PROTEA CHEMICALS (PTY) LTD

PROTEA CHEMICALS DECOMMISSIONING OF STORAGE TANKS

DRAFT BASIC ASSESSMENT

22 FEBRUARY 2021

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WSP
1ST FLOOR, PHAROS HOUSE
70 BUCKINGHAM TERRACE, WESTVILLE
DURBAN, 3629
SOUTH AFRICA

T: +27 31 240 8874
F: +27 31 240 8801
WSP.COM

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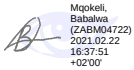
Signature	 Mqokeli, Babalwa (ZABM04722) 2021.02.22 16:37:51 +02'00'			
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SIGNATURES

PREPARED BY

Mqokeli, Babalwa (ZABM04722) 2021.02.22 16:36:29 +02'00'

Babalwa Mqokeli, Consultant

REVIEWED BY

Elliott, Carla (ZACE00769) 2021.02.22 16:29:50 +02'00'

Carla Elliott, Associate

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PRODUCTION TEAM

CLIENT

Corporate Environmental Specialist	Tholoana Seotsanyana
Site Manager – Distribution Centre	Nilesh Rughoobeer

WSP

Associate	Carla Elliott
Environmental Consultant	Babalwa Mqokeli

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1 INTRODUCTION

1.1 BACKGROUND

Protea Chemicals (Pty) Ltd (Protea Chemicals) is a manufacturer, distributor and storage facility for speciality and functional chemicals throughout sub-Saharan Africa. Protea Chemicals operates six sites in South Africa, with two of their facilities situated in Mobeni and Jacobs in Durban.

The Jacobs facility ceased operation in July 2020, and Protea Chemicals is proposing site exit of the facility. This requires the decommissioning and removal of fifty-five (55) tanks used previously for the storage of dangerous goods (Acids, Alkaline, and Solvents). These tanks comprise both underground storage tanks (UST) and above ground storage tanks (AST).

In terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) and the Environmental Impact Assessment (EIA) Regulations promulgated in Government Notice (GNR) 326 of 7 April 2017, a Basic Assessment (BA) process is required for the proposed decommissioning and removal of facilities previously storing dangerous goods. In order for the proposed project to proceed, it will require an Environmental Authorisation (EA) from the Competent Authority (i.e. the KwaZulu-Natal Department of Economic development, Tourism & Environmental Affairs (EDTEA)).

1.2 THE PURPOSE OF THE BA PROCESS

The Basic Assessment (BA) process is a simplified version of what may broadly be referred to as the environmental and social impact assessment (ESIA) process. It applies to activities contained in Listing Notice 1 of the EIA Regulations that are considered to have a relatively lower environmental impact than those contained in Listing Notice 2 (requiring a Scoping and EIA).

The BA process is an interdisciplinary procedure to ensure that environmental considerations are included in decisions regarding projects that may impact the environment. The process helps identify the possible environmental effects of a proposed activity and how those impacts can be mitigated. In the context of this report, the purpose of the BA process is to inform decision-makers and the public of the environmental consequences of the proposed project. This document (the BA report) is a technical tool that identifies, predicts, and analyses impacts on the physical environment, as well as social, cultural, and health impacts. The report identifies alternatives and mitigation measures to reduce the environmental impact of the proposed project; and it also serves an important procedural role in the overall decision-making process by promoting transparency and public involvement.

Stakeholder engagement is a fundamental part of the BA process and aims to include potential Interested and Affected Parties (I&APs) in the process by notifying them of the proposed project. The objectives of the stakeholder engagement process are to:

- Ensure an open and transparent BA and consultation process;
- Enable stakeholders to register their interest and provide input into the BA process and share information; and,
- Ensure that all relevant issues are addressed as part of the BA process.

A Stakeholder Engagement Report (SER) is included in **Appendix A** of this report, detailing the project's compliance with the public participation requirements of the EIA Regulations.

1.3 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

WSP Environmental (Pty) Ltd (WSP) has been appointed in the role of independent Environmental Assessment Practitioner (EAP) to undertake the BA process for the proposed project. **Table 1-1** outlines the details of the EAP and their expertise. The EAP Curriculum Vitae is attached in **Appendix B**.

Table 1-1: Details and Expertise of the EAP

NAME OF CONSULTANT	**WSP ENVIRONMENTAL (PTY) LTD**
Contact Person	Carla Elliott
Postal Address	1st Floor Pharos House 70 Buckingham Terrace Westville Durban 3629 South Africa
Telephone	031 240 8874
Fax	031 240 8801
E-mail	Carla.elliott@wsp.com
EAP Expertise	Carla has 15 years post graduate experience in the field of economic development, project management and environmental services. Carla has been a project manager of various strategic and integrated development projects. Her areas of expertise include: environmental strategic and framework planning and environmental management authorisation processes both within the infrastructural and industrial sectors. She has undertaken various projects in the South Durban Basin, including the decommissioning project at the Port of PE.

1.4 BASIC ASSESSMENT REPORT STRUCTURE

For the purposes of demonstrating legal compliance, **Table 1-2** cross-references the sections within the BA Report with the requirements as per Appendix 1 of GNR 326 of 2017.

Table 1-2: Legislation Requirements as detailed in Appendix 1 of GNR 326

LEGISLATED REQUIREMENTS AS PER APPENDIX 1	SECTION IN BA REPORT
3. (1) A basic assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include: (a) details of: (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae;	Section 1.3

(b) the location of the activity, including: (i) the 21digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Section 1.5
(c) a plan which locates the proposed activity or activities applied for as well as 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;	Section 1.5, Figure 1-2
(d) a description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for; and a description of the activities to be undertaken including associated structures and infrastructure;	Section 2
(e) a description of the policy and legislative context within which the development is proposed including- (i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and (ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;	Section 1.6
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;	Section 2.4
(g) a motivation for the preferred site, activity and technology alternative;	Section 3
(h) A full description of the process followed to reach the proposed preferred alternative within the site, including - (i) details of all the alternatives considered;	Section 3
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Appendix A
(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;	Appendix A
(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 4
(v) the impacts and risks identified for each alternative, 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;	Section 5
(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	
(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) the outcome of the site selection matrix;	

(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and	
(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity.	
(i) a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including- (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) 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;	Section 5
(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 avoided, managed or mitigated;	Section 5
(k) where applicable, a summary of the findings and impact management measures identified in 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 report;	N/A
(l) an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment; (ii) 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 (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Section 6
(m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the Environmental Management programme (EMPr);	Appendix F
(n) 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;	N/A
(o) a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 7
(p) 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;	Section 6
(q) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	N/A

(r) 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 l&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 and affected parties; and	Included in Application Form
(s) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	N/A
(t) any specific information that may be required by the competent authority; and	N/A
(u) any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A
2) Where a government notice gazetted by the Minister provides for the basic assessment process to be followed, the requirements as indicated in such a notice will apply.	N/A

1.5 PROJECT LOCATION

Protea Chemicals is situated at the corner of Quality Street and Balfour Street in Jacobs, Durban, KwaZulu-Natal. The site is surrounded by commercial and light industrial land-use in the Jacobs area. It is located within Ward 75 of the eThekwini Municipality. The property details, including the 21-digit Surveyor General (SG) code for the cadastral land parcel and coordinates is outlined in **Table 1-3** below. A locality map of the site is included in **Figure 1-1** and an overview of the site layout is presented in **Figure 1-2.**

Table 1-3: Location of the Proposed Decommissioning Site

PROPERTY DETAILS

21digit Surveyor General code of each cadastral land parcel	N0FT03760000048900000 N0FT03760000043200000 N0FT03760000043100000 N0FT03760000043000000 N0FT03760000050500017 N0FT03760000042500000
Farm Name	Not Applicable. Allotment Township: Wentworth
Central Coordinates	29°55'50.48"S, 30°58'43.48"E

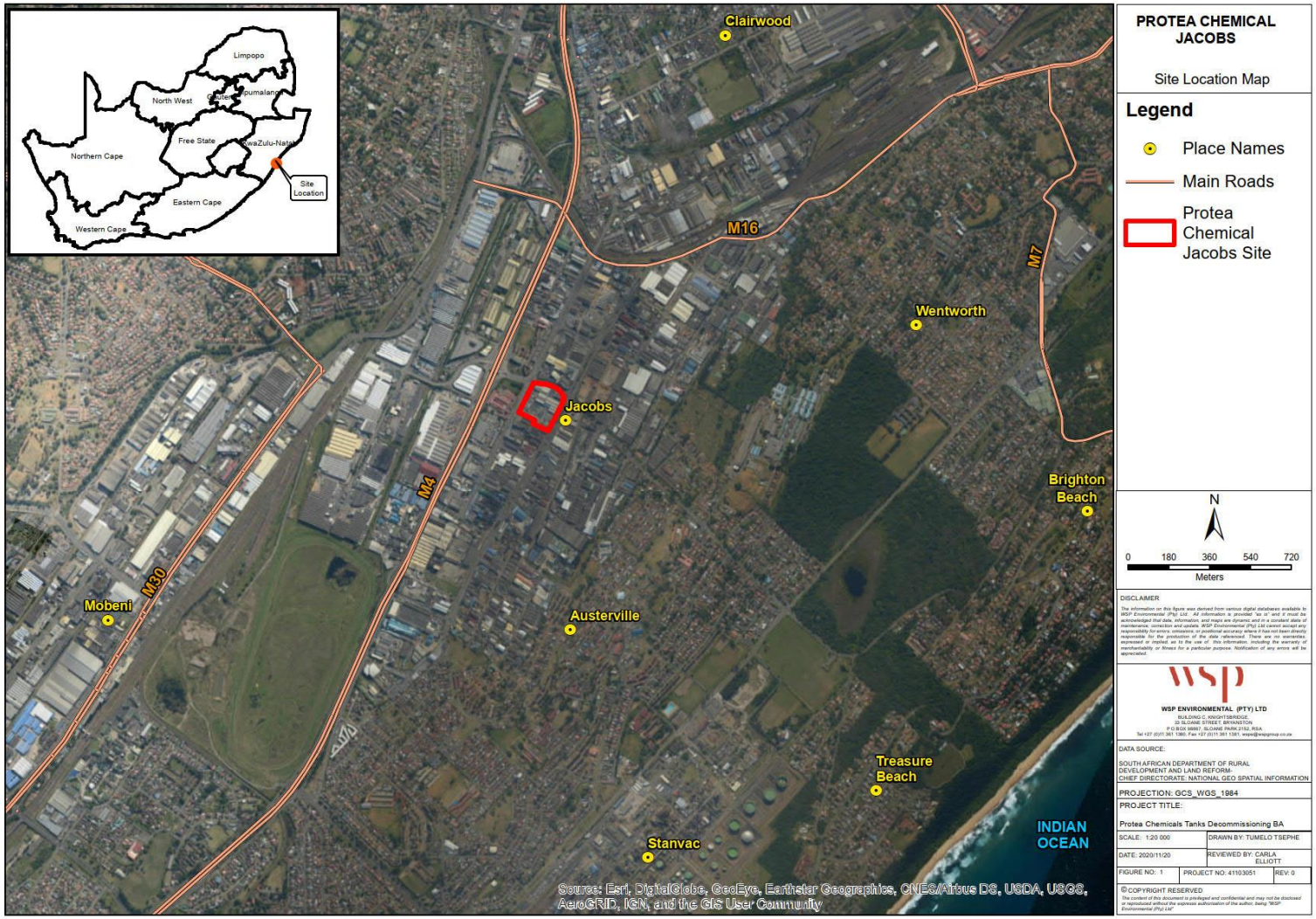

Figure 1-1: Location of the Protea Chemicals Jacobs Facility (WSP, 2020)

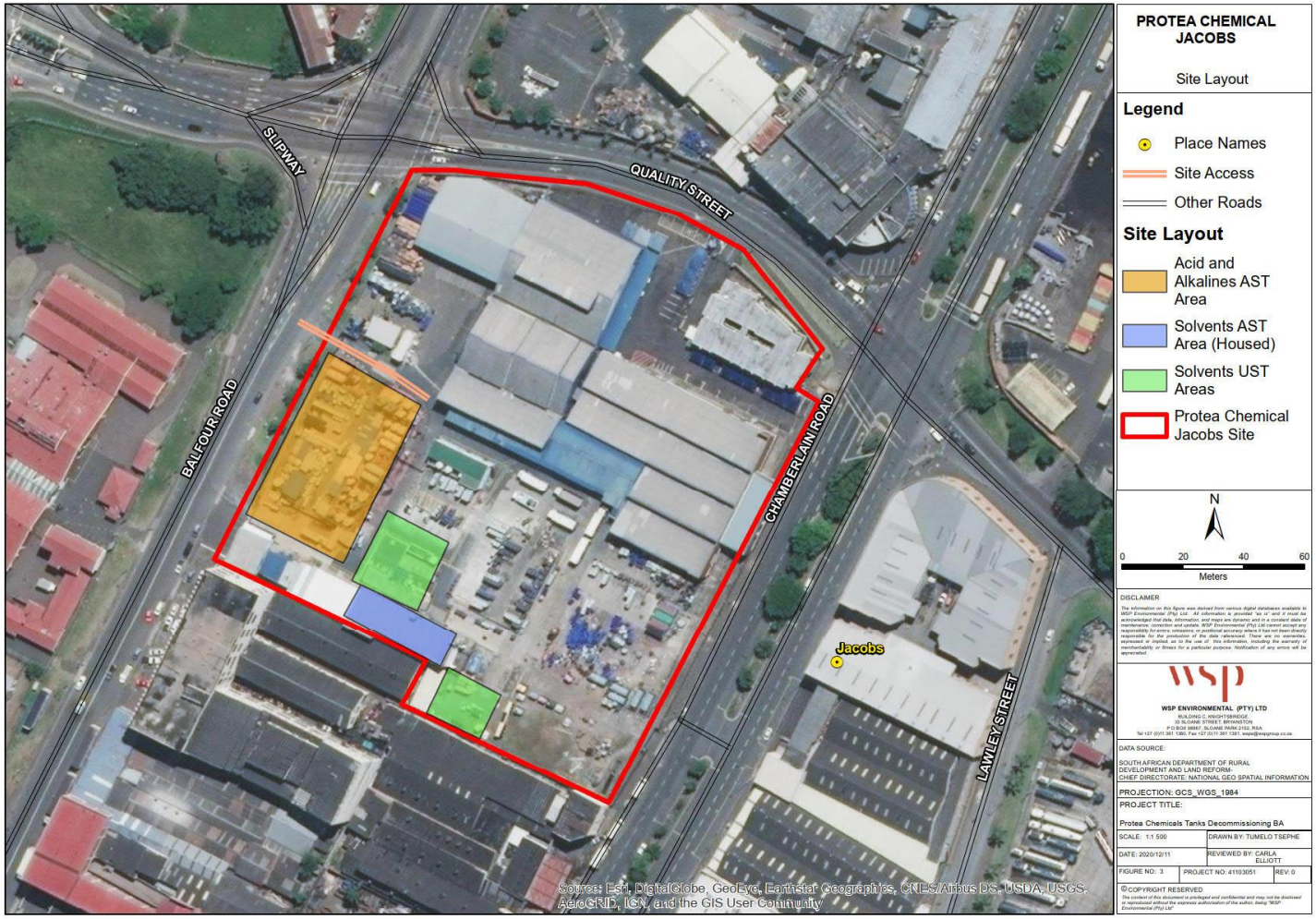

Figure 1-2: Protea Chemicals Jacobs Facility Site Layout (WSP, 2020)

1.6 POLICY AND LEGAL CONTEXT

Table 1-4 provides a summary of the applicable legislation, policy and/or guidelines considered relevant to the proposed project.

Table 1-4: Summary of National Legislation Applicable to the Project

TITLE OF LEGISLATION, POLICY OR GUIDELINE	APPLICABILITY TO THE PROJECT
NEMA (Act 107 of 1998, as amended)	The proposed development will require the consideration and implementation of environmental management practices in all stages of the project. An application for EA for the proposed project is submitted in terms of GNR 326 of the EIA Regulations promulgated under NEMA.
NEMA EIA Regulations GNR 326	The EIA Regulations provide the process that needs to be followed for the BA ensuring the promotion of integrated environmental management. Contents of this BA Report are in line with the requirements of the EIA Regulations. The decommissioning of chemical storage tanks requires a BA process in terms of the EIA Regulations GNR 326. ***GNR 327 (Listing Notice 1) Activity 31: The decommissioning of existing facilities, structures or infrastructure for -*** ***(i) any development and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014;*** ***(ii) any expansion and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014;*** ***(iii) …….*** ***(iv) any phased activity or activities for development and related operation activity or expansion or related operation activities listed in this Notice or Listing Notice 3 of 2014;*** ***or*** ***(v) any activity regardless the time the activity was commenced with, where such activity:*** ***(a) is similarly listed to an activity in (i) or (ii) above; and*** ***(b) is still in operation or development is still in progress;*** The development and storage of dangerous goods of ~648m^3 triggers secondary clause: Listing Notice 2 (Activity 4): The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres. This clause includes a related operational component and all tanks were still in operation on 08 December 2014. Additionally, the decommissioning will not be covered by Part 8 of NEMWA, as the site is not contaminated (Phase I & II Contamination Assessment carried out by RGM Environment (Pty) Ltd, September 2020). The exclusionary clause does therefore not apply.

National Environmental Management, Waste Act (No 59 of 2008)	This Act provides for regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation. The Act also provides for the licensing and control of waste management activities through GNR. 921 (2013): List of Waste Management Activities that Have, or are Likely to Have, a Detrimental Effect on the Environment. The facility and associated decommissioning does not constitute a Listed Activity requiring a Waste Management Licence (WML) as defined in GNR 921. However, the contents of this BA Report will include reasonable measures for the prevention of pollution and good international industry practice (GIIP).
The National Water Act, (No 36 of 1998)	This Act aims to control the use of water which may impact on water resources through the licencing of specific water uses in terms of Section 21 of the Act. The Act provides for the protection and management of water resources. Protea Chemicals does not fall within the regulated watercourses, and the proposed decommissioning is not anticipated to trigger Section 21 water uses requiring licencing in terms of the National water Act (NWA). Comment from the Department of Water and Sanitation (DWS) on the absence of any Water Use Licencing (WUL) requirements for the project will be requested as part of the stakeholder engagement process.
National Heritage Resources Act, 1999, (Act No. 25 of 1999)	The site has been fully transformed from its natural state and due to its brownfields nature is unlikely to contain significant cultural heritage resources other than buildings/structures older than 60 years. An application for Heritage Review associated with the decommissioning project was submitted to AMAFA on the 2nd November 2020.

2 PROJECT DESCRIPTION

2.1 PROJECT OVERVIEW

Site exit at the Jacobs facility requires the decommissioning and removal of fifty-five (55) tanks storing dangerous goods. This comprises thirty-three (33) tanks of a combined capacity of 422, 500 litres storing Acids and Alkaline (also referred to as BTPs[1]) and twenty-two (22) tanks of a combined capacity of 226, 00 litres storing Solvents. Solvents have been stored in nineteen (19) underground storage tanks (UST) and three (3) above ground storage tanks (AST). Acids and Alkalines have been stored in 33 ASTs. See Solvent and BTP Tanks Layout in **Appendix C –** including the ten (10) UST solvent tanks (storing white liquor, caustic, diesel leased from Engen.

