Pumps must be maintained as per their specifications. ▪ Implementation of groundwater and surface water monitoring programmes as specified in the geohydrology and hydrology sections.						
	Extent	Duration	Probability	Cumulative	Severity	Significance after mitigation	
	-2	-3	-1	-1	-1	-7	Low
Decommissioning	Potential Impacts						
	▪ There are no decommissioning phase health and safety impacts associated with this project.						

10 ENVIRONMENTAL IMPACT STATEMENT

10.1 Key Findings of the EIA

The results of the impact assessment indicate that the most significant impacts as a result of the proposed project would include impacts on geohydrology, hydrology, and visual environment. These impacts can be successfully mitigated through the measures and recommendations presented in this study (Sections 9.2 - 9.14) and the Environmental Management Programme – EMPr (**Appendix I**). The site sensitivity map is presented in Figure 37

Currently, the water management system at the Charlie 1 Landfill site is not in accordance with permit conditions. Should the status quo remain then Sasol will not be able to comply with the applicable legislation, guidelines, regulations and standards and the current situation will continue which includes:

- Inadequate stormwater management around the landfill site;
- Inadequate leachate management around the landfill site; and
- Inability of the current site to meet the airspace requirements for the remaining life of the landfill.

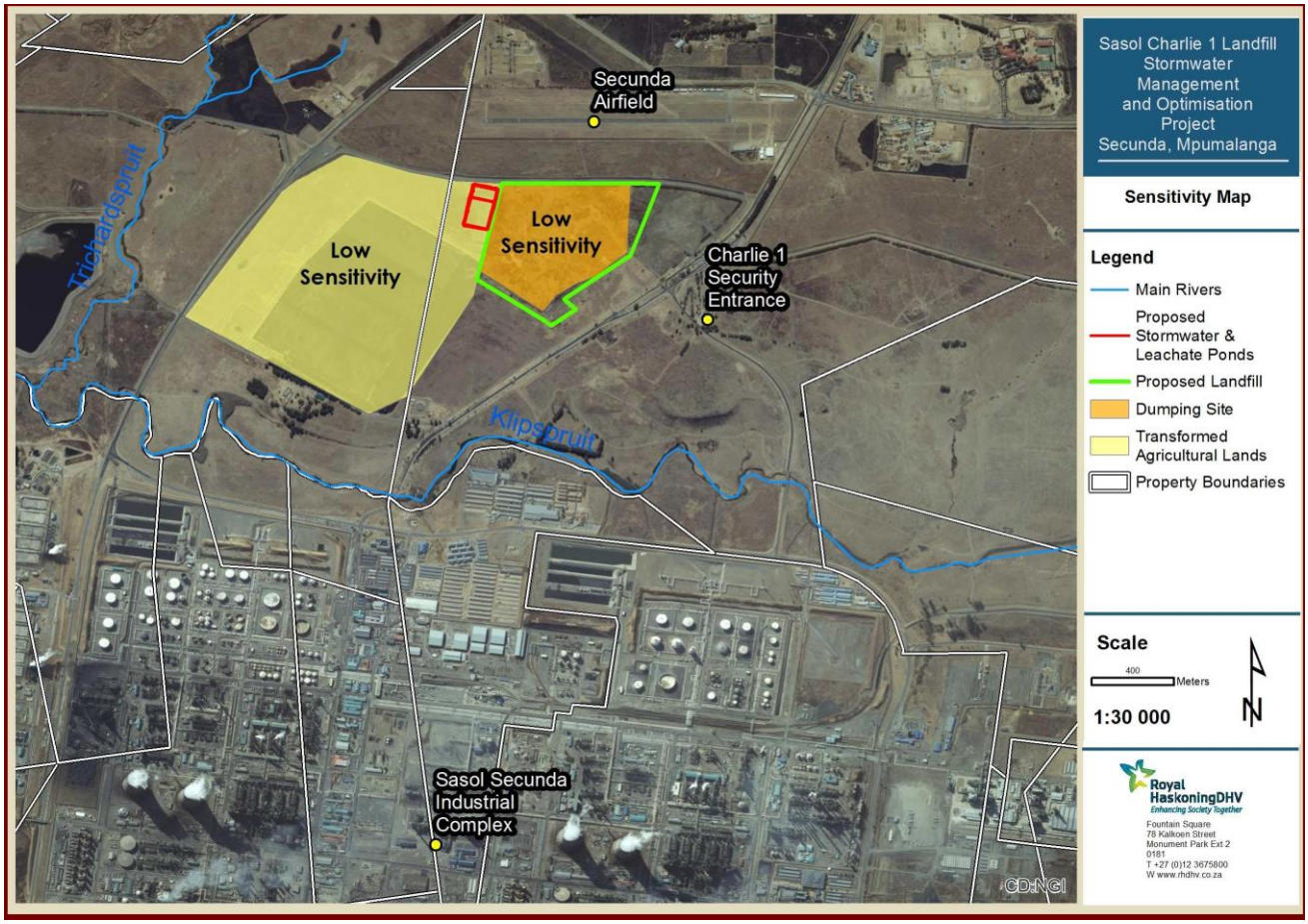


Figure 37: Site sensitivity map

The EAP therefore, based on the findings of this EIA study, recommends that the Charlie 1 Landfill height expansion and the pollution control ponds (CLP and CSP) be authorised and a Waste Management Licence be granted.

10.1.1 Summary of Impacts

A summary of positive and negative impacts are provided in Table 23.

Table 23: summary of positive and negative impacts identified and assessed

Environmental Attributes	Impacts per Phase		
	Construction	Operation	Decommissioning
Geotechnical	***Negative impacts***	***Negative impacts***	***No impacts envisaged***
	Earthworks and construction of infrastructure.	Increase in landfill height resulting in potential stability impacts.	
Soils	***Negative impacts***	***Negative impacts***	***Negative impacts***
	Removal and compaction of soil. Erosion, degradation and loss of topsoil. Potential contamination of soils due to spillage, leakage, incorrect handling of fuel and other hazardous materials.	Improper management of the leachate and stormwater run-off could potentially contaminate soils. Potential contamination of soils due to: accidental release of the leachate and stormwater from the ponds; damage of the ponds lining system; lack of maintenance of stormwater and leachate drains; and silt traps that are not de-silted regularly.	Increased erosion due to decommissioning activities. Refer to construction phase impacts.