Tanks at the Jacobs site were installed and operated pre-2014, and operation of the tanks ceased in July 2020. Integrity testing of tanks to determine suitability for reuse and scrapping was carried out. Mothballing activities included high pressure flushing and draining of the tanks, which have now been isolated and blanked off (i.e. temporarily disconnected). Tank contents were treated as hazardous waste and removed offsite by a licenced contractor, Oricol Environmental Services. The only current activity on site is the "free storage" / warehousing of stock (chemicals containers). All stock is planned to be removed off-site (sold) by end February 2021.

There is no plan to demolish subsurface structures / *insitu* systems etc. The future buyer would need to determine any other environmental requirements should future use of the site required decommissioning of support infrastructure.

2.2 PROPOSED DECOMMISSIONING ACTIVITIES

2.2.1 TANK REMOVAL AND WASTE MANAGEMENT

The chemical inventory (Safety Data Sheets in **Appendix D**) suggests that most products previously stored and/or handled on site were hazardous - residual chemicals are therefore required to be managed accordingly. All tanks were therefore pressure cleaned and emptied of any residual liquid and cleaned where required. Potentially contaminated wash water was collected by Oricol in sealed receptacles for disposal at an appropriate licenced facility.

Atomic Demolishers have provided a scope of work for demolition, including both removal of some of the tanks for scrapping by Atomic[2] and relocation of other tanks. This will entail:

- Compilation and submission of a Health and Safety Plan by the Contractor
- Site establishment
- Mobilisation of plant and equipment including a ZX330 excavator with hammer attachment
- Mechanical demolition of concrete surface to expose underground tanks
- Rigging of underground tanks and placing onto ground elevation for processing.
- Controlled demolition of overhead and surface mounted tanks /vessels by use of a Hyundai 50ton with a mechanical shear attachment
- Demolition of any walls in the way or requested to be demolished between tank farm and bund areas

[1] The terms acid and base describe chemical characteristics of many substances that we use daily. Acidic things taste sour. Basic or alkaline things taste soapy. Strong acids are corrosive and strong bases are caustic; both can cause severe skin damage that feels like a burn (https://www2.nau.edu/lrm22/lessons/acids_and_bases/acids_and_bases.html).

[2] All material will become the property of Atomic – this is presumably linked to recover cost of demolition via scrap return.

- Processing of tanks to be demolished as per inventory listing inclusive of stainless tanks
- Cut and process material into manageable size for removal
- Rigging of JoJo tanks and setting aside for reuse
- Loading of material into designated trucks and skips
- Cartage of steel material from site
- Stockpiling of rubble into designated stockpiles for filling by others
- Basic cleaning of site
- De-establishment

2.2.2 TANK REUSE

Six (6) ASTs are planned to be retained and reused at other Protea Chemical Facilities as planned:

- Three (3) tanks (previously storing caustic and white spirits) to be used at the Wadeville site in Gauteng
- Three (3) tanks (previously storing caustic) to be used at the Mobeni site in Durban
- Rig and transport 3 x tanks to Mobeni Site including offloading
- Rig and Transport 3 x Tanks to Wadeville site including offloading

2.2.3 TANK SCRAPPING AND DISPOSAL

Atomic shall handle the removal of tanks on site that shall be sent for scrap metal. End of life for all USTs (i.e. Solvents) includes:

- The disposal of Protea Chemical Tanks in poor condition
- The return of ten (10) tanks (white liquor, caustic, diesel etc.) to Engen (leased)[3]

2.3 OTHER PERMIT REQUIREMENTS FOR SITE EXIT

2.3.1 AIR EMISSIONS LICENSE

It has been confirmed by the eThekwini Atmospheric Licence Department (*pers comm*, Lindani Kumalo, 23 November 2020) that according to Protea Chemicals – Jacobs Atmospheric Emission Licence, AEL093/S3, there are no other specific conditions relating to decommissioning besides notifying the Licensing authority in writing. This has been completed via email, so therefore there are currently no further requirements from this Department.

2.3.2 EFFLUENT PERMIT

Protea Chemicals notified the eThekwini Water and Sanitation Unit on 24th February 2020 via formal letter that the effluent permit for the site which expired on 30 November 2020 would no longer be operational. Protea Chemical requested that the Unit inform Protea Chemicals of any decommissioning requirements. The response indicated that a close-out site visit should be scheduled once all operations have ceased on site.

[3] Engen tanks will be removed as per Engen Protocols with a team allocated for tank removal. Engen shall only start the project plan after a "Record of Decision" has been received from the Department.

2.4 PROJECT JUSTIFICATION (NEED AND DESIRABILITY)

Protea Chemicals is proposing the closure and divestiture of their Jacobs site. This is due to the negative impacts of the economy which have led to the business decision to close one of Protea Chemical's site in Durban. The Mobeni site in Durban will, however, continue to operate. Protea Chemicals has invested in faster production at their automated facility in Wadeville, Gauteng. The automated facility will be undertaking packing for all the sites in Cape Town, KwaZulu-Natal and Port Elizabeth.

Operations at the Jacobs site ceased in July 2020, and the only current activity on site is the "free storage"/ warehousing of stock planned for removal. The proposed decommissioning is therefore on the basis that the Jacobs facility is not operational and no longer forms part of Protea Chemicals' core competency.

It is considered best practice, as well as environmentally responsible to remove and appropriately decommission redundant industrial infrastructure, particularly ASTs and USTs that are no longer functional.

3 ALTERNATIVES

In terms of the Environmental Impact Assessment (EIA) Regulations, feasible alternatives should be considered within the BA process. Alternatives should be identified as early as possible in the project cycle and the search for alternatives should be well documented and should take into account the views of stakeholders.

Key criteria for consideration when identifying alternatives are that they should be "practicable", "feasible", "relevant", "reasonable" and "viable". In other words, while a range of alternatives might exist, not all will be necessarily appropriate for the project under consideration.

For the purposes of this assessment, only the preferred alternative has been assessed in detail, due to the fact that the proposed project is for the decommissioning of existing tanks. However, the no-go alternative has been considered as it provides a basis against which the impacts of the project can be compared.

3.1 EVALUATION OF ALTERNATIVES

3.1.1 SITE ALTERNATIVES

Protea Chemicals is proposing the removal and decommissioning of storage tanks at an existing site for the purpose of closure and divestiture (to be sold) of the site. The Jacobs facility is currently not operational and no longer forms part of Protea Chemicals' core competency. The decommissioning of the storage tanks at the Jacobs facility is therefore an overall business and site-specific objective. Therefore, no alternate sites have been considered and assessed.

3.1.2 LAYOUT ALTERNATIVES

The Protea Chemicals Jacobs site is an existing site with all its existing facilities and infrastructure already in place. The layout of the infrastructure was designed and established during the site's operational phase. As with the location of the facility, no site layout alternatives have been considered as the decommissioning is for existing structures which are no longer in operation.

3.1.3 TECHNOLOGY ALTERNATIVES

The proposed activity is for the removal and demolition of storage tanks. No technology alternatives have been considered as no new technology is being proposed as part of this project.

3.1.4 NO-GO ALTERNATIVE

The no-go alternative refers to the option of not undertaking the proposed decommissioning, and to continue as per current status quo or baseline. The proposed decommissioning is for the removal of structures which are currently not operational. In the event that the proposed decommissioning does not go ahead, these inoperative storage structures will remain.

The no-go alternative also entails that the environmental impacts (as detailed in **Section 5.2**) associated with decommissioning activities would not occur. However, the assumption that the status quo represents an environmentally-neutral state, where no negative impacts will manifest from maintaining inoperative storage tanks, is not correct. The appropriate decommissioning of storage tanks that are no longer functional is considered best practice, and will provide the opportunity for a more productive use of the site for potential future buyer.

In light of the above, the no-go alternative is not a feasible alternative.

4 DESCRIPTION OF THE BASELINE ENVIRONMENT

4.1 METEOROLOGY

Seasonal and diurnal pollutant concentration levels fluctuate in response to the changing state of atmospheric stability, to concurrent variations in mixing depth and to the influence of mesoscale and macroscale wind systems on the transport of atmospheric contaminants. This section provides an overview of the atmospheric circulations influencing airflow and the subsequent dispersion and dilution of pollutant concentrations in the South Durban Basin (SDB).

Localised airflow in South Durban is described as a system of drainage winds that flow down the Umbilo and the Umhlatuzana valleys at night, across the alluvial flats at the head of the bay and up against the Bluff ridge (**Figure 4-1**)[4]. From here, the air is diverted between the Bluff and Berea ridges as gentle south-westerly winds towards Durban's central business district. The accumulation of cold air in the Durban South basin may lead to valley inversions at night, limiting vertical dispersion. This local wind pattern is regularly disrupted by the passage of coastal lows and westerly wave frontal systems that clear the boundary layer every three to five days during the winter months.

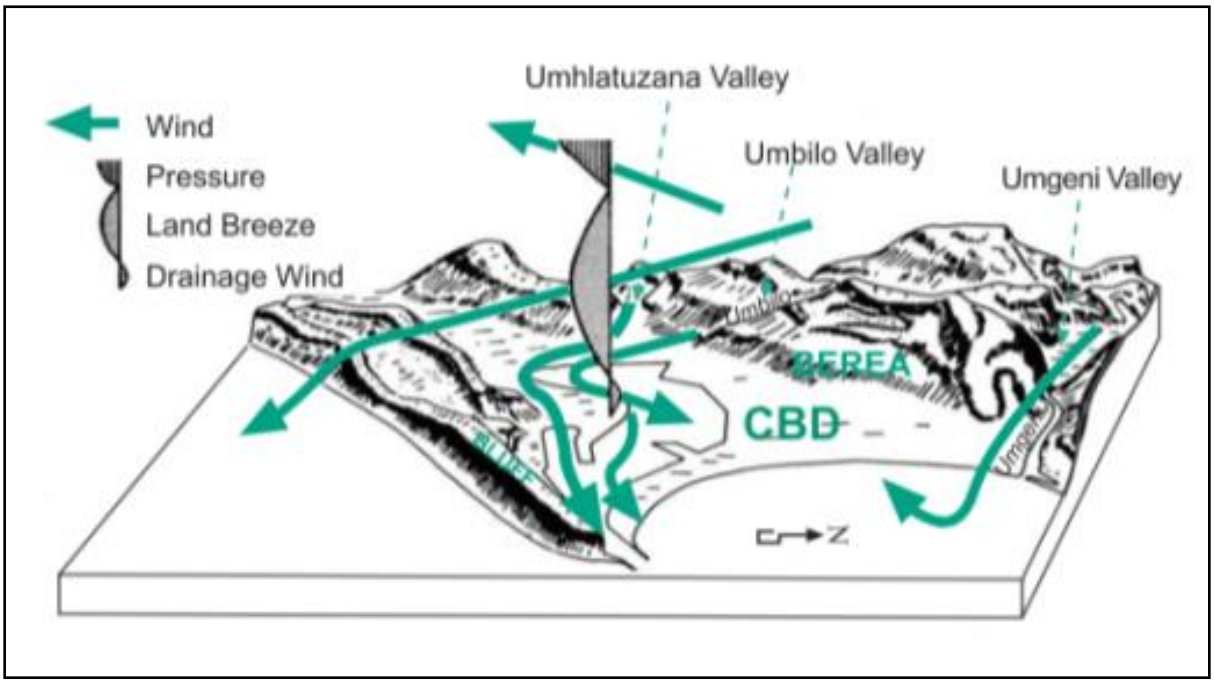

Figure 4-1: Nocturnal air circulations in Durban (Preston-Whyte and Diab, 1980)

[4] Preston-Whyte and Diab, R.D. (1980): Local Weather and Air Pollution: The Case of Durban, Environmental Conservation, 7, 241- 244.

4.2 CLIMATE

The Protea Chemicals site is situated in the SDB. The Durban climate is warm and temperate, characterised by hot and humid summers and warm winters. Average rainfall is approximately 975 mm per year, with most rainfall occurring in March (134 mm) and the lowest average rainfall in June (30 mm) (**Figure 4-2**)

The temperature in Durban averages 20.9 °C per annum, with February being the warmest month with an average of 24.5 °C. The lowest average temperature is in July at around 16.8 °C. (**Figure 4-3)**. The highest average temperatures occur in the summer months, between December and March, and the coldest months are between June and August.

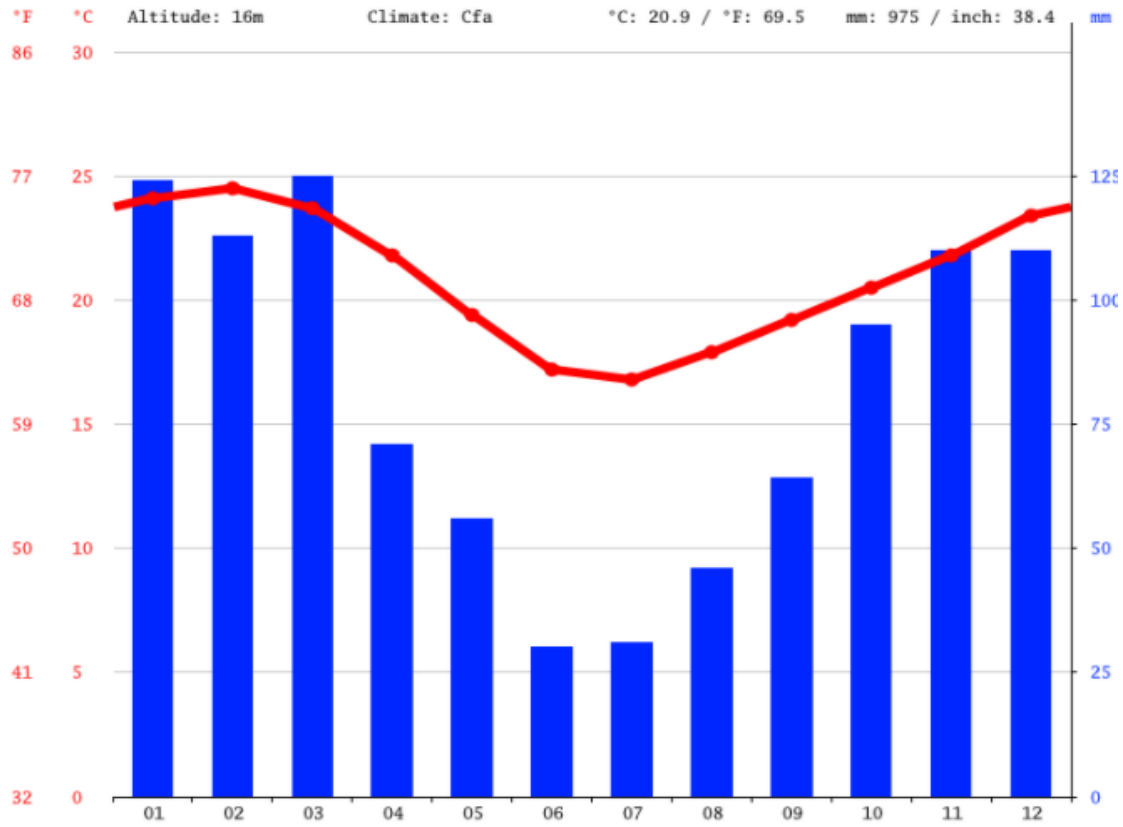

Figure 4-2: Average rainfall in Durban, KwaZulu-Natal (Source: https://en.climate-data.org/)

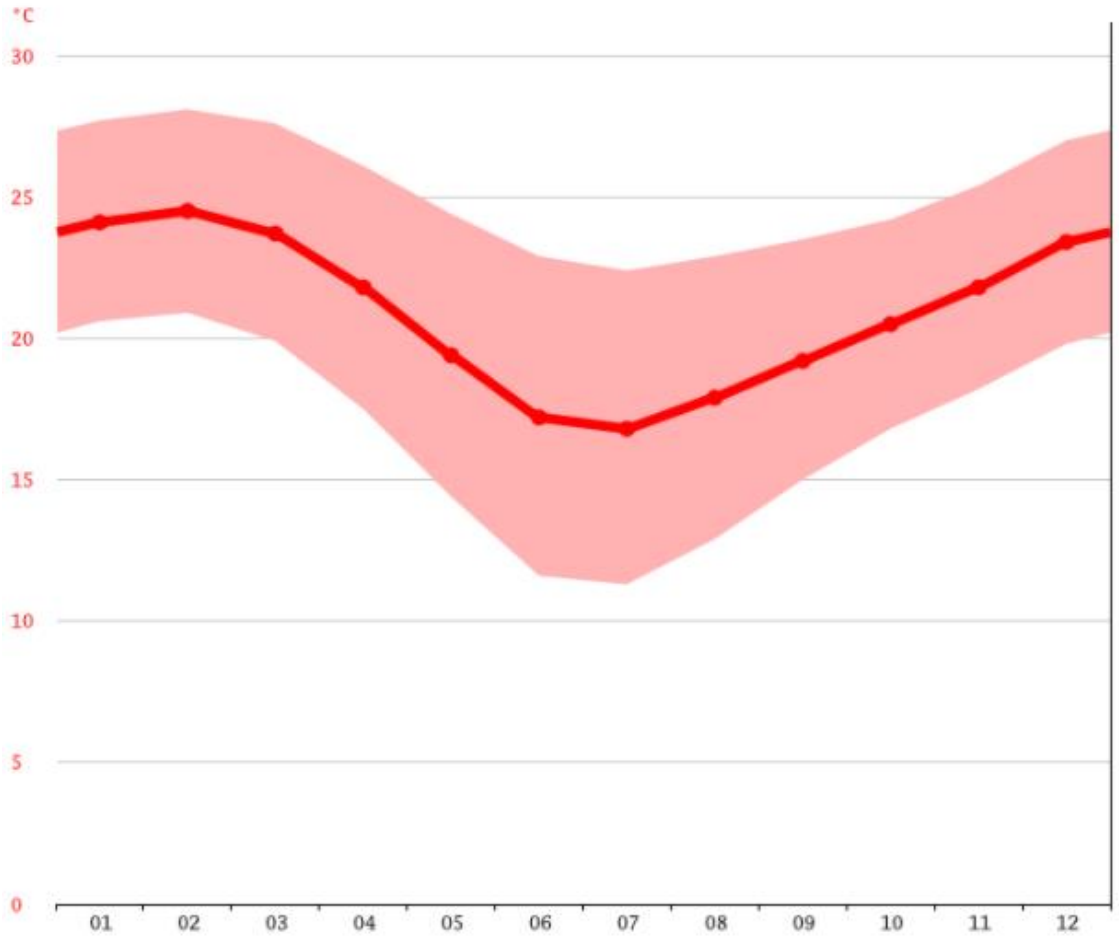

Figure 4-3: Average temperature in Durban, KwaZulu-Natal (Source: https://en.climate-data.org/)

4.3 NOISE

Baseline noise levels in the south Durban basin are a function of a wide range of sources including industrial operations (heavy machinery and equipment, loading and unloading of materials, operational processes, etc.) and road traffic (heavy vehicular and commuter traffic).

Noise from air traffic was historically a significant source up until the relocation of the Durban International Airport to north of Durban. There is currently no systematic noise measurement program carried out in the area, from which an assessment of the environmental noise climate for the region can be performed. However, numerous complaints have been reported to eThekwini Municipality, clearly indicating that noise is a nuisance in the region.

The current offsite noise sources are road traffic and various activities associated with surrounding industries.

4.4 GEOLOGY AND SOILS

The 1:250 000 Geological Map of Durban (Series 2930) indicates that the site is underlain by non-differentiated coastal and inland deposits (unconsolidated to semi-consolated sediments including sand, calcrete, calarenite, aeolianite, conglomerate, clay, silcrete, milestone etc.) of the Berea Formation (Qb) (RGM Environment (Pty) Ltd, 2020) (**Figure 4-4)**.

The natural soil on the site is likely to be poorly consolidated material that may have a generally collapsible fabric as well as rapid lateral and vertical variability in clay content and moisture conditions.

Figure 4-4: Geological Formation associated with the proposed project area (RGM Environment (Pty) Ltd, 2020)

Protea Chemicals requested on 3 September 2020 that soil sampling be conducted around the existing underground storage tanks in preparation for excavation works and planned tank removal as part of their divestment from the site. RGM conducted groundwater monitoring at existing wells, undertook soil sampling and prepared the "Chemical Phase I and II Environmental Site Assessment (May 2020) (**Appendix E**).

Soil sampling conducted by RGM in the vicinity of the underground storage tanks, concludes that liabilities associated with ownership and continued commercial/industrial use are unlikely to be realised as the site is not contaminated.

4.5 GEOHYDROLOGY

According to RGM Environment (2020), the site is underlain by a dual porosity aquifer with both intergranular and fractured flow, averaging borehole yield between 0.5 to 2l/s.

The underlying aquifer is classified as a minor aquifer, which is a moderately vulnerable aquifer system with medium susceptibility. The aquifer extent may be limited and seldom produce large quantities of water.

4.6 TOPOGRAPHY AND HYDROLOGY

The site occurs in a relatively flat area and as such soil erosion and slope stability is not a concern.

There are no identified natural watercourses within a 500m radius of the site. A man-made canal is located approximately 390 m west of the site, and flows north easterly through Clairwood.

4.7 ECOLOGY

The site falls within the KwaZulu-Natal Coastal Belt Grassland (CB 3) vegetation type (Mucina and Rutherford 2006). According to the 2011 Conservation Status, this vegetation is listed as Critically Endangered. However,

no vegetation occurs within the project site, the entire project area comprise of hard standing surface. The vegetation areas of interest associated with the site are the Bluff Nature Reserve, which is located approximately 1km east of the site. Additionally, according to the KZN Biodiversity Sector Plan an Irreplaceable Critical Biodiversity Area (CBA) lies approximately 650m east of the site.

The proposed project is located within an industrial area situated in an urban area, and consequently no environmentally sensitive areas are located within the site or within close proximity of the site.

4.8 SOCIO-ECONOMIC ENVIRONMENT

4.8.1 REGIONAL CONTEXT

eThekwini Municipality spans an area of approximately 2 297km² and is home to some 3.8 million people in 2016. The eThekwini Municipality consists of a diverse society, which faces a variety of social, economic, environmental and governance challenges. eThekwini is characterised as having a growing economy and is the primary economic contributor (65.5%) to KZN's Gross Domestic Product (GDP). The eThekwini economy grew by 0.9% in 2016. eThekwini's economy is dominated by tertiary industries including contributions from the finance (20%), manufacturing (19%), community services (20%), trade (18%) transport (14%) and construction (5%) sectors. The production of fuel and petroleum are significant contributors to the manufacturing sector in the municipality (eThekwini, May 2012).

According to Statistics South Africa (2012), the unemployment rate within eThekwini Municipality was 30.2%, with 17.1% households having no income.

The tertiary sector accounts for the largest portion of the workforce which includes community services, finance and trade, followed by manufacturing. In terms of skill levels, the largest portion of the workforce is employed at semi-skilled level followed by skilled and low skilled.

The eThekwini Municipality has improved infrastructure delivery, with 86% having access to electricity for cooking and 89.9% for lighting.

4.8.2 LOCAL CONTEXT

Due to a lack of available local data, Statistics SA 2011 was used as the primary data source. The Protea Chemicals site falls within Ward 75 of the eThekwini Municipality, comprising a land area of 7.2 km^2. The ward is comprised of a predominantly Black African population (79%), with a total population of 21 669 people.

Education levels are fairly average with 37% having completed their matric, which is about 10% higher than the provincial as well as the national rate.

The area has a 36% employment rate, with the formal sector being the highest contributing sector of employment (77%). The average annual household income in the ward is R14 600, about half the amount in KwaZulu-Natal and South Africa. Approximately 31% of households have no household income.

4.9 HERITAGE

The project area was originally known as Wentworth and formed part of the SDB which was developed as the industrial hub of Durban due to its proximity to the harbour. The Group Areas Act in the 1950's enforced divisions relocating people of colour to residential areas adjacent to the industrial areas.

According to the Assessment of Heritage Value (2020) undertaken for the site, some of the buildings at the Protea Chemicals site were constructed between 1949 and 1951. This indicates that the buildings constructed in that period are overs 60 years old and consequently of heritage significance.

The project site has been fully transformed from its natural state and consists of hard standing surface. Due to the brownfield nature of the Protea Chemicals site, it is unlikely that intact heritage resources will be found on the site other than building older than 60 years.

5 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

In this section the potential impacts of the project on the physical, biological and socio-economic environmental components has been assessed. The assessment is limited to the environmental components where potential interactions are present.

5.1 METHODOLOGY

5.1.1 ASSESSMENT OF SIGNIFICANCE

The assessment of impacts and mitigation evaluated the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to validate impacts identified through a matrix, identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts.

A standard risk assessment methodology was used for the ranking of the identified environmental impacts pre- and post-mitigation. The significance of environmental aspects was determined and ranked by considering the criteria presented in **Table 5-1**.

Table 5-1: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low	Low	Medium	High	Very high
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probably	Definite

ENVIRONMENTAL SIGNIFICANCE = (MAGNITUDE + EXTENT + REVERSIBILITY + DURATION) x PROBABILITY					
TOTAL SCORE	4 to 15	16 to 30	31 to 60	61 to 80	81 to 100
ENVIRONMENTAL SIGNIFICANCE RATING (-)	Very low	Low	Moderate	High	Very High
ENVIRONMENTAL SIGNIFICANCE RATING (+)	Very low	Low	Moderate	High	Very High

5.1.2 IMPACT MITIGATION

The following mitigation hierarchy (illustrated in **Figure 5-1**) was applied when proposing prevention, compensation and mitigation measures:

- **Avoid / Prevent**: Avoidance or prevention refers to the consideration of options in project location, siting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services, and people. This is referred to as 'the best option', but it is acknowledged that avoidance or prevention is not always possible.
- **Minimise**: Minimisation refers to the consideration of alternatives in the project location, siting, scale, layout, technology and phasing that would minimise impacts on biodiversity, ecosystem services and people. Acceptable options to minimise will vary and include: abate, rectify, repair, and/or restore impacts, as appropriate.
- **Rehabilitate / Restore**: Rehabilitation refers to the consideration of the rehabilitation of areas where impacts are unavoidable and measures are provided to return impacted areas to a near-natural state or an agreed land use.
- **Offset**: Offsetting refers to the consideration of measures over and above rehabilitation to compensate for the residual negative effects on biodiversity ecosystem services and people, after every effort has been made to minimise and then rehabilitate impacts.

Figure 5-1: Impact Assessment Mitigation Hierarchy

5.2 RESULTS

5.2.1 AIR EMMISSIONS

a) Localised air quality deterioration due to dust emissions from decommissioning activities

Impact Description:	Negligible emissions are expected from vehicles and equipment during the decommissioning and cutting of equipment to smaller pieces. Limited dust nuisance may arise during excavation over the short term period (~2 weeks).
Mitigation:	– Ensure that vehicles and equipment used are adequately maintained to limit any potential emissions. – Implement effective and environmentally-friendly dust control measures during drilling activities.

Significance Rating:

Pre-Mitigation							Post-Mitigation						
(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
2	2	1	1	4	**24**	N2	2	1	1	1	3	**15**	N1
N2 - Low							N1 - Very Low						

5.2.2 NOISE EMISSIONS

a) Elevated noise levels from decommissioning activities

Impact Description:	Increase in ambient noise resulting in a potential nuisance factor to nearby receptors. The proposed project site is located within an industrial area with existing noise sources. Additionally, noise related impacts are limited to the short term period expected for the decommissioning activities. Therefore, no significant changes in noise levels are anticipated beyond the site boundary.
Mitigation:	– Ensure that noisy vehicles and equipment used are equipped with silencers. – Undertake noisy construction activities during daylight hours to minimise disturbance to the surrounding receptors. – Maintain vehicles and machinery in good working order. – Instances of excessive noise and complaints must be investigated and possibilities for mitigation assessed.

Significance Rating:

Pre-Mitigation							Post-Mitigation						
(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
2	2	1	1	4	**24**	N2	2	1	1	1	3	**15**	N1
N2 - Low							N1 - Very Low						

5.2.3 SOIL EROSION/INSTABILITY

b) Soil erosion instability as a result of excavations during decommissioning activities

<table>
<tr><td>Impact Description:</td><td>The natural soil on the site is likely to be poorly consolidated material that may have a generally collapsible fabric as well as rapid lateral and vertical variability in clay content and moisture conditions. These materials are also likely to be sensitive to changes in moisture content. Therefore any excavations are likely to have a variable stability depending on moisture conditions. As such excavations should be considered to be unstable and allowances should be made for safe excavation practices to be followed.</td></tr>
<tr><td>Mitigation:</td><td>– Backfilling of excavations should be done using compacted lifts of materials of similar or greater strength to the in situ soil profile. This is to ensure that the filled void does not settle excessively after filling.
– This assessment does not account for any redevelopment of the area where tanks will be removed. If any structures are to be placed on the area of concern a geotechnical investigation will need to be performed in accordance with the foundation requirements of the proposed structures.</td></tr>
<tr><td>Significance Rating:</td><td>
<table>
<tr><td colspan="7">Pre-Mitigation</td><td colspan="7">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>Rating</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>Rating</td></tr>
<tr><td>3</td><td>1</td><td>5</td><td>1</td><td>2</td><td>20</td><td>N2</td><td>3</td><td>1</td><td>3</td><td>1</td><td>1</td><td>8</td><td>N1</td></tr>
<tr><td colspan="7">N2 - Low</td><td colspan="7">N1 - Very Low</td></tr>
</table>
</td></tr>
</table>

5.2.4 CONTAMINATION OF SOIL, GROUND AND SURFACE WATER

a) Soil and groundwater contamination due to accidental spillage of hazardous substance

<table>
<tr><td>Impact Description:</td><td>The storage and handling of hazardous substances (such as diesel and oil) for use during the decommissioning of the redundant equipment has the potential to result in accidental spillage of small quantities of hazardous substances. Although the surface is paved, any potential cracks can lead to the contamination of groundwater sources. Contamination of surface water is unlikely as the site is paved, with stormwater channels directing stormwater runoff to the effluent system.</td></tr>
<tr><td>Mitigation:</td><td>– Provide and utilise drip trays for immobile vehicles and machinery that will be operated on site.
– Acquire spill kits to clean up any hydrocarbon or chemical spills during closure to prevent seepage.
– Storage of hazardous materials if any, should be undertaken within impermeable bunded, ventilated and covered storage areas, capable of containing 110% of total volume.
– Spill and response equipment must be accessible on-site.
– Suitable spill containment must be provided for transfer points outside of bunded areas.
– Spillages / leaks are to be contained immediately; deploy oil containment berms if the spill migrates to other areas.
– Cover the spill with absorbent material.
– Remediation of the spill areas will be undertaken to the satisfaction of the Environmental Manager.
– Dispose of the clean-up material in line with SDS requirements of spilled material.
– Staff handling hazardous substances / materials must be aware of the potential impacts and follow appropriate safety measures. Appropriate personal protective equipment (PPE) must be made available.</td></tr>
</table>

Significance Rating:	Pre-Mitigation							Post-Mitigation						
	(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
	3	2	5	1	3	**33**	N3	3	1	3	1	2	**16**	N2
	N3 - Moderate							N2 - Low						

b) Soil and groundwater contamination during tank removal

Impact Description:	Potential leakage of residual hazardous substances during the removal of tanks on site leading to localised contamination to surrounding soils.
Mitigation:	– Ensure all tanks are emptied or cleaned prior to tanks removals, and the residual chemicals are managed accordingly (i.e. disposed as hazardous waste at licensed facility)[5]. – Residual chemicals to be managed in accordance with the relevant Safety Data Sheets (SDS). – Validation analysis of the surrounding soils within the cavity must be undertaken following uplift of tanks, and prior to backfilling of excavation cavities to prove absence of contamination. – If encountered, material should be managed appropriately.

Significance Rating:	Pre-Mitigation							Post-Mitigation						
	(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
	3	2	5	1	3	**33**	N3	3	1	3	1	2	**16**	N2
	N3 - Moderate							N2 - Low						

5.2.5 WASTE GENERATION

a) Improper handling of hazardous waste during the decommissioning activities could result in offsite contamination

Impact Description:	The proposed project will result in the generation of waste. Waste generation includes scrap metal, contaminated PPE, food waste, office waste and steel off-cuts. The accumulation of hazardous waste on site and improper storage / disposal has the potential to lead to soil and groundwater pollution (including offsite).

[5] Protea Chemical can make the safe disposal certificates (provided by Oricol) available on request.

Mitigation:	– There must be adequate waste receptacles on site for general and hazardous waste. – Contractors must be instructed not to litter and to place all waste in the appropriate waste bins provided on site. – Working areas are to be cleared of litter on a daily basis. No litter / waste is to be burnt on-site. – Bins/skips must be emptied regularly and collected by a licensed contractor for disposal at an appropriate, licensed facility. – Proof of disposal is to be received and filed. – Bins/skips must not be allowed to overflow. – Storage of hazardous waste should be undertaken within impermeable, bunded and covered storage areas, with a capacity to contain 110% of total volume. – Personnel involved in the handling of hazardous waste must be provided with the necessary PPE as stipulated in the SDS.

Significance Rating:

Pre-Mitigation							Post-Mitigation						
(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
3	2	5	1	3	**33**	N3	3	1	3	2	2	**18**	N2
N3 - Moderate							N2 - Low						

b) Improper segregation of waste during decommissioning activities

Impact Description:	Improper segregation of waste will result in lost opportunity for reuse and recycling resulting in increased pressure on local landfills.
Mitigation:	– Waste should be stored in separate, labelled and secure skips / containers depending on management options – opportunities should be determined, in consultation with waste service providers, for re-use, recycle, or disposal options. – Recover, recycle and reuse waste where possible. Uncontaminated scrap metal may be sold to licensed scrap metal dealers. – Any recyclable material which is considered hazardous is to be collected and transferred by a permitted/trained waste contractor in accordance with the SANS 10228 for transport to the approved recycling/recovery facility.

Significance Rating:

Pre-Mitigation							Post-Mitigation						
(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
2	3	4	4	4	**52**	N3	2	3	2	4	2	**22**	N2
N3 - Moderate							N2 - Low						

5.2.6 ECOLOGICAL DISTURBANCE

The proposed project site is located within an existing industrial facility, which has been completely transformed from its original natural state. There will be no impact on vegetation or biodiversity as all activities will be limited to the existing disturbed site footprint.

5.2.7 HERITAGE

a) Disturbance of features of heritage importance

Impact Description:	The project site has been fully transformed from its natural state and consists of hard standing surface. Due to the brownfield nature of the Protea Chemicals site, it is unlikely that intact heritage resources will be found on the site other than building older than 60 years.
Mitigation:	– Approval from SAHRA (AMAFA) should be obtained prior to any alteration or decommissioning of heritage buildings and features of heritage importance. – Should any archaeological features be discovered on site during excavations, it should be reported to SAHRA (AMAFA) and a qualified Heritage specialist should be notified (i.e. Chance Find Procedure followed as outlined in EMPr).

Significance Rating:

Pre-Mitigation							Post-Mitigation						
(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
2	1	4	1	2	**16**	N2	2	1	1	1	1	**5**	N1
N2 - Low							N1 - Very Low						

5.2.8 TRAFFIC

a) Increased traffic congestion

Impact Description:	An increase in localised traffic associated with the transport of equipment and waste removal is expected during the decommissioning of the redundant equipment. These are to be transported on heavy vehicles to and from the site. This process will occur intermittently as and when required.
Mitigation:	– The movement of vehicles into and out of the site must be managed such as ensuring that abnormal loads are moved outside of peak traffic hours. – Ensure that there is sufficient parking and loading space for vehicles to limit congestion around the site. – Effective signage and traffic control measures must be implemented along the access route to ensure that public and staff safety is managed adequately.

Significance Rating:

Pre-Mitigation							Post-Mitigation						
(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
3	2	1	1	3	**21**	N2	3	2	1	1	1	**7**	N1
N2 - Low							N1 - Very Low						

5.2.9 HEALTH AND SAFETY

a) Potential health and safety risks to workers

Impact Description:	During the decommissioning activities the labour force may be involved in high risk activities. The use of appropriate PPE and implementation of health and safety measures is required for the decommissioning activities

<table>
<tr><td>Mitigation:</td><td>— The management of worker health and safety falls outside of the remit of the EIA Regulations and this BA Report, and the associated EMPr thus excludes mitigation measures. Protea Chemicals and its appointed contractors are required to manage worker health and safety in accordance with the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993). This must include:
— Detailed project / activity specific hazard identification and risk assessment (HIRA) process; and;
— Implementation of appropriate mitigation measures e.g. safe work procedures, use of PPE; design safety, occupational monitoring, training and awareness programmes, and performance assessment and reporting.</td></tr>
<tr><td>Significance Rating:</td><td>
<table>
<tr><td colspan="7">Pre-Mitigation</td><td colspan="7">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>Rating</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>Rating</td></tr>
<tr><td>4</td><td>1</td><td>4</td><td>4</td><td>2</td><td>26</td><td>N2</td><td>4</td><td>1</td><td>4</td><td>4</td><td>1</td><td>13</td><td>N1</td></tr>
<tr><td colspan="7">N2 - Low</td><td colspan="7">N1 - Very Low</td></tr>
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5.2.10 EMPLOYMENT

b) Employment opportunities

<table>
<tr><td>Impact Description:</td><td>A limited number of temporary semi-skilled and skilled opportunities will be generated during the decommissioning period. The majority of employment opportunities will be through contractors such as Atomic Demolishers and waste service providers. The majority of these opportunities are unlikely to be new opportunities, as labour is sourced through existing contractors.</td></tr>
<tr><td>Mitigation:</td><td>— Where possible, unskilled labour will be sourced from within the local communities.</td></tr>
<tr><td>Significance Rating:</td><td>
<table>
<tr><td colspan="7">Pre-Mitigation</td><td colspan="7">Post-Mitigation</td></tr>
<tr><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>Rating</td><td>(M+</td><td>E+</td><td>R+</td><td>D)x</td><td>P=</td><td>S</td><td>Rating</td></tr>
<tr><td>3</td><td>2</td><td>1</td><td>1</td><td>2</td><td>14</td><td>P1</td><td>3</td><td>2</td><td>1</td><td>1</td><td>2</td><td>14</td><td>P1</td></tr>
<tr><td colspan="7">P1 - Very Low</td><td colspan="7">P1 - Very Low</td></tr>
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</td></tr>
</table>

6 CONCLUSIONS AND RECOMMEDNATIONS

6.1 SUMMARY OF IMPACT ASSESSMENT

The BA process has found that the proposed project will involve activities which will lead to a limited number of direct and indirect negative impacts on the biophysical and socio-economic environment. These impacts were found to vary in terms of their consequence and probability. Positive impacts are limited to employment of contractor. Where appropriate, mitigation measures to reduce the negative impacts, and enhance positive impacts have been proposed, and detailed in the EMPr (**Appendix F**).