Geohydrology	***Negative impacts***	***Negative impacts***	***Negative impacts***
	Contamination of groundwater due to spillage, leakage, and incorrect handling of fuel and other hazardous materials. Lack of provision of ablutions may lead to the creation of informal ablutions.	Improper management of the leachate and stormwater run-off from the Charlie 1 Landfill site allows rainwater to pond in areas on the surface and side areas of the landfill. These ponds allow for artificial hydraulic heads to form which force water into the body of the landfill, to percolate through, and contribute to the potential for leachate generation that could potentially contaminate groundwater resources. Improper design of the lining system for the ponds could provide a pathway for the contamination of the groundwater resources. Potential contamination of groundwater during operations and maintenance due to:	Groundwater contamination due to decommissioning activities. Refer to impacts on groundwater resources during the construction phase.

Environmental Attributes	Impacts per Phase		
	Construction	Operation	Decommissioning
		– accidental release of the leachate and stormwater from the ponds; – damage of the ponds lining system; – lack of maintenance of stormwater and leachate drains; and – silt traps that are not de-silted regularly.	
Hydrology & Stormwater	***Negative impacts*** Contamination of surface water resources due to spillage, leakage, and incorrect handling of fuel and other hazardous materials.	***Negative impacts*** Improper management of the leachate and stormwater run-off from the Charlie 1 Landfill site due to an absence of clean and dirty water Improper surface water management arising from rainfall falling on the landfill – contamination of surface water and increase in leachate generation by infiltrating through the landfill.	***Negative impacts*** Refer to construction phase impacts.
Ecology	***Negative impacts*** Impact on the remaining limited fauna residing in or utilising the transformed agricultural lands on the site. Alteration of the transformed agricultural lands will directly, and indirectly, impact on the smaller sedentary species. Disruption of natural faunal cycles.	***No impacts envisaged***	***No impacts envisaged***
Visual	***No impacts envisaged***	***Negative impacts*** Due to the proposed height increase at the Charlie 1 Landfill, 80% of the study area (including key receptors: Charlie 1 Security Entrance, Graceland Casino, and Secunda Mall) will be visual impacted by the increase in landfill height if unscreened.	***Positive impact*** Positive visual impact as the landscape could be returned to a more natural appearance once the landfill has been rehabilitated.