Both the initial and residual (post-mitigation) significance of impacts have been presented in **Section 5.2** So as to obtain an indication of the effectiveness of the mitigation measures. All negative impacts can be reduced to ***low*** and ***very low*** significance with implementation of mitigation measures.

6.2 CONCLUSION

The overall objective of the BA process was to provide sufficient information to enable informed decision-making by the authorities. This was undertaken through consideration of the proposed project components, identification of the aspects and sources of potential impacts and subsequent provision of mitigation measures.

All negative potential environmental and social impacts associated with the project have been assessed as having very low significance (residual i.e. assuming that mitigation is implemented).

Mitigation measures have been developed where applicable for the above aspects and are presented within the EMPr. It is imperative that all impact mitigation recommendations contained in the EMPr are implemented.

It is the opinion of WSP that the project should be authorised; and, that information contained in this BA Report is sufficient for an informed decision to be made.

7 ASSUMPTIONS AND LIMITATIONS

General assumptions and limitations relating to the BA process are listed below:

- The EAP hereby confirms that they have undertaken to obtain project information from the client that is deemed to be accurate and representative of the project;
- A Site Visit has been undertaken by the EAP to better understand the project and ensure that the information provided by the client is correct, based on site conditions observed;
- The EAP hereby confirms their independence and understands the responsibility they hold in ensuring any comments received for the project will be accurately replicated and responded to within the EIA documentation;
- The comments received in response to the public participation process, will be representative of comments from the broader community; and
- Based on the pre-application meeting and subsequent minutes, the competent authority would not require additional specialist input, in order to make a decision regarding the application.

Notwithstanding these assumptions, it is the view of WSP that this BA report provides a good description of the issues associated with the project and the resultant impacts.

APPENDIX

A STAKEHOLDER ENGAGEMENT REPORT

PROTEA CHEMICALS (PTY) LTD

PROTEA CHEMICALS DECOMMISSIONING OF STORAGE TANKS

DRAFT STAKEHOLDER ENGAGEMENT REPORT

22 FEBRUARY 2021

DRAFT

PROTEA CHEMICALS DECOMMISSIONING OF STORAGE TANKS

DRAFT STAKEHOLDER ENGAGEMENT REPORT

PROTEA CHEMICALS (PTY) LTD

TYPE OF DOCUMENT (VERSION)
DRAFT

PROJECT NO.: 41103051
DATE: FEBRUARY 2021

WSP
1ST FLOOR, PHAROS HOUSE
70 BUCKINGHAM TERRACE, WESTVILLE
DURBAN, 3629
SOUTH AFRICA

T: +27 31 240 8804
F: +27 31 240 8801
WSP.COM

QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks	Draft Report			
Date	February 2021			
Prepared by	Babalwa Mqokeli			
Signature				
Checked by	Carla Elliott			
Signature				
Authorised by	Carla Elliott			
Signature				
Project number	41103051			
Report number	01			
File reference	G:\000 NEW Projects\41103051 - Protea Chemicals Tanks Decommissioning BA			

SIGNATURES

PREPARED BY

Babalwa Mqokeli, Consultant

REVIEWED BY

Carla Elliott, Associate

PRODUCTION TEAM

CLIENT

Corporate Environmental Specialist	Tholoana Seotsanyana
Site Manager – Distribution Centre	Nilesh Rughoobeer

WSP

Associate	Carla Elliott
Environmental Consultant	Babalwa Mqokeli

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1 INTRODUCTION

1.1 PURPOSE OF THIS REPORT

Protea Chemicals (Pty) Ltd (Protea Chemicals) is proposing site exit of their Jacobs facility. This requires the decommissioning and removal of fifty-five (55) tanks used previously for the storage of dangerous goods (Acids, Alkaline, and Solvents). These tanks comprise both underground storage tanks (UST) and above ground storage tanks (AST). The decommissioning of storage tanks requires environmental authorisation (EA) in terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) and the 2014 Environmental Impact Assessment (EIA) Regulations (as amended).

WSP Environment (Pty) Ltd has been appointed by Protea Chemicals to undertake the function of independent Environmental Assessment Practitioner (EAP) to facilitate the Basic Assessment (BA) process in accordance with the EIA Regulations.

The stakeholder engagement process is being undertaken in accordance with the EIA Regulations. The process aims to ensure that potential stakeholders are identified and provided with an opportunity to review the details of the proposed project and to submit any issues and concerns.

1.2 OBJECTIVE OF THE STAKEHOLDER ENGAGEMENT PROCESS

In order to ensure compliance with the applicable national legislation, WSP undertook the stakeholder engagement process in a diligent manner at the outset of the BA Process. The NEMA requires an inclusive, transparent process of stakeholder engagement.

The objectives of the stakeholder engagement process are as follows:

- To ensure an open and transparent BA and consultation process,
- To identify and inform stakeholders of the proposed project and associated environmental authorisation process,
- Provide an opportunity for stakeholders to raise all issues, concerns and questions and ensure that these are considered in the environmental authorisation process for the project,
- Ensure that stakeholders have an opportunity to make a meaningful contribution towards decision making by the competent authority, and
- Compile a Comment and Response Report (CRR) of all issues, concerns and questions raised during the stakeholder engagement process to inform the Competent Authority's decision making process.

2 STAKEHOLDER NOTIFICATION

2.1 AUTHORITY CONSULTATION

A pre-application meeting was held on 24 November 2020 with the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (EDTEA) in order to discuss the proposed project. The minutes of this meeting are included in **Appendix A**. An application for EA was received by EDTEA on 19 January 2021 and acknowledged by EDTEA on 28 January 2021 with reference number: **DM/0004/2021**.

The organs of state that have jurisdiction over the activity are EDTEA and the eThekwini Municipality (Development Planning, Environment and Management Unit). These two organs of state were provided written notification of the project via email. Other authorities provided with written notification included:

- Department of Water and Sanitation (DWS)
- Ezemvelo KZN Wildlife; and
- Amafa.

2.2 ADVERTISEMENT

The EIA Regulations require that an advertisement be placed in a local newspaper or official gazette for a project of this nature. An advert was published in the Southlands Sun local newspaper on 11 December 2020 (**Figure 1**). The advertisement formally announced the commencement of the EA application process and requested that stakeholders register their interest with the EAP.

2.3 PUBLIC NOTICES

The EIA Regulations require that site notices be fixed at places that are conspicuous to and accessible by the public at the boundary or on the fence or along the corridor of the site where the application will be undertaken or any alternative site. English and IsiZulu site notices were placed at the following locations on 20 January 2021.

- Protea Chemicals fence boundary (**Figure 2**);
- Local Tea Room on Chamberlain Road (**Figure 3**);
- Spar Austerville on 5 Alabama Road (**Figure 4**); and
- Merebank Library (**Figure 5**).

2.4 WRITTEN NOTIFICATION

The EIA Regulations states that written notices must be given to the stakeholders outlined in **Table 1**. Written notice (**Figure 6**) notifying stakeholders of the proposed development was distributed via email on 13 January 2021 (**Figure 7** and **Figure 8**).

Table 1: Interested and Affected Parties

STAKEHOLDER	EAP COMMENT
(i) The occupiers of the site and, if the proponent or applicant is not the landowner or person in control of the site which the activity is to be undertaken, the owner or person in control of the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken;	Protea Chemicals is the landowner of the site in which the water intake pump house upgrade is proposed.

(ii) Owners, persons in control of, and occupiers of land adjacent to the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken;	Protea Chemicals provided WSP with a list of occupiers of land adjacent to the site for inclusion in the stakeholder database. Written notice was distributed via email and SMS on 13 January 2021.
(iii) The municipal councillor of the ward in which the site and alternative site is situated and any organisation of ratepayers that represent the community in the area;	The Ward Councillor (Eunice Sibongile Khanyile (Ward 75)) was notified via email on 13 January 2021.
(iv) The municipality which has jurisdiction in the area;	eThekwini Municipality were notified via email on 13 January 2021. This was sent to Batha Msomi for distribution to the relevant line departments.
(v) Any organ of state have jurisdiction in respect of any aspect of the activity; and	Written notice was distributed to authorities (as per Section 2.1) via email on 13 January 2021.
(vi) Any other party as required by the competent authority	Stakeholders will be added on request by EDTEA as the competent authority.

Happy ending for sisters

HAVING had a tough upbringing, which often found them homeless, Wentworth sisters, Jolene Hammand and Tamika Dedericks, have been afforded the opportunity to have their own humble home, thanks to a generous donation of a Wendy house from Clarko Piping Contractors.

This was made possible after community activists, Roselyn and Celeste King, reached out to the community on a Facebook post describing the dire situation. "The sisters experience issues in the home. They struggle to make ends meet on top of having an abusive father who puts them out the house often, forcing them to sleep outside or fend for somewhere else to stay. Tamika even resorted to staying a shelter because of the situation. Their mother passed away, which has added to their challenges," said Celeste, who together with Roselyn, spread the word on this emotional story.

It wasn't long before Jonathan Clark gladly agreed to assist the family in need by donating a Wendy house.

An overjoyed Jolene said, "All thanks to God for this blessing and making this possible. It's really a privilege to have the community rally to help us. We are truly grateful. I'm so happy that myself, my children, my sister and her daughter now have our own place to stay," said the mother of two.

Celeste King, Jolene Hammand, Rosley King and Jonathan Clark.

Remember the animals

Thobele Nzama

AS the festive season draws close and leisure time becomes more available, consider visiting the doggies at the Bluff Rescue Kennels (BRK).

Whether it is to drop off a bag or two of food or to just spend time there, you can be sure that the furry friends are always ready to shower you with affection.

The dog shelter has grown after starting out just last year. With the public's generosity, the BRK is now a registered non-profit organisation, which means more stray dogs off the streets. The team of dedicated volunteers have also been able to secure funds to add more kennels, and in true BRK fashion, these kennels are big and very open.

"We've added a total of five kennels since last year, three of which are at the back. These are the emergency kennels for dogs that are with us for a short term stay which we've just started doing. Our boarding facilities are available to keep dogs a night or two in instances where homes are fumigated of your home or moving house and the dogs need to be off the property. We offer this service, providing that a kennel is available, and the stay can be for a period of up to two weeks. But, I must stress that the rescues will always come first," said founder and director, Amanda Herschel.

She said the charge for the short term stay is a donation 'fee' that goes to towards the kennels' upkeep. They currently have 14 dogs in their care which might increase during the looming festive season. The dogs typically go through an 8kg bag of food daily.

"This adds up to about 30 bags of food per month and this is without the tins and treats. Our wish list will always be food - dry food, biscuits or treats. We also need toys, old blankets or towels, as long as they are still in good condition. And as far as our building is concerned, we're always in need of building material to help expand the kennels. Monetary donations also go a long way as we're able to use it for everything such as the vet bill, sterilisations, the building of more kennels or whatever we need at that stage. Recently, with the annual fireworks celebrations, we had more expenses with getting the dogs calming tablets, which we don't normally use during the year," she said.

Amanda said while their aim initially was to take care of strays on the Bluff, they have since expanded their reach as far as Cape Town and the Eastern Cape. They collaborate with other rescue organisations and share resources, sometimes having to keep their dogs temporarily.

"We're open to having volunteers, especially over the festive season, as the regular volunteers would want to spend time with their families. For the younger volunteers, we prefer children over the age of 10. They would be much more capable of taking care of the dogs, especially the bigger ones," she said.

To make a donation or for more information, like the Bluff Rescue Kennels page on Facebook or Amanda Herschel on 071-869-8746 or Mariska Baard on 082-335-4511.

Founder and director at the Bluff Rescue Kennels, Amanda Herschel with Tinley.

wsp

BASIC ASSESSMENT PROCESS

NOTICE OF APPLICATION FOR ENVIRONMENTAL AUTHORISATION FOR THE PROPOSED DECOMMISSIONING OF STORAGE TANKS, PROTEA CHEMICALS FACILITY IN JACOBS, KWAZULU-NATAL

Notice is given in terms of Section 24(5) of the National Environmental Management Act 1998, (Act No. 107 of 1998) and the Environmental Impact Assessment (EIA) Regulations (7 April 2017, as amended) of the intent to submit an application for Environmental Authorisation (EA) to the Department of Economic Development, Tourism and Environmental Affairs (EDTEA).

PROJECT DESCRIPTION

The Protea Chemicals (Pty) Ltd. (Protea Chemicals) Jacobs site in Durban ceased operations in July 2020. Protea Chemicals is proposing site exit of the Jacobs facility. This requires the decommissioning and removal of fifty-five (55) tanks used previously for the storage of dangerous goods (Acids, Alkalines, and Solvents). These tanks comprise both underground storage tanks (UST) and above ground storage tanks (AST).

REGISTRATION

Protea Chemicals appointed WSP Environmental (Pty) Ltd., to manage the Basic Assessment process. Parties wishing to register as stakeholders in order to offer their comment on the proposed project are requested to forward their full contact details to WSP at the details provided below. Registered stakeholders will be informed about how to participate in the process.

ENVIRONMENTAL ASSESSMENT PRACTITIONER CONTACT DETAILS:

Carla Elliott
Telephone: +27 31 2408874
Email: Carla.elliott@wsp.com

BREAKING THE STIGMA AGAINST GENDER BASED VIOLENCE

A PROGRAMME aimed at breaking the silence against gender-based violence (GBV) was held recently, at the Austerville Community Hall.

The event, which was supported by various NGOs in Wentworth, was aimed at breaking the stigma against GBV while interacting with victims.

Special thanks to Cookie Edwards from KZN Network, eThekwini Municipality and all those who were part of making this day a success, including the community, who came out to support the initiative.

Cookie Edwards from KZN network pictured with Audrey Anderson of BAFDT Community Support Group.

Figure 1: Proof of Newspaper Advertisement – Southlands Sun

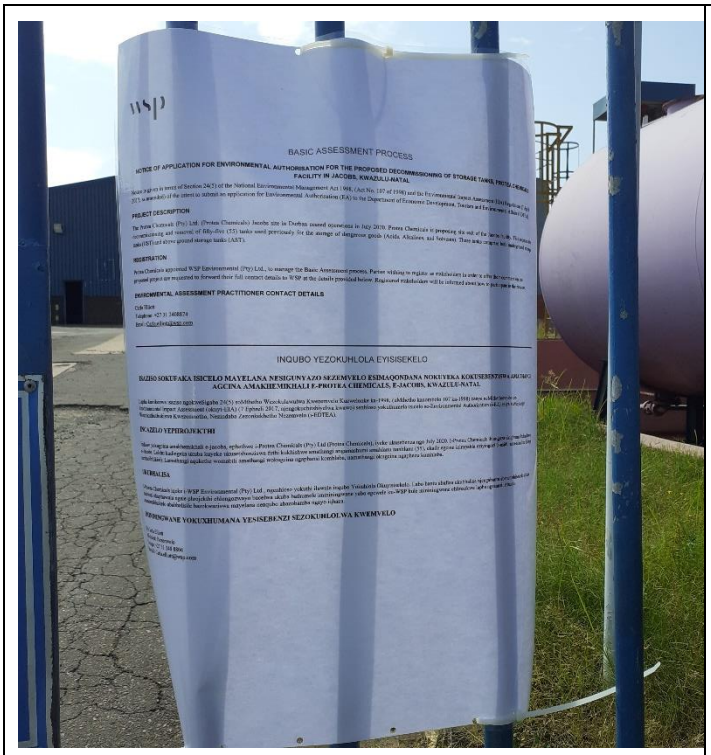

Figure 2: English and IsiZulu Site Notice at the Protea Chemicals Fence Boundary

Figure 3: English and IsiZulu Site Notice at the Local Tea Room on Chamberlain Road

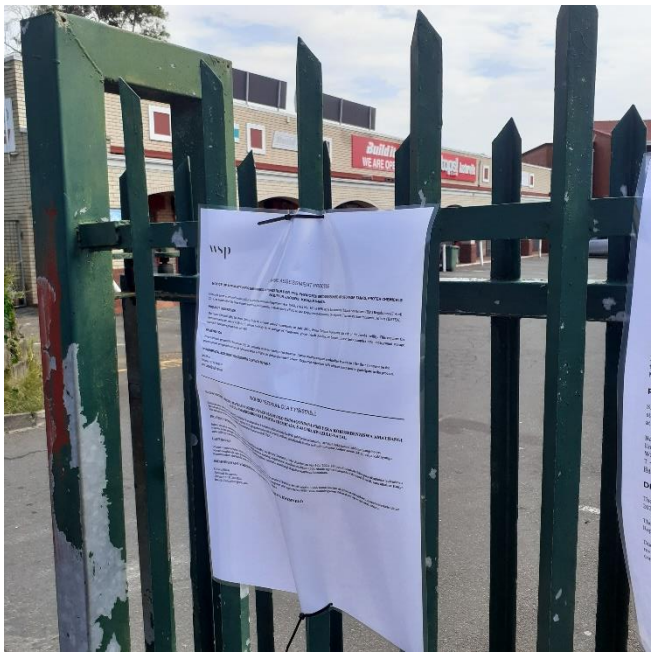

Figure 4: English and IsiZulu Site Notice at the Austerville Spar on 5 Alabama Road

Figure 5: English and IsiZulu Site Notice at the Merebank Linrary

WSP ref.: 41103051

13 January 2021

Dear Madam/Sir:

WRITTEN NOTICE OF THE PROPOSED DECOMMISSIONING OF STORAGE TANKS, PROTEA CHEMICALS FACILITY IN JACOBS, KWAZULU-NATAL

Notice is given in terms of Section 24(5) of the National Environmental Management Act 1998, (Act No. 107 of 1998) and the Environmental Impact Assessment (EIA) Regulations (7 April 2017, as amended) of the intent to submit an application for Environmental Authorisation (EA) to the Department of Economic Development, Tourism and Environmental Affairs (EDTEA).

DESCRIPTION AND LOCATION

The Protea Chemicals (Pty) Ltd. (Protea Chemicals) site is located on 87 Balfour Road, in industrial Jacobs south of Durban. The site ceased operation in July 2020, and Protea Chemicals is proposing site exit of the facility. This requires the decommissioning and removal of fifty-five (55) tanks used previously for the storage of dangerous goods (Acids, Alkaline, and Solvents). These tanks comprise both underground storage tanks (UST) and above ground storage tanks (AST).

REGISTRATION

Protea Chemicals appointed WSP Environmental (Pty) Ltd., to manage the Basic Assessment process for the proposed decommissioning of tanks. If you would like to participate in the process, please confirm your interest by registering as a stakeholder. You can register by providing your full contact details to the WSP by return email or at the details provided below.

ENVIRONMENTAL ASSESSMENT PRACTITIONER CONTACT DETAILS

Carla Elliott
T +27 31 240 8874 (office hours)
carla.elliott@wsp.com

Yours sincerely,

Elliott, Carla (ZACE00769) 2021.01.13 12:18:01 +02'00'

Carla Elliott
Associate

1st Floor, Pharos House
70 Buckingham Terrace, Westville
Durban, 3629
South Africa

T: +27 31 240 8874
F: +27 31 240 8801
wsp.com

Figure 6: Written notice distributed to various stakeholders.

Mqokeli, Babalwa

From: Mqokeli, Babalwa
Sent: Wednesday, 13 January 2021 12:42
Cc: Elliott, Carla
Subject: Notification of Basic Assessment Process: Proposed Protea Chemicals Tanks Decommissioning in Jacobs
Attachments: 41103051_Protea Chemicals Tanks Decommissioning BA_Notification Letter_Signed.pdf

Tracking:

Recipient	Delivery
Elliott, Carla	Delivered: 2021/01/13 12:42
'natasha.brijlal@kznedtea.gov.za'	
'yugeshni.govender@kznedtea.gov.za'	
'omar.parak@kznedtea.gov.za'	
'Alfred.Matsheke@kznedtea.gov.za'	
'mngoma-madibej@dws.gov.za'	
'Batha.Msomi@durban.gov.za'	
'vishnu.govender@kzncogta.gov.za'	
'judy.reddy@kzntransport.gov.za'	
'lmahlangu@environment.gov.za'	
'bernadetp@amafapmb.co.za'	
'archaeology@amafapmb.co.za'	
'wienersd@kznwildlife.com'	
'dominic.wieners@kznwildlife.com'	
'pillaya@kznwildlife.com'	
'Nerissa.Pillay@kznwildlife.com'	
'Revash.Dookhi@durban.gov.za'	
'dale.bruce@durban.gov.za'	
'Sudira.Haripersadh@wessa.co.za'	
'tbeach@wessa.co.za'	
'singhe@durban.gov.za'	
'Fanele.Masombuka@durban.gov.za'	
'Anitha.Govender@durban.gov.za'	
'shanusha@sdceango.co.za'	
'shanice@sdceango.co.za'	
'desmond@sdceango.co.za'	
'rico@groundwork.org.za'	
'bobby@groundwork.org.za'	
'team@groundwork.org.za'	
'eskhanyile1@gmail.com'	
'mike.smith@proteamining.co.za'	
'sharon.sewnarian@sherwin.com'	
'dwaynel@almstab.co.za'	
'jai@jaicubed.co.za'	
'narendra.gokul@colas-southafrica.com'	
'bearing1987@iafrica.com'	

1

Figure 7: Proof of written notice distributed to various stakeholders via email on 13 January 2021 (Page 1)

Recipient	Delivery
'admin@sharpsharp.co.za'	

Dear Stakeholder

Please find attached notification regarding the **Proposed Protea Chemicals Tanks Decommissioning in Jacobs**.

Notification is given to all potential interested and affected parties of the intention to submit an application for Environmental Authorisation, and the Basic Assessment (BA) being undertaken for the above-mentioned project.

Please confirm your interest in this project by registering as a stakeholder. You can register by providing your full contact details to the WSP by return email or at the details provided in the notification letter.

Best Regards

Babalwa Mqokeli Pr Sci Nat
Environmental Consultant
WSP, Environment & Energy, Africa

T +27 31 240 8804
F +27 31 240 8801

1st Floor, Pharos House,
70 Buckingham Terrace,
Westville
3629 South Africa

wsp.com

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Figure 8: Proof of written notice distributed to various stakeholders via email on 13 January 2021 (Page 2)

2.5 STAKEHOLDER DATABASE

Stakeholders with a potential interest in the project were identified at the project outset, and continue to be identified throughout the BA process. This included all relevant authorities (government departments and the eThekwini Municipality), relevant conservation bodies and non-governmental organisations (NGO's), as well as neighbouring landowners and the surrounding community. The stakeholder database (**Table 2**) has been maintained throughout the BA process, and those who registered with an interest in the project as a result of the notification process.

Table 2: Stakeholder Database

ORGANISATION	NAME	SURNAME
Provincial Authorities		
Department of Economic Development, Tourism & Environmental Affairs: Environmental Impact Assessment (EIA) Component eThekwini District	Natasha	Brijlal
Department of Economic Development, Tourism & Environmental Affairs: Environmental Impact Assessment (EIA) Component eThekwini District	Yugeshni	Govender
Department of Economic Development, Tourism & Environmental Affairs: Coastal and Biodiversity Management	Omar	Parak
Department of Economic Development, Tourism & Environmental Affairs: Coastal and Biodiversity Management	Alfred	Matsheke
Department of Water & Sanitation	Jabulile (Ntombi)	Madibe-Mngoma
KZN Corporate Governance and Traditional Affairs	Vishnu	Govender
KZN Department of Transport	Juddy	Reddy
Local Authorities		
Ethekwini Municipality: Environmental Planning & Climate Protection Department	Bathabile	Msomi
Amafa aKwaZulu Natali	Bernadet	Pawandiwa
Amafa aKwaZulu Natali	Weziwe	Tshabalala
Ezemvelo KZN Wildlife	Dominic	Wieners
Ezemvelo KZN Wildlife	Nerissa	Pillay

eThekwini Transport Authority	Dookhi	Revash
Environmental Health Services /AQO Health Unit eThekwini Municipality	Bruce	Dale
NGOs, CBOs & Associations		
WESSA	Sudira	Haripersadh
WESSA	Sade	Steenkamp
South Durban ABM	Eurakha	Singh
South Durban ABM	Fanele	Masombuka
South Durban ABM	Anitha	Govender
SDCEA	Shanusha	Samson
SDCEA	Desmond	D'Sa
SDCEA	Shanice	Firmin
GroundWork	Rico	Euripidou
GroundWork	Bobby	Peek
GroundWork	Admin	
Ward Councillor		
Ward 75 (Jacobs) Ward Councillor	Eunice Sibongile	Khanyile
Landowner		
Protea Chemicals	Mike	Smith
Adjacent Landowners		
The Sherwin-Williams Company	Sharon	Sewnarian
Almstab	Dwayne	Lorentz
Jai Cubed Freight	Jai	Alwar Bhana
Colas South Africa	Narendra	Gokul
Bearing & Seal Center CC	Lorraine	

Sharp Sharp Factory Shop		Mr Khan
General		
Private Individual	Cornelius	Florence

2.6 COMMENT AND RESPONSE REPORT

The CRR associated with the notifications is included in **Table 3**. Copies of comments received are included in **Appendix B**.

Table 3: Comment and Response to Notifications

NO.	COMMENT	RESPONSE
1. Batha Msomi, eThekwini Municipality – 18 January 2021 (via email)		
1.1	May you kindly register eThekwini as an I&AP	Contact details have been added to the stakeholder database.
2. Shanice Firmin, SDCEA – 19 January 2021 (via email)		
2.1	Please can you register me as an interested affected party. Shanice, SDCEA, & Desmond D'Sa, SDCEA	Contact details have been added to the stakeholder database.
3. Cornelius Florence, Private Individual – 18 January 2021 (via phone call and email)		
3.1	I am a qualified rigger seeking for a vacancy. I am based in Wentworth and really need a job.	Protea Chemicals will be using service providers like Atomic Demolishers and Oracle for the removal and disposal of tanks. The stakeholder was informed to go through the formal route and view jobs on the Omnia Careers job portal.

3 DRAFT BASIC ASSESSMENT REPORT

3.1 AVAILABILITY OF THE DRAFT BASIC ASSESSMENT REPORT

In terms of Directions Regarding Measures to Address, Prevent and Combat the Spread of Covid -19 Relating to National Environmental Management Permits and Licences, published on 05 June 2020, reports may not be made available at any public places or premises closed to the public, as contemplated in the regulations.

As a result, the Draft BA report (BAR) will be made available to stakeholders as follows:

— Ward Councillor office (Sizakala Centre in Lamontville)

— From WSP on request

— Online on the WSP website: http://www.wspgroup.com/en/WSP-Africa/What-we-do/Services/All-Services-A-Z/Technical-Reports/

The Draft BA report will be made available to all stakeholders for a 30-day comment period.

3.2 COMMENT AND RESPONSE REPORT

Written comments received from the stakeholders will be captured in this section of the Final BAR, which will outline the comments received from the stakeholders and responses provided by the applicant and EAP for consideration by EDTEA. Copies of the original comments will be included in **Appendix C** of the Final BAR.

4 FINAL BASIC ASSESSMENT REPORT

The final BAR will be submitted to the EDTEA, and made available to all stakeholders for final review and comment.

The EAP has 90 days from the submission of the application to submit the Final BAR to the EDTEA. The EDTEA will be allocated 107 days to review the Final BAR. The Final BAR will be placed on stakeholder review for a reasonable time period (likely 21 days) during the EDTEA's final review and decision-making process.

Stakeholders will be requested, in terms of the EIA Regulations, as amended, to submit any further comments directly to the EDTEA and provide a copy to the EAP.

APPENDIX

A EDTEA PRE-APPLICATION MEETING MINUTES

APPENDIX

MEETING AGENDA

JOB TITLE	Decommissioning of Protea Chemicals
PROJECT NUMBER	41103051
DATE	24 November 2020
TIME	11am – 12pm
VENUE	EDTEA eThekwini Office
SUBJECT	Pre-Application Meeting
CLIENT	Protea Chemicals
INVITEES	Natasha Brijlal (NB) - EDTEA Siyabonga Sikhakhane (SS) - EDTEA Carla Elliott (CE) - WSP
APOLOGIES	NA

AGENDA ITEMS		**RESP.**
1.0	**INTRODUCTION AND BACKGROUND**	
1.1 1.2 1.3	All parties introduced themselves Carla Elliott explained purpose of meeting was to provide EDTEA with proposed project background; and get guidance / clarity from the competent authority on proposed approach. Explanation was provided by CE on the primary purpose of the chemical plant decommissioning (i.e. sale of land).	
2.0	**LEGAL FRAMEWORK**	
2.1	EDTEA confirmed that **Listing Notice 1 (Activity 31)** is triggered: *The decommissioning of existing facilities, structures or infrastructure for— any development and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014; any expansion and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014.* — Activity 31 is applicable to development and storage of dangerous goods of ~648m³. This triggers secondary clause: Listing Notice 2 (Activity 4): *The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.*	
3.0	**SPECIALIST INPUTS**	
3.1	EDTEA flagged the importance of referencing Material Safety Data Sheets (MSDSs) of the previously stored chemicals in the Basic Assessment Report, as well as the need to show proponents understanding of the underlying geotechnical conditions to inform the	

APPENDIX

MEETING NOTES

underground Storage tanks (UST) removal. It is noted that a Geotechnical Assessment was recommended in DEA Screening Tool Report.

3.2 With reference to the DEA Screening Tool Report, WSP motivated that the following additional specialist studies are not required:

Agricultural Impact Assessment	Project located within industrial area.
Archaeological and Cultural Heritage Impact Assessment	Some existing building (nearing 60 years) are being demolished (to be confirmed during BA). But these are of an industrial nature and do not display cultural and heritage significance. This will be confirmed with AMAFA via application and request for comment on the Basic Assessment Report.
Palaeontology Impact Assessment	Existing developed area within industrial complex.
Terrestrial Biodiversity Impact Assessment	Existing developed area within industrial complex.
Aquatic Biodiversity Impact Assessment	Existing developed area within industrial complex, and not in close proximity to watercourses.
Hydrology Assessment	No change to the water flow or hydrology of the area will occur due to removal of tanks.
Noise Impact Assessment	Construction phase (demolition) impacts will be assessed qualitatively.
Traffic Impact Assessment	Construction phase (congestion) impacts will be assessed qualitatively.
Socio-Economical Assessment	Limited socio-economic impacts and benefits. Existing staff at Jacobs facility will be transferred to Mobeni facility.
Plant Species Assessment	Existing developed area within industrial complex.
Animal Species Assessment	Existing developed area within industrial complex.

4.0 WAY FORWARD

4.1 WSP to commence with drafting and submission of application form (appending minutes).

APPENDIX

B PROOF OF WRITTEN NOTIFICATION COMMENTS

APPENDIX

Mqokeli, Babalwa

From: Batha Msomi <Batha.Msomi@durban.gov.za>
Sent: Monday, 18 January 2021 13:27
To: Mqokeli, Babalwa
Cc: Elliott, Carla
Subject: RE: Notification of Basic Assessment Process: Proposed Protea Chemicals Tanks Decommissioning in Jacobs

Good Day Ladies☺.

Compliments of the New Year. Hope you both had a lovely holiday and keeping Covid safe.

Bhabha, may you kindly register eThekwini as an I&AP.

Thank you.

Batha Msomi
Senior Environmental Technician: Biodiversity Impact Assessment
Environmental Planning & Climate Protection Department
Room 200, City Engineers Building

Tel: 031 311 7940
Cell: 083 372 5110

From: Mqokeli, Babalwa [mailto:Babalwa.Mqokeli@wsp.com]
Sent: Wednesday, 13 January 2021 12:42
Cc: Elliott, Carla <Carla.Elliott@wsp.com>
Subject: Notification of Basic Assessment Process: Proposed Protea Chemicals Tanks Decommissioning in Jacobs

Dear Stakeholder

Please find attached notification regarding the **Proposed Protea Chemicals Tanks Decommissioning in Jacobs**.

Notification is given to all potential interested and affected parties of the intention to submit an application for Environmental Authorisation, and the Basic Assessment (BA) being undertaken for the above-mentioned project.

Please confirm your interest in this project by registering as a stakeholder. You can register by providing your full contact details to the WSP by return email or at the details provided in the notification letter.

Best Regards

Babalwa Mqokeli Pr Sci Nat
Environmental Consultant
WSP, Environment & Energy, Africa

T +27 31 240 8804
F +27 31 240 8801

1st Floor, Pharos House,
70 Buckingham Terrace,
Westville

APPENDIX

Mqokeli, Babalwa

From: Shanice <shanice@sdceango.co.za>
Sent: Tuesday, 19 January 2021 17:10
To: Mqokeli, Babalwa
Cc: Elliott, Carla
Subject: RE: Notification of Basic Assessment Process: Proposed Protea Chemicals Tanks Decommissioning in Jacobs

Importance: High

Hi Babalwa

Please can you register my as an interested affected party. Shanice, SDCEA, shanice@sdceango.co.za, 031 468 1257 & Desmond D'Sa, SDCEA, desmond@sdceango.co.za, 083 982 6939

Regards

Shanice

From: Mqokeli, Babalwa <Babalwa.Mqokeli@wsp.com>
Sent: Wednesday, 13 January 2021 12:42
Cc: Elliott, Carla <Carla.Elliott@wsp.com>
Subject: Notification of Basic Assessment Process: Proposed Protea Chemicals Tanks Decommissioning in Jacobs

Dear Stakeholder

Please find attached notification regarding the **Proposed Protea Chemicals Tanks Decommissioning in Jacobs**.

Notification is given to all potential interested and affected parties of the intention to submit an application for Environmental Authorisation, and the Basic Assessment (BA) being undertaken for the above-mentioned project.

Please confirm your interest in this project by registering as a stakeholder. You can register by providing your full contact details to the WSP by return email or at the details provided in the notification letter.

Best Regards

Babalwa Mqokeli Pr Sci Nat
Environmental Consultant
WSP, Environment & Energy, Africa

T +27 31 240 8804
F +27 31 240 8801

1st Floor, Pharos House,
70 Buckingham Terrace,
Westville
3629 South Africa

wsp.com

APPENDIX

C PLACEHOLDER FOR DRAFT BAR COMMENTS

APPENDIX

B EAP CURRICULUM VITAE

CARLA ELLIOTT, M.Soc.Sc., EAP

Associate, Environment & Energy

Years with the firm

12

Years of experience

16

Professional qualifications

EAP

Areas of expertise

Environmental & Social Impact Assessment

Environmental Authorisation Processes

Sustainability Reporting

Strategic Environmental Planning

Languages

English

CAREER SUMMARY

Carla has 16 years' postgraduate experience in the field of environmental services, economic development and project management. Coming from a development planning background (starting her career working for the City of Durban for 4 years), Carla is an extremely competent project manager of strategic and integrated development projects. Her areas of expertise include environmental & social impact assessments (ESIAs) and environmental strategic and framework planning; both within the infrastructural, industrial and power generation sectors. Her role as project manager for the Pemba Oil and Gas Service Centre (POGSC) infrastructure project in Mozambique in 2016 provided her with her first opportunity to develop her project manager skills into the international arena. This large-scale project (Category A), involving both Critical Habitat impacts and substantial resettlement, required dedicated client interaction with project funders, developers and design engineers; and a streamlined approach in order to successfully integrate numerous specialist studies into the single assessment process. More recently (2018) she has delivered the ESIA in support of the Lesotho Lowlands Bulk Water Supply Scheme (Works Bank Operational Principles (OPs) and EHS Guidelines); and more recently in 2020 drafted an ESIA and ESMP in compliance with the African Development Bank (ADB) for a proposed 50MW solar PV Plant in Nigeria. Her lead on these projects has allowed her to gain knowledge of working with a diverse range of project and community stakeholders; and addressing challenges to successfully complete projects to international standards timeously. She is a strong team leader and fulfils the role of Team Coordinator for WSP's Durban-based Environmental Services team.