Environmental Attributes	Impacts per Phase		
	Construction	Operation	Decommissioning
Heritage and Palaeontology	***Negative impacts*** Potential impact on archaeological and palaeontological resources unearthed during construction and excavations.	***No impacts envisaged***	***No impacts envisaged***
Social	***Positive impact*** Contractors and labour will be sourced locally as far as possible for the proposed project.	***No impacts envisaged***	***No impacts envisaged***
Air Quality	***Negative impacts*** Potential air pollution due to vehicle movement within the project area. Dust generation due to set up and removal of construction equipment; and truck transport.	***Negative impacts*** Dust generation during operations.	***Negative impacts*** Refer to construction phase impacts.
Noise	***Negative impacts*** Noise generation during the construction phase at the proposed site.	***No additional impacts envisaged***	***Negative impacts*** Refer to construction phase impacts.
Traffic	***Negative impacts*** Increase in traffic due to construction activities.	***Negative impacts*** Operational phase traffic.	***Negative impacts*** Refer to construction phase impacts.
Waste	***Negative impacts*** General waste produced includes domestic waste and small amounts of building rubble. Hazardous waste generated through the spillage of oil/diesel/chemicals used during construction.	***No impacts envisaged***	***Negative impacts*** Refer to construction phase impacts.
Health & Safety	***Negative impacts*** Potential health and safety impacts during construction which may include exposure to dust during windy periods.	***Negative impacts*** Potential contamination of groundwater resources affecting human health.	***No impacts envisaged***

10.2 Conditions

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this EIA study are included within an EMPr. The EMPr would be used to ensure compliance with environmental specifications and management measures.

The implementation of this EMPr for the entire life-cycle (i.e. construction, operation and decommissioning) of the project is considered to be vital in achieving the appropriate environmental management standards as detailed for this project.

In addition, it is recommended that the following key conditions should be included as part of the authorisation:

a) The proponent is not negated from complying with any other statutory requirements that is applicable to the undertaking of the activity. Relevant key legislation that must be complied with by the proponent includes inter alia:
   - Provisions of the National Water Act, 1998 (No. 36 of 1998).
   - Provision of the National Heritage Resources Act, 1999 (No. 25 of 1999).

b) The proponent must appoint a suitably experienced (independent) Environmental Control Officer (ECO) for the construction phase of the development that will have the responsibility to ensure that the mitigation / rehabilitation measures and recommendations are implemented and to ensure compliance with the provisions of the EMPr.

c) Mitigation measures which will be implemented during the operational phase of the CSP and CLP includes the following:
   - Lining of the CLP and CSP as per the recommendations of the FEP (**Appendix D**)
   - Regular maintenance of stormwater management system to ensure that leachate and stormwater run-off does not pond on the surface and side areas of the landfill.
   - Implementation of a groundwater monitoring programme.

10.3 Assumptions, Uncertainties or Gaps in Knowledge

- All information provided by Sasol South Africa (Pty) Ltd to the EAP was correct and valid at the time it was provided.
- All data from unpublished research is valid and accurate.
- This study is based on conceptual/preliminary landfill designs as provided in the FEP prepared by Golder Associates.
- The images represented in the visual assessment are significantly reduced in scale and therefore likely "underplay" the likely actual appearance and resultant visual impact of the expanded landfill; and
- The results of the visual assessment process are based on conceptual/preliminary landfill designs and screening vegetation placement arrangements; and should therefore be considered as indicative only in the event of notable landfill configuration changes with detailed design.

10.4 Undertaking by EAP

The EAP hereby confirms that:

i. All information presented in this report is correct and valid. Information provided by the Client and external consultant team is considered valid and accurate.
ii. The comments and inputs from stakeholders and I&APs have been incorporated into the study.
iii. The input and recommendations from specialist reports have been incorporated into the report and the EMPr.
iv. Information provided to I&APs and responses by the EAP are captured in **Appendix E** – Public Participation Documents.

An EAP Declaration is included in **Appendix J**.

Royal HaskoningDHV

Enhancing Society Together