EDUCATION

Master of Social Science, Geography and Environmental Management, University of KwaZulu-Natal, Durban, South Africa	2004
Bachelor of Social Science (Honours), Geography and Environmental Management, University of KwaZulu-Natal, Durban, South Africa	2001
Bachelor of Social Science, Environmental and Geographical Science, University of KwaZulu-Natal, Durban, South Africa	2000

ADDITIONAL TRAINING

Water Governance; 3 CPD-points	2020
Hazard Identification & Risk Assessment (HIRA), Safety Risk Management (SRM): NQF Level 3	2016
Project Management Foundations (PMBOK): NQF Level 4	2006

PROFESSIONAL MEMBERSHIPS

Member of Durban Chamber and Commerce: Environmental Committee	-

COUNTRY EXPERIENCE

South Africa, Lesotho, Mozambique, Swaziland, Nigeria

PROFESSIONAL EXPERIENCE

Infrastructural ESIA and ESMPs

- 50MW PV Solar Project, Kaduna (2020) Project Manager and Lead EAP. Development of an ESIA and ESMP aligned with African Development Bank (AfDB) and International Finance Corporation (IFC). This role included the management of a sub-consultant for the delivery of an Abbreviated Resettlement Action Plan (ARAP) and Livelihood Restoration Plan (LRP). Women focussed meetings played and the implementation of a Grievance Redress Mechanism played an important role in the successful inclusion of vulnerable groups.
- Single Buoy Mooring (SBM) Buoy 3 Anchor and Chain's Replacement, South Africa (2020): Project Manager and Lead. Development of an Environmental and Social Management Plan (ESMP) for the replacement of anchor and chains securing a subtidal pipeline used to facilitate the transfer of liquid and/or gas between tanker vessels and the shore. Specialist inputs included Marine Ecology and Marine Underwater Cultural Heritage. Client: Shell SA Refining and BP Southern Africa (SAPREF).
- Lesotho Lowlands Bulk Water Supply Scheme Zone 6 & 7, Mafeteng and Mohales Hoek, Lesotho (2018). Project Manager and Lead EAP. ESIA, ESMP and Resettlement Action Plan (RAP) to World Bank (WB) and European Investment Bank (EIB) Standards for the provision of bulk water infrastructure to peri-urban and rural communities. This Category A-rated project includes ~60 ML/day of water abstraction, water treatment works for 40 m^3/day, 31 service reservoirs / sumps / tanks; 18 pump stations, 160 km length of pipeline, associated power supply infrastructure and a low level weir across the Makhaleng River to optimise intake.
- Single Buoy Mooring (SBM) Stabilisation, South Africa (2018): Project Manager and Lead. Development of an Environmental and Social Management Plan (ESMP) for the stabilisation of a subtidal pipeline used to facilitate the transfer of liquid and/or gas between tanker vessels and the shore Client: SAPREF.
- Durban Port Water Reticulation Project, South Africa (2016-2017): Project Manager and Lead Environmental Assessment Practitioner (EAP). ESIA for the proposed water reticulation replacement project and reservoir for the Port of Durban (largest port in Sub Sahara Africa) to improve efficiencies for port users. Client: Transnet National Port Authority (TNPA). Client: Transnet National Ports Authority (TNPA).
- Expansion of the Comrie Dam, South Africa, South Africa (2015-2016): Project Manager and Lead EAP. ESIA for the expansion of the dam supplying water for continued operation of a downstream paper mill during periods of drought. Carla successfully facilitated the process coordinating inputs from a number of specialists: Vegetation Assessment, Hydrological Impact Assessment., Wetland Assessment and Rehabilitation Plan, and an Ecological Reserve Determination). Client: Sappi Southern Africa (Pty) Ltd.
- Pemba Oil and Gas Service Centre (POGSC), Pemba, Mozambique (POGSC), Africa (2014-2015): Project Manager and Lead EAP. ESIA, ESMP and Resettlement Action Plan (RAP) for the Phase 1 of the Proposed POGSC. The facility's primary purpose is to provide support to the oil and gas industry – particularly to the offshore vessels along African east coast. The ESIA included several specialist studies which assessed various environmental and social aspects within a 700ha project area. Carla's streamlined project facilitation approach, knowledge of environmental attributes, and strong people's skills allowed her to successfully interface across the disciplines and project stakeholders including

coordination with the local consultant's inputs on the RAP and Livelihood Restoration Plan (LRP). Client: Portos de Cabo Delgado S.A (PCD).

- Hydropower Dam, Lubombo Region, Swaziland (2015): Environmental input as part of a multidisciplinary consortium undertaking a bankable feasibility study for the proposed Lubovane mini-hydropower dam. Carla undertook the environmental screening of the project and provided recommendations with respect to the required environmental authorisation process, and related studies and permits. This required an understanding of the biophysical and social environment to identify development sensitivities. Swaziland Electricity Company (SEC).
- Floating Dry Dock, Port of Durban, South Africa (2015): Project Manager and Lead EAP. Facilitation of the ESIA process working closely with Ecological and Air Quality specialists to present the environmental authorities with a robust assessment and confidence in the proposed management and mitigation measures to ensure the project will not result in significant residual marine impacts. The ESMP mitigation measures referenced both country specific legislation requirements as well as the World Bank General (WBG) Environmental, Health and Safety (EHS) Guidelines. Dormac – a division of Southern Group Holdings (DORMAC).
- Moses Mabhida Railway Station, Durban, KwaZulu-Natal, South Africa (2008-2009): EAP. ESIA for the construction of a railway station in the vicinity of the Moses Mabhida Stadium to serve as support infrastructure to the Kings Park Sports Precinct. Its primary driver was the provision of support infrastructure and facilities for the 2010 FIFA Soccer World Cup – authorisation was therefore sought and successfully facilitated within a tight timeframe. Client: Passenger Rail Association of South Africa (PRASA).
- Ridgeside Substation Durban, KwaZulu-Natal, South Africa (2008-2009): Project Manager and Assistant EAP. ESIA for the construction and operation of a new electrical substation to meet the planned future developments proposed for the Umhlanga area. Client: Tongaat Hulett on behalf of eThekwini Municipality.
- Multipurpose Terminal Expansion - ESIA, Richards Bay, KwaZulu-Natal, South Africa (2008-2009): Lead EAP. Carla fulfilled the role as project manager for the ESIA on behalf of Transnet Port Terminals for the proposed expansion of multipurpose terminal storage facilities and liner. The project rationale resulted from current and forecasted market trends indicating an increased handling cargo capacity would be required in order to meet increased demand. Specialist studies associated with the process which needed to be considered in the ESIA included an Avifauna, and Air Quality Assessment. The project concluded with the drafting and submission of an ESMP for the construction phase. Client: Transnet Port Terminals.

Industrial ESIAs and ESMPs

- Biomass and Bagasse Power Generation Ubombo, Swaziland, Africa (2015-2016): Project Manager and Lead EAP. WSP was appointed as lead environmental consultant to undertake an ESIA process for the proposed Furfural Plant, connected to, the existing Ubombo sugar mill. The ESIA included particular focus on Air Quality Impact Assessment (AQIA) and waste management (ash). The client, Illovo Sugar Limited, is the largest producer of cane sugar and related chemicals on the African continent.
- SAPREF Cleaner Fuels Phase 2 (CF2), Durban, KwaZulu-Natal, South Africa (2012-2013): Project Manager. ESIA to ensure compliance with the South African Department of Energy (DoE) amended regulations requiring a reduction in sulphur (gasoline and gasoil), benzene (gasoline) and aromatics (gasoline). The primary purpose of the SAPREF CF2 was to undertake the required major modifications to the SAPREF refinery (South Africa's largest refinery) to meet

these specifications. Project required the coordination of the following specialist input: traffic, air quality, noise, and Major Hazard Installation risk assessment. Client: SAPREF (Shell and BP JV).

- Lomati Biomass Power Generation Project, Mpumalanga, South Africa (2011-2012): Project Manager and Lead EAP. Facilitation of the ESIA for a proposed NERP (National Energy Response Plan) facility – burning of biomass in a multi-fuel boiler primarily as an alternative energy source (exceeding 50 MWth) for the Mill and excess to contribute electricity to the national grid. The ESIA process needed to be conducted and approved within a very short timeframe to be in line with the national Department of Energy (DOE) independent power producers (IPP) process. The assessment included the following investigations: AQIA, wetland screening, and a waste classification of the ash for guidance on correct disposal. Client: Sappi Southern Africa.

Remediation Projects

- Advisor to Transnet National Ports Authority Port for Oil Company Site Exist at the Port of Port Elizabeth (PoPE), South Africa (2010). Technical support to the TNPA Environmental Compliance Department for the review of Remediation Action Plan., Decommissioning EMPr, Risk Registers, Legal Register and Stakeholder Engagement Strategy.. Client: Transnet National Ports Authority.
- PoPE Oil and Gas Depot Site Exist and Remediation, South Africa (2017). ESIA representative on advisory panel for permanent solution to prevent further seepages of free phase hydrocarbons into the Port Elizabeth Harbour, and the removal of free-phase hydrocarbons from the subsurface. Client: Shell South Africa.

Sustainability Reporting and Strategies

- Sustainability Strategy for the Proposed Richards Bay Port Expansion Project (2017-2018). Carla led the WSP team and specialist sub-consultants to develop a framework and strategy to guide the multi-billion Rand future development of the port (South Africa's largest port for the handling of dry bulk commodities – primarily agriculture and mining product); and to ensure that sustainability principles and criteria are integrated into all planned activities and areas of operation. The strategy is based on the identification of sustainability priority areas and related objectives, goals, sustainability initiatives and reporting indicators. Client: Transnet Group Capital (TGC).
- Proposed Durban Dig-Out Port (DDOP), Sustainable Port Development Framework (SPDF), Durban, KwaZulu-Natal, South Africa (2012-2013): Project Manager. The DDOP will represent one of the largest infrastructure projects in South Africa's history, when it takes place. The SPDF is to ensure that the DDOP is developed and operated in a sustainable manner, Transnet contracted WSP to compile a SPDF to guide the design, construction and operational phases of the proposed port. Client: Transnet Capital Projects.
- Agrizone Green Projects Feasibility Study, Durban, KwaZulu-Natal, South Africa (2011): Assistant Environmental Consultant. WSP was commissioned to provide consulting services to assist the DTP in identifying potential Green Projects within the Agrizone and to determine the feasibility of the proposed projects. Carla project managed this process and assisted the Climate Change and Sustainability (CCS) team and WSP Group industrial engineers in the coordination, identification and further investigation into the following projects: on-site composting; tariff optimisation; photovoltaic panels and refrigeration; green star tool sponsorship; accreditation and eco-labelling; carbon footprinting and life cycle assessment; and sustainable supply chain system. Client: Dube Trade Port (DTP).
- 2010 National Greening Programme Legacy Project, Nationwide, South Africa (2010): Project Coordinator. WSP was commissioned to coordinate the collection and interpretation of information from municipalities and other authorities

throughout South Africa in order to report back on a number of focus areas (Energy and Climate Change, Transport, Waste, and Water) and in essence prepare a *scorecard* for each South African City on events and achievements that took place during the 2010 FIFA World Cup. A glossy coffee table book was produced which showcased the projects that were *substantially implemented* and resulted in benefits for both the environment and people of South Africa. Client: Department of Environmental Affairs.

- Cleaner Development Mechanism (CDM) Feasibility for eThekwini Integrated Rapid Passenger Transport Network (IRPTN), Durban, KwaZulu-Natal, South Africa (2009-2011): Assistant Environmental Consultant. Carla assisted the WSP CCS Unit in a coordination and client liaison role in the provision of carbon footprint calculations and feasibility of CDM credits for the IRPTN to be incorporated into the proposed project financial modelling exercise. Client: eThekwini Municipality.

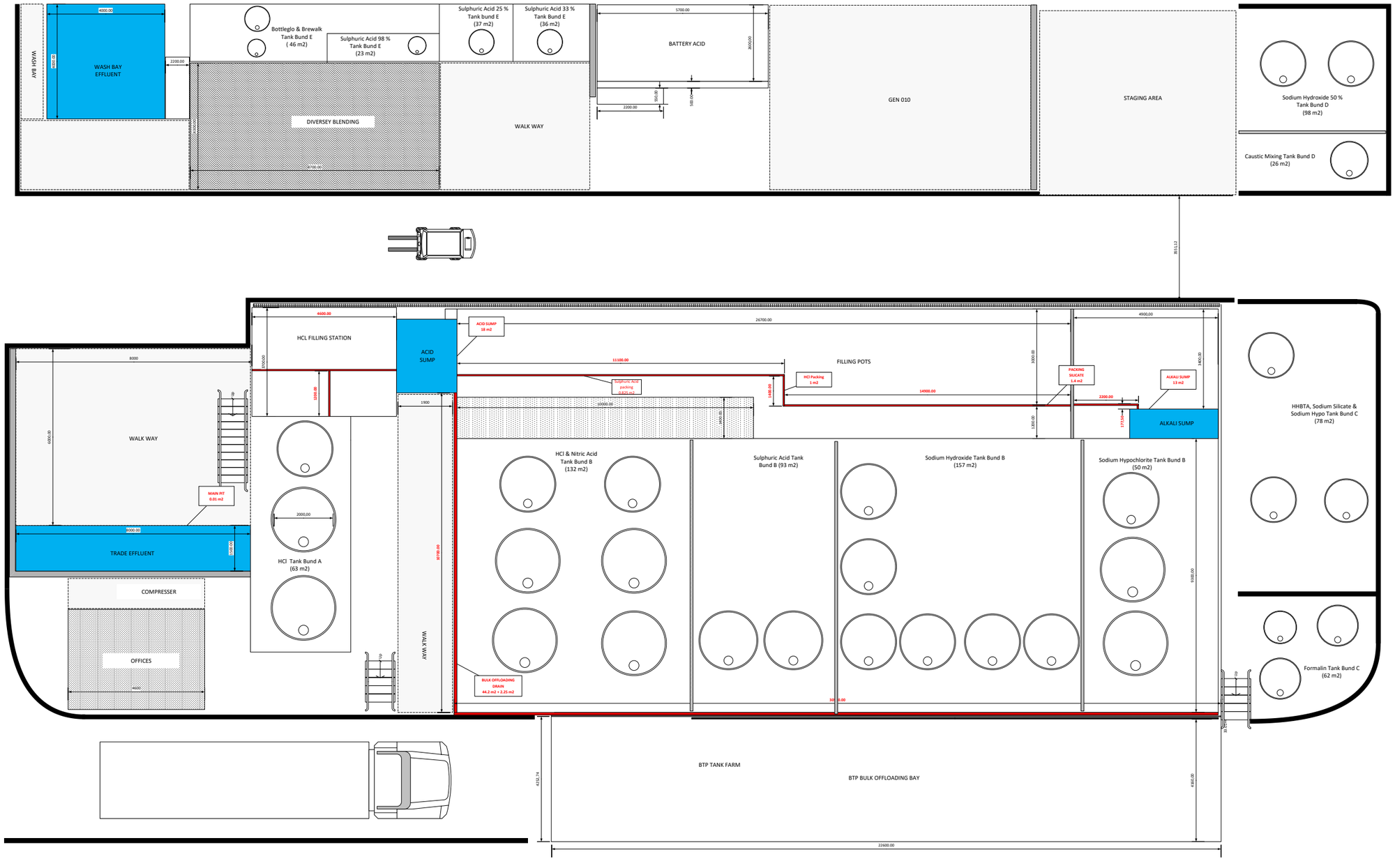
Strategic Environmental Planning

- Southern Public Transport Corridor Densification Framework, Durban, KwaZulu-Natal, South Africa (2013-2015): Lead Environmental Consultant. WSP provided environmental planning services as part of a design team appointed to identify densification opportunities and constraints within a defined corridor in South Durban including Umlazi, Isipingo / Reunion, Clairwood / Merebank and Congella / Umbilo. Carla played the role as primary environmental role player within the team. Client: eThekwini Municipality.
- Strategic Environmental Assessment (SEA) of the eThekwini Spatial Development Plans, Durban, KwaZulu-Natal, South Africa (2009-2011): Project Coordination. Carla provided project support services to assist the eThekwini Municipality Head: Environmental Planning and Climate Change Protection with the programme management for the development of a methodology and drafting of a terms of reference with both international specialists and drafting within the fields of SEA and scenario planning. This involved a project coordination role with the advisory teams as well as with key eThekwini Municipality line departments. Client: eThekwini Municipality.
- South Durban Shoreline Management Plan (SMP), Durban, KwaZulu-Natal, South Africa (2008-2009): Project Manager. Carla fulfilled the role as project coordinator for SMP on behalf of the eThekwini Municipality for a 25-30 km of shoreline between the Durban harbour and Umbogintwini. The brief called for the production of a SMP to provide the Municipality with a basis to implement sustainable policies and to set objectives for the future management of the shoreline, taking into account natural coastal processes, coastal defence needs and environmental considerations, planning issues and current and future land use. Recommendations were made according to proposed responses relating to different scenarios based on the potential erosion and inundation impacts resulting from a rise in sea-level rise of 0.3 m, 0.6m and 1m. A broad range of response strategies and defence options applicable to the study area were then identified. As per the ICMA (Act 24 of 2008), a clear communication strategy was developed for engagement with the public and relevant eThekwini line departments. Client: eThekwini Municipality.
- eThekwini Municipality Local Area Plans (LAPs), Environmental Planning Frameworks, Illovo and Shongweni, KwaZulu-Natal, South Africa (2008-2009) & (2010-2012): Lead Environmental Consultant. Carla has been involved in two LAPs for Illovo and Shongweni where she undertook the role of project manager by providing environmental input into the strategic planning process as part of a consortium including urban designers, social and economic specialists, traffic planners, and public participation specialists.

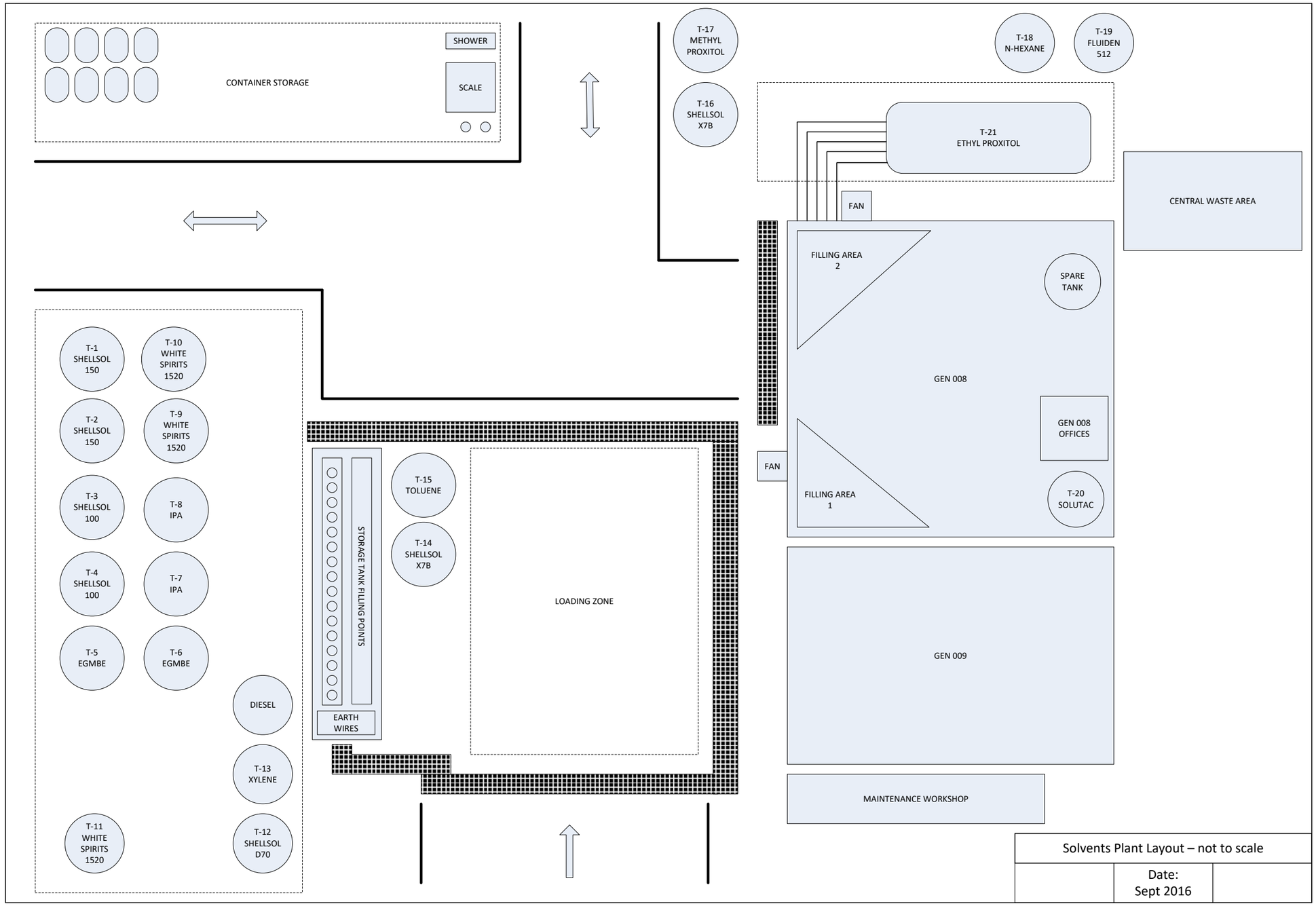
APPENDIX

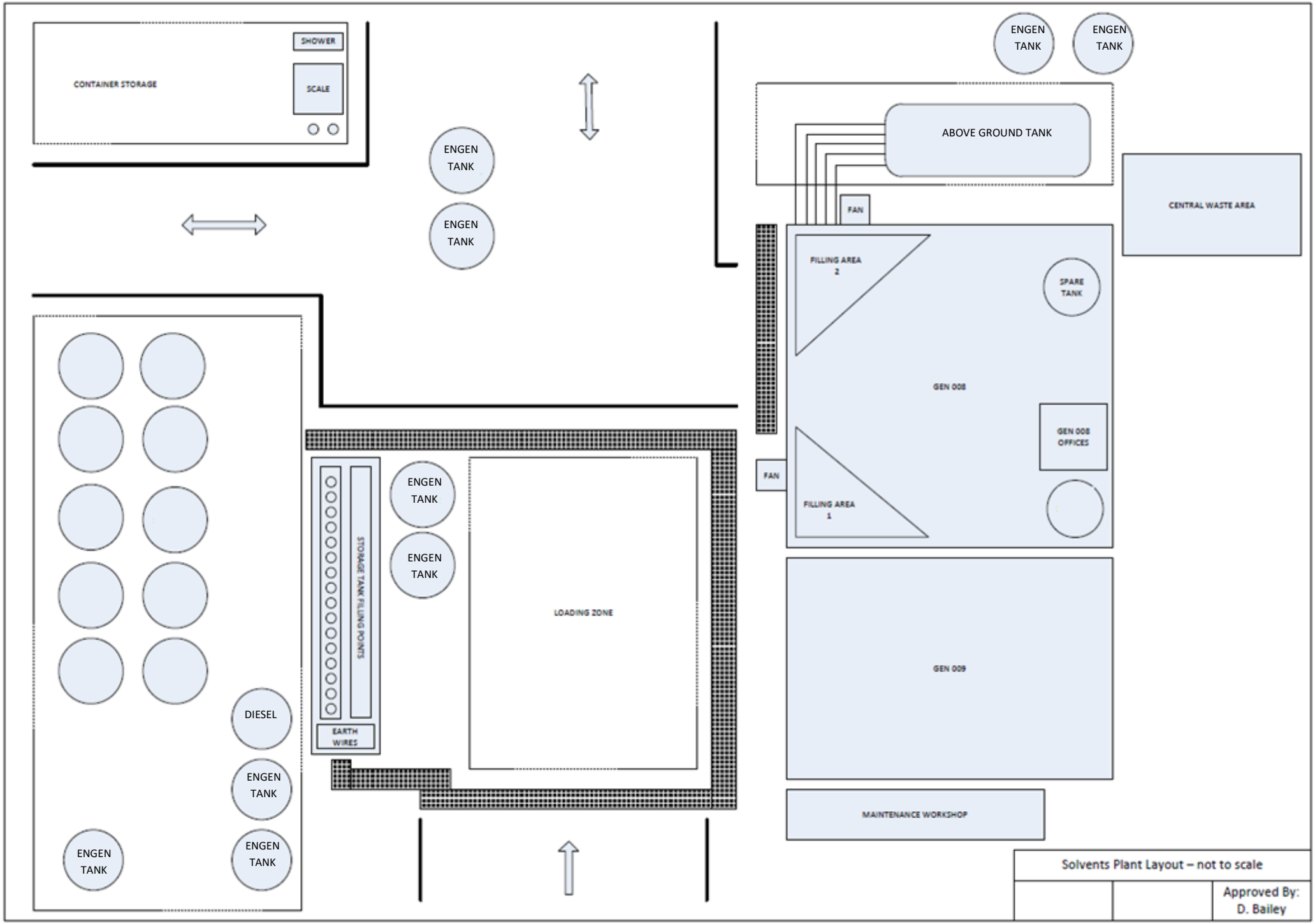
C SOLVENT AND BTP TANKS LAYOUT

BTP Plant Layout Drawing



Solvents Plant Layout Drawing




CONTAINER STORAGE
SHOWER
SCALE
ENGEN TANK
ENGEN TANK
ENGEN TANK
ENGEN TANK
ABOVE GROUND TANK
CENTRAL WASTE AREA
FAN
FILLING AREA 2
SPARE TANK
GEN 008
GEN 008 OFFICES
FAN
FILLING AREA 1
ENGEN TANK
ENGEN TANK
STORAGE TANK FILLING POINTS
EARTH WIRES
LOADING ZONE
GEN 009
DIESEL
ENGEN TANK
ENGEN TANK
ENGEN TANK
MAINTENANCE WORKSHOP
Solvents Plant Layout – not to scale
Approved By:
D. Bailey

APPENDIX

D CHEMICALS INVENTORY

Table 1 Safety Data Sheets (SDS) for Dangerous Goods Previously Stored at Protea Chemicals, Jacobs 1

NUMBER OF SDS	TRADER NAME	GHS CLASSIFICATION
1	ETHYLENE GLYCOL MONO BUTYL ETHER	– GHS07
2	FLUIDEN 512	– GHS02 – GHS07 – GHS08
3	FORMALDEHYDE 36.0 - 37.5%	– GHS02 – GHS05 – GHS07 – GHS08
4	HEAVY HIGH BOILING TAR ACID (HHBTA)	– GHS02 – GHS06
5	HYDROCHLORIC ACID (HCL) SOLUTION 30 - 33%	– GHS05 – GHS07
6	ISO PROPANOL (PROPYL ALCOHOL) 99.7%	– GHS02 – GHS07
7	KOGASIN	– GHS02 – GHS08
8	N-HEXANE	– GHS02 – GHS07 – GHS08 – GHS09
9	PARAFFIN C9 -C11 (KEROSOL)	– GHS02 – GHS07 – GHS08 – GHS09
10	PROPYLENE GYLCOL MONO METHYL ETHER	– GHS02 – GHS07
11	PROTEA AROMATIC 150	– GHS02 – GHS07 – GHS08
12	SHELLSOL A100 or FLUIDAR 100, LAMP OIL	– GHS02 – GHS07 – GHS08
13	SHELLSOL D40	– GHS02 – GHS07 – GHS08

Block A, 1 on Langford
Langford Road, Westville
Durban, 3629
South Africa

T: +27 31 2408874
F: +27 31 240 8861
www.wsp.com

14	SHELLSOL D70	– GHS07 – GHS08 – GHS09
15	SODIUM HYDROXIDE SOLUTION (47-50%)	– GHS05 – GHS06
16	SODIUM HYPOCHLORITE 11 - 15%	– GHS05 – GHS09
17	SODIUM SILICATE	– GHS05 – GHS07
18	SOLVENT NAPHTHA (PETROLEUM), LIGHT ALIPH.	– GHS02 – GHS06 – GHS08
19	SULPHURIC ACID 20% - 50%	– GHS05
20	SULPHURIC ACID 98% INDUSTRIAL GRADE	– GHS05
21	TOLUENE	– GHS02 – GHS07 – GHS08
22	WHITE SPIRITS 3.5%	– GHS02 – GHS07 – GHS08
23	XYLENE	– GHS02 – GHS07

APPENDIX

E PHASE I AND II ENVIRONMENTAL SITE ASSESSMENT

Protea Chemicals

Phase I and Phase II Assessment Report for Protea Chemicals – Jacobs Facility
Durban

RGM Reference Number: 20-0530-R01-01

Client Reference Number: OPCH071367PO

Protea Chemicals
A member of the Omnia Group

SEPTEMBER 2020

RGM AN RSK GCS Mamadi Pty Limited company

RGM GENERAL NOTES

Project No.: 20-0530

Report No.: 20-0530-R01-01

Title: Phase I and Phase II Assessment Report for Protea Chemicals – Jacobs Facility, Durban

Client: Protea Chemicals

Date: 21 September 2020

Office: RGM Environment (Pty) Limited, 63 Wessel Road, Rivonia 2128, PO Box 2597, South Africa. Telephone: +27 (0)11 803 5726

Status: Rev 01

Author	Thomas Brown	**Document reviewer**	Lucy Thomas
Signature		Signature	
Date:	21 Sep. 20	Date:	21 Sep. 20
Document Authorisation	Johan Kriek	**Quality reviewer**	Lucy Thomas
Signature		Signature	
Date:	21 Sep. 20	Date:	21 Sep. 20

Revision control sheet

Revision reference	Date	Reason for revision
Rev 01	21/09/2020	Updated Scope of Work

ACRONYMS

AH	Auger Hole
AST	Aboveground Storage Tank
BH	Borehole
BTEXN	Benzene, Toluene, Ethylbenzene, Xylenes and Naphthalene
DO	Dissolved Oxygen
DTV	Dutch Target Value
DWS	Department of Water and Sanitation
EC	Electrical Conductivity
ERA	Environmental Risk Assessment
GRDM	Groundwater Resource Directed Measures
KL	Kilolitre
LRP	Lead Replacement Petrol
MAMSL	Metres above mean sea level
MBGL	Meters below ground level
MTBE	Methyl tertiary butyl ether
MW	Monitoring Well
NEMWA	National Environmental Management Waste Act
NGA	National Groundwater Archive
PID	Photo Ioniser Detector
PPM	Parts per million
PVC	Polyvinyl Chloride
SANAS	South African National Accreditation System
SANS	South African National Standard
SSV	Soil Screening Value
SVS	Soil Vapour Survey
SWL	Static Water Level
TAME	Tertiary-amyl methyl ether
TDS	Total Dissolved Solids
TOW	Tank Observation Well
ULP	Unleaded Petrol
UST	Underground Storage Tank
WGS	World Geodetic System

GLOSSARY

Aquifer – Geological formation which has structures or textures that hold water or permit appreciable water movement through them.

BTEXN – Volatile organic compound present in petroleum derivatives. Refers to benzene, toluene, ethylbenzene, xylene and naphthalene compounds.

Dyke – A tabular igneous intrusive rock unit that cuts across the host rock and usually consists of dolerite.

Environmental Risk: The chance/probability that human health or the environment will suffer harm as a result of the presence of environmental hazards.

Fuel Tank Area: Areas where the fuel tanks and associated infrastructure are located on the site.

Hazardous Material: Any material that, because of its quantity, concentration, or physical or chemical characteristics, may pose a real hazard to human health or the environment.

Methyl tertiary butyl ether (MTBE) – An ether manufactured by reacting methanol and isobutylene. It is used as an oxygenate to increase the octane number in gasoline.

Naphthalene - Aromatic hydrocarbon, smallest of the PAHs (2 rings).

Photo Ioniser Detector (PID) – Portable vapour and gas detector that detects a variety of hydrocarbon compounds

Pump Island Area: Area where the relevant fuel pumps are located

Primary Contaminant Sources – Hazardous materials that may have a significant impact (due to the large volumes and concentrations) on the environment in the event of a spillage

Risk Assessment - A study to determine risks posed by the site if no clean-up action was taken and what clean-up levels need to be established to be protective of human health and the environment.

Risk Management - The process of making decisions about whether an environmental risk is high enough to present a significant public health concern and about the appropriate means for controlling the risk. Risk management considers political, social, economic and engineering information in addition to risk information to evaluate and select alternative regulatory and non-regulatory responses to a potential health hazard.

Secondary Contaminant Sources - Hazardous materials that may impact on the environment on a smaller scale (small volumes and lower concentrations) in the event of a release or spill.

Tertiary-amyl methyl ether (TAME) – An ether used as an oxygenate to gasoline.

Source – Pathway – Receptor (S-P-R) linkage – In order for there to be a probable or complete risk pathway, there needs to be a source, a pathway for the contaminants to migrate through and a receptor of concern which can be affected by the contaminant. A missing component means that the S-P-R linkage is not complete and there is no risk based on the current data/ model.

EXECUTIVE SUMMARY

RGM Environment (Pty) Ltd (RGM) was contracted by Protea Chemicals to conduct an environmental due diligence assessment at the Protea Chemicals Jacobs site, Durban, Kwazulu-Natal Province. The site is situated on the intersection of Quality Street and Balfour Street.

The site work initially entailed a site walkover, a visual assessment of site conditions, review of available information and collection of groundwater samples from the existing groundwater monitoring network. The purpose of the initial assessment was to determine the level of groundwater impact at the time of Protea Chemicals exit of the site. Subsequently, on 03 September 2020, RGM was asked to also obtain soil samples to support subsequent removal of underground fuel storage tanks.

The site walkover was conducted on 29 and 30 June 2020 which included a hydrocensus, initial assessment of the existing groundwater monitoring wells and tank monitoring wells and an in person interview with the site manager. The site walkover was conducted and there were no obvious issues noted. During the interview with site personnel (Mr Nilesh Rughoobeer and Mr Maxwell Tshezi), it was indicated by both parties that no significant leaks or spills had occurred on the site during their 5 year tenure on the site. The hydrocensus, conducted in a 200m radius of the site, indicated that there were no private abstraction wells within the locale of the site, including onsite.

Groundwater samples were collected by RGM on 22 July 2020 from existing on-site monitoring wells MW1 to MW6. No light nonaqueous phase liquids (LNAPLs) were present in the monitoring wells (MW1-MW6). However, the existing tank monitoring wells (TMW1-TMW6) were found to be dry and therefore could not be sampled. Samples were submitted for a wide range of organic compounds including;

- Gasoline range organics (GRO)
- Benzene, toluene, ethylbenzene, xylene, naphthalene (BTEXN);
- Total petroleum hydrocarbons TPH C_6-C_{10}, C_{10}-C_{28}, C_{28}-C_{40};
- Volatile organic compound analysis including chlorinated hydrocarbons.
- Monitored natural attenuation parameters (dissolved Fe^{2+}, Mn^{2+}, NO_3 and SO_4).

Laboratory analyses revealed that three groundwater samples (MW4, MW5 and MW6) had no detectable concentrations of any analytes sampled with concentrations of dissolved phase components detected in the remaining three wells (MW1, MW2 and MW3). Only the concentrations of benzene in MW1 and MW3, naphthalene in MW2, chloroform in MW2 and GRO C_6-C_{10} concentrations in MW1 and MW3 exceeded the US EPA drinking water risk-based screening values. However, as groundwater is not used for drinking water

purposes at or in the vicinity of the site the use of drinking water screening criteria is a conservative approach. Groundwater flow direction is estimated, based on topography, to be towards the north-west. Monitoring wells MW1 and MW5 were therefore considered hydraulically downgradient of site operations. MW1 had detectable concentrations of analytes in the same order of magnitude as the drinking water standards. MW1 is situated on the downgradient border of the site some off site migration of contaminants could have occurred at this locale.
Contaminant trending analysis of current and historical contaminant concentrations indicated that contaminant concentrations were stable in the sampled monitoring wells with statistical analysis noting that there were no increasing trends since July 2018.

Protea Chemicals requested, on 3 September 2020, that soil sampling be conducted within the vicinity of the existing underground storage tanks. The purpose of this request was to comply with the South African Provincial Departments request which required Protea Chemicals to investigate the sub-surface strata in the vicinity of the underground storage tank before the removal of the tanks. Site works commenced on 10 September 2020 and concluded the same day. Following scanning, six locations were opened, augured and the sub-surface soil was profiled. Photo-ionisation detector (PID) analysis indicated that one location, SS4, presented a concentration of 226.4 ppm. Six soil samples were collected and submitted to a SANAS accredited laboratory for soil analysis. The soil analysis reported concentrations of benzo(a)pyrene and TPH GRO C7-C9 which exceeded screening guidelines protective of water and/or health for a residential setting but did not exceed those for an industrial end use. Method statements and risk assessments together with permits to work and contingency plans should be adopted in the preparation of, and during, tank removal works.

A conceptual site model (CSM) was collated that identifies potential sources of contamination, receptors that could be impacted and plausible pathways that link the two. Based on the findings of the phase I and phase II investigation, the only identifiable source-pathway-receptor linkage that was identified is the leaching of petroleum hydrocarbons in localised areas of the site where hardstanding is absent.

The information given in this summary is necessarily incomplete and is provided for initial briefing purposes only. The summary must not be used as a substitute for the full text of the report.

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1. INTRODUCTION

RGM Environment (Pty) Ltd was contracted by Protea Chemicals to conduct a Phase I and Phase II assessment screening study of the Protea Chemicals Jacobs site, Durban, Kwazulu-Natal Province.

Following the conclusion of the groundwater sampling and report issue in August 2020, Protea Chemicals requested on 3 September 2020 that soil sampling be conducted around the existing underground storage tanks in preparation for excavation works and planned tank removal as part of their divestment from the site. Protea Chemicals indicated the following from their email communication on 3 September 2020:

"*As discussed, the soil sampling is a requirement for us to be given a go head to remove any tank from site. I have attached the Norms and Standards of which we have to screen against as per KZN Provincial Environmental Department. We have to attend to this as a matter of urgency and have the current report amended to include soil sampling section. The Provincial Department requires this report to give us a way forward in the process to follow in the removal of the tanks.*"

1.1 Background

Protea Chemicals is owned by, and operates under, Omnia Group (Pty) Ltd. The land on which Protea Chemicals (Jacobs site) is situated on was originally owned by Gen Chem and operated as a chemical manufacturer, distributor and chemical storage facility/warehouse before selling the land to Protea Chemicals before 2010 (greater than 10 years ago).

Protea Chemicals operates as a chemical manufacturer, distributor and chemical storage facility/warehouse. Table 5-2, Table 5-3, Table 5-4 provide a summary list of the chemicals (Class 3, Class 5.1 and Class 6.1) stored and utilised at the Jacobs facility.

Protea Chemicals plans to divest the site.

RGM provided a scope of work as per RGM proposal *"RGM Proposal_ Protea Chemical Phase I and II Environmental Site Assessment_ May 2020".* During discussions on 15 July 2020, the client requested that groundwater monitoring be performed on the existing monitoring wells only from which groundwater quality would be established.

Following discussions held with the client on 3 September 2020, Protea Chemicals was provided a work schedule on 9 September 2020 to conduct the required soil sampling in the vicinity of the underground storage tanks utilising the existing budget from the project as per PO “OPCH071367PO”.

1.2 Objective of Investigation

The objective of the assessment was to understand environmental liabilities associated with ownership and operation of the site for its current use before divestment. The aims of the assessment are:

1. to understand groundwater quality and determine the risk present (if any) posed by the site to the surrounding human health and environmental receptors.
2. Understand soil quality around the existing UST to inform subsequent removal of these in accordance with the Provincial Department requirements.

2 SCOPE OF WORK

The scope of work undertaken at the site is provided below:

- Data Review of the previous reports made available by Protea Chemicals;
- Identification of sensitive ecological areas with a 1km radius of the site;
- Site inspection for the following:
  - Inspection of drains and existing monitoring wells;
  - Record any visible spillages on the site;
  - Obtain water level measurements and field parameters from the existing monitoring wells on site;
  - Collection of PID readings from drains, monitoring wells and any accessible buried utilities on site.
- Conduction of a hydrocensus (walking and driving) within a 300m radius of the site.
- Collection of six (6) groundwater samples from the existing monitoring wells for analysis based on chemicals historically and currently stored on the premises.
- Supervision of utility scanning at six (6) agreed upon positions at the site in the vicinity of the existing underground storage tanks.
- Supervision of the opening concrete, augering and repair of concrete at the six (6) positions.
- Soil profiling and soil sampling for *in-situ* analysis at the six positions.
- Collection of representative soil samples for submission to a SANAS accredited laboratory for soil analysis.
- Identification of potential source – pathway – receptor linkages.
- Updating of the previously issued report to incorporate the soil analysis data.

3 METHODOLOGY

The following sections outline the methodology employed during the collection of environmental samples. The samples were taken independently by an RGM team member following permission provided by authority from Protea Chemicals – Jacobs facility management during the phase I & II assessments and the soil sampling conducted in September 2020.

3.1 Groundwater Investigation and Sampling

Depth to water (static water level) was gauged in the existing on-site monitoring wells (MW1 – MW6) and from the on-site tank monitoring wells (TMW1 – TMW6).

The monitoring wells were purged by three times their volume and then allowed to rest for approximately 1-2 hours before samples were collected.

Groundwater samples were collected from existing on-site monitoring wells MW1 – MW6 using a new PVC bailer at each location. Information regarding the static waters and depths were collected from the monitoring wells and tank monitoring wells, where possible.

During the site assessment the following information on the water quality was collected:

- The presence, location and condition of the groundwater monitoring wells and tank monitoring wells, where possible.
- The depth to static water level and depth of the monitoring wells and tank monitoring wells, where possible.
- In-field physicochemical measurements from the monitoring wells and tank monitoring wells, where possible.
- During the site assessment, information was collected on the current groundwater monitoring systems (these might include individual monitoring wells drilled on site or might include the tank observation wells associated with the Underground Storage Tanks (USTs)).
- This includes the presence or absence of monitoring wells, adequacy of the monitoring, and the condition of the monitoring wells/boreholes.
- Laboratory analyses included:
    - Gasoline Range Organics (GRO) - BTEXN - fully speciated including o- and m,p-Xylenes with sum of Xylenes), trimethylbenzene (fully speciated 1,2,4 and 1,3,5-trimethylbenzenes);

- Total petroleum Hydrocarbons TPH C_6-C_{10}, C_{10}-C_{28}, C_{28}-C_{40};
- Volatile organic compound analysis.
- Monitored Natural Attenuation Parameters (Dissolved Fe^{2+}, Mn^{2+}, NO_3 and SO_4).

Water samples retrieved during the assessment underwent chain of custody (CoC) procedures and were sent to UIS Organics laboratory, based in the Gauteng for analysis.

3.2 Soil Sampling

Shallow auger holes were advanced to maximum depth of 3.0 mbgl or refusal (whichever was encountered first) utilising a hand auger in areas cleared of buried utilities. During sampling any olfactory or visual signs of contamination were noted. The soil was screened for volatile vapours at interval depths of 0.5m or where soil impact or refusal was encountered. The soil PID measurements were taken by means of sampling the in-situ profile and placing the soil sample in a zip-locking bag which was sealed and left in the sun for a few minutes. Soil samples were collected from the intervals with the highest VOC reading and/or greatest depth of each auger hole.

Soil samples were taken according to QA/QC procedures and transported to a fully accredited laboratory. The auger holes were profiled, and seepage zones and olfactory evidence of contamination recorded. Six (6) Sub-surface samples were collected for laboratory analysis.

The following analysis was conducted on the soil samples by a SANAS accredited laboratory:

- Soil SSV Analysis
  - Total petroleum hydrocarbon (TPH) banding: C7-C9, C10-C14, C15-C36
  - Benzene, toluene, ethylbenzene, xylene and naphthalene (BTEXN)
  - Polycyclic aromatic hydrocarbons (PAHs)
  - Volatile organic compounds (VOCs).

4 ENVIRONMENTAL SETTING

The following sections summarise the environmental setting of the site as obtained from available information and published literature obtained during the assessment.

4.1 Topography

The regional topography of Jacobs area, in which Protea Chemicals is located, can be viewed as relatively flat in the north western portion of the area with a gentle slope downward towards the north and northeast towards the concrete tributary. Towards the southeast of the Jacobs area, the area is hilly with relatively steep sections present. The north western portion of Jacobs area typically accommodates industry and commercial properties while the south eastern portion of the Jacobs area accommodates residential properties and small commercial properties.

The Protea Chemicals facility itself is located in the north western portion of Jacobs on a relatively flat section. There is a minor downward gradient towards the northwest.

4.2 Hydrology

The surface water features identified from the latest Google Earth Imagery (2020/01/31) are presented in Table 4-1.

Table 4-1: Hydrological Features

Hydrological feature	Distance*	Comment
Unnamed tributary	±387 m	This tributary appears to flow in a north easterly direction through Clairwood towards the harbour approximately 3.7 km away.
Surface water body	±1,4 km	A surface water body is located approximately 1.4 km to the southeast within the Bluff Nature Reserve.
Surface water body	±980 m	A surface water body is located approximately 980m to the southwest.

Notes: * distance from main facility fence

4.3 Geology

According to the 1:250 000 Geological Map Sheet (2930 Durban) the site is underlain by non-differentiated coastal and inland deposits (unconsolidated to semi-consolidated sediments including sand, calcrete, calarenite, aeolianite, conglomerate, clay, silcrete, limestone etc.).

On-site geology was recorded as follows based on the soil sampling conducted on the 10 September 2020.

Table 4-2: On-site Geological Features

Depth (m bgl)	Geological Features
0.5	Weathered with rock inclusions, fine sand with rock inclusions, dark Brown, no moisture, Sandy clay.
1.0	Weathered, fine sand texture, dark Brown, no moisture, Sandy clay.
1.5	Some sign of weathering, sorted grains, fine sand texture, dark brown/yellow, no moisture, sandy clay.
2.0	No weathering, sorted grains, fine sand texture, dark brown/yellow, no moisture, sandy clay.
2.5	No weathering, sorted grains, fine sand texture, dark brown/orange, no moisture, sandy clay.
3.0	No weathering, sorted grains, fine sand texture, light brown/yellow, no moisture, sandy clay.

Notes: * distance from main facility fence

4.4 Hydrogeology

According to the 1:500 000 hydrogeological map series 3126 Queenstown (Smart *et al*., 1997) the site is underlain by a dual porosity aquifer with both intergranular and fractured flow with an average borehole yield between 0.5 to 2l/s.

The aquifer vulnerability and classification maps of South Africa classify the underlying aquifer as a minor aquifer which is a moderately vulnerable aquifer system and has a medium susceptibility. According to Parsons and Conrad (1998), a minor aquifer system can be defined as fractured or potentially fractured rocks which do not have a high permeability, or other formations of variable permeability. The aquifer extent may be limited and seldom produce large quantities of water.

4.5 Quaternary Catchment

Data from relevant hydrogeological databases including, the Groundwater Resource Directed Measures (GRDM) was obtained from the Department of Water and Sanitation (DWS). The site area falls within quaternary catchment: T12B, as indicated in Table 4-3.

Table 4-3: Summarized Quaternary Catchment Information (GRDM, 2013)

Quaternary Catchment	Total Area (km^2)	Recharge (mm/a)	Current use (L/s)	Rainfall (mm/a)	Average groundwater level (m bgl)
U60F	272.1	156.6	0.001126	1157	13.5

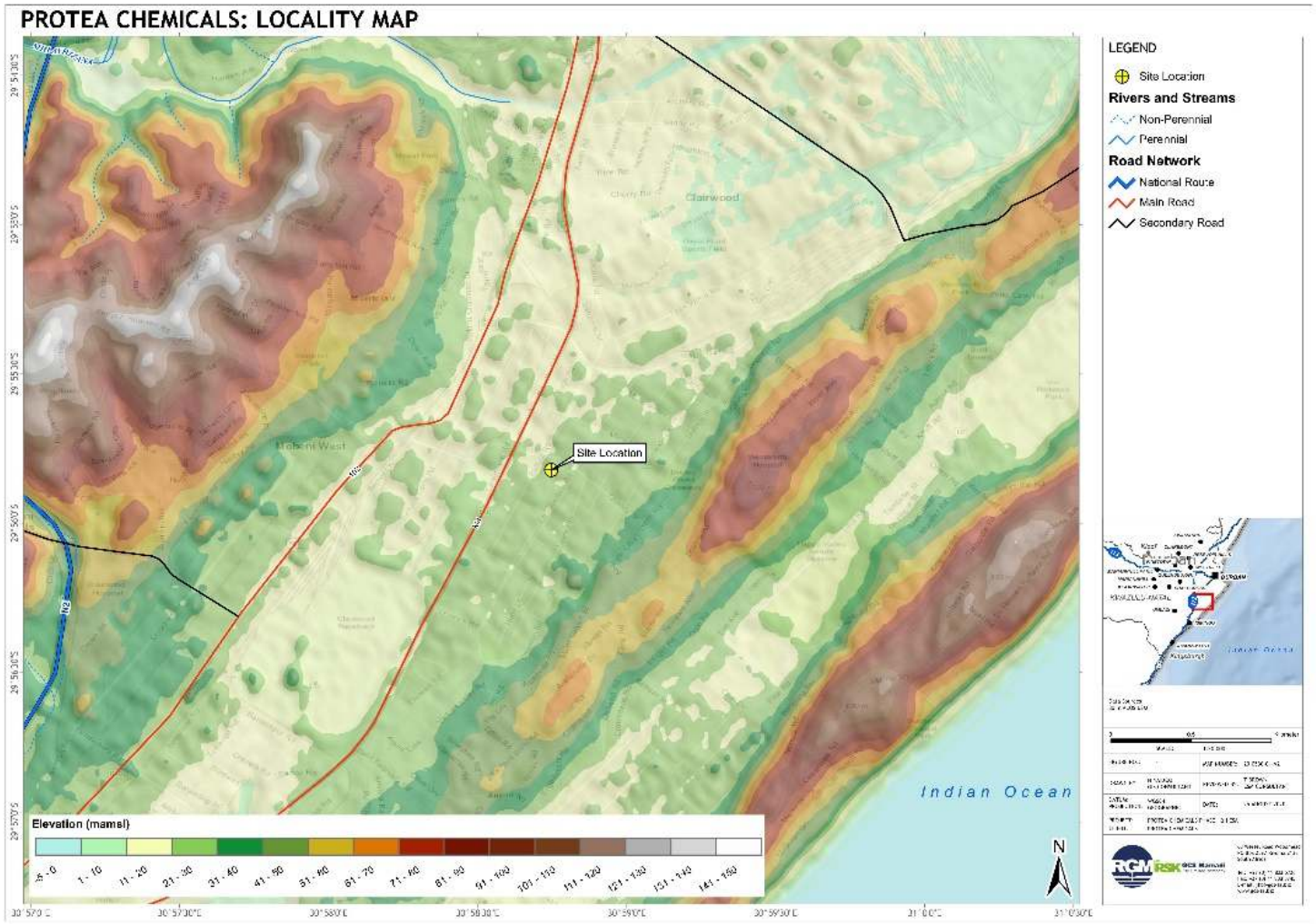

Figure 4-1: Locality Map

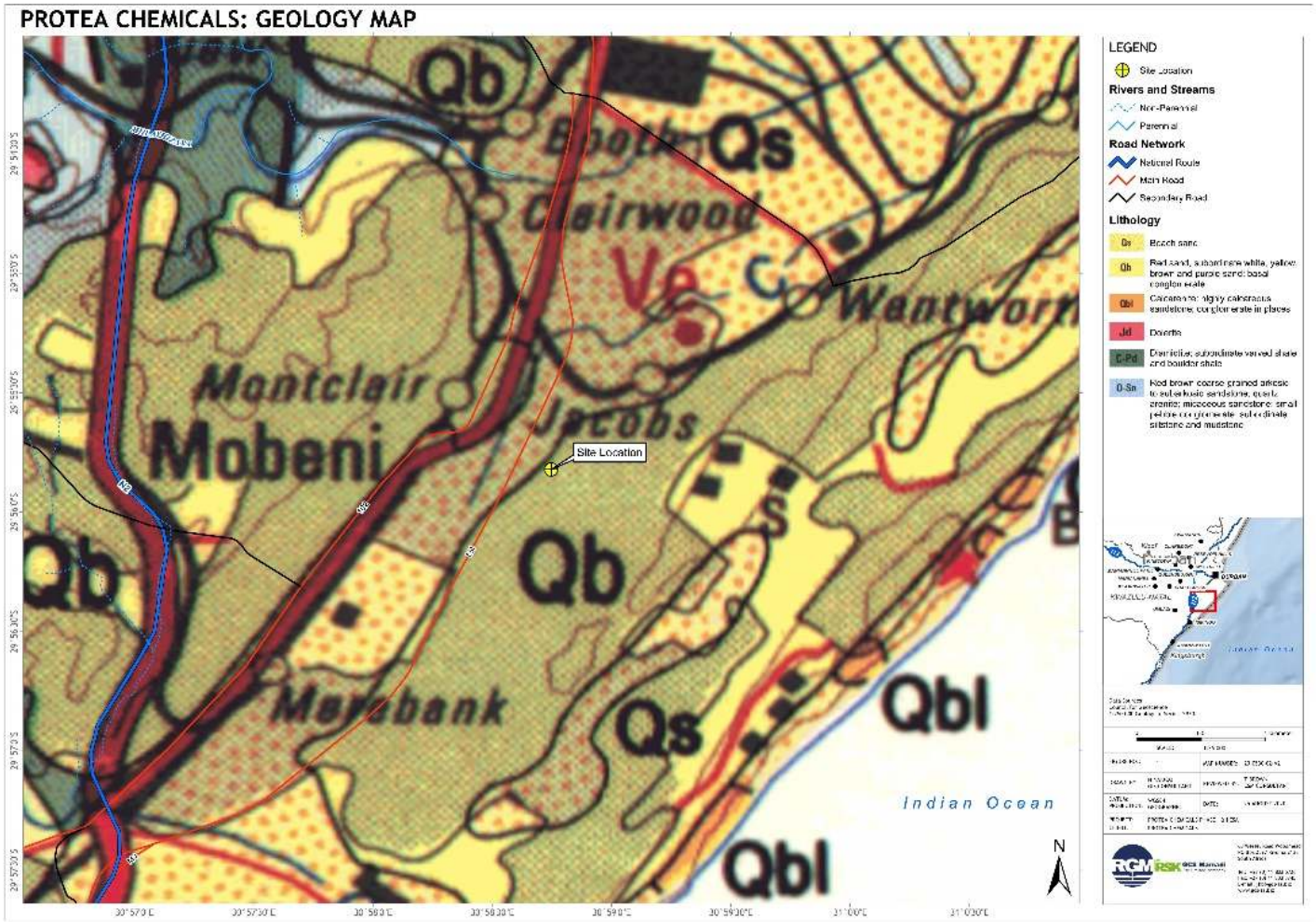

Figure 4-2: Geology Map

5 SITE DESCRIPTION

The site is situated within a commercial land-use within the area of Jacobs, Durban. The site is physically situated on the intersection of Quality Street and Balfour Street with entrances to the site located on both streets. The site is located at the following co-ordinates: -29.930371; 30.979122 (see Figure 4-1). The site is under the management of Mr Nilesh Rughoobeer since 2015.

5.1 Hydrocensus and Adjacent Land Use Survey

During the Phase I assessment, a hydrocensus survey was conducted on properties within 300m radius of the site. No private boreholes were located within this radius.

A neighbouring land survey was conducted for the site in order to prepare a list of adjacent land uses as detailed in Table 5-1.

Table 5-1: Neighbouring Land Use

Direction	Land Use
North	Commercial properties
East	Commercial properties
South	Commercial properties and a fuel station (Jacobs Service Station)
West	Commercial property (Department of Labour – Service Products)

5.2 Summary of Site History and Operations

Protea Chemicals is owned by, and operates under, Omnia Group (Pty) Ltd. The land on which Protea Chemicals (Jacobs site) is situated on was originally owned by Gen Chem and operated as a chemical manufacturer, distributor and chemical storage facility/warehouse before selling the land to Protea Chemicals before 2010 (greater than 10 years ago).

Protea Chemicals operates as a chemical manufacturer, distributor, and chemical storage facility/warehouse. Table 5-2, Table 5-3, Table 5-4 provide a summary list of the chemicals (Class 3, Class 5.1 and Class 6.1) stored and utilised at the Jacobs facility.

5.3 Site Interview

During the interview with the Protea Chemicals – Jacobs site personnel (Mr Nilesh Rughoobeer and Mr Maxwell Tshezi), it was indicated by both parties that no leaks or spills had occurred on the site during their 5-year tenure on the site.

In terms of tank integrity, the site manager indicated that he was not aware of any tank integrity issues since their tenure and that the last visual tank inspections occurred in 2019.

The managers reported that that the USTs (T1-T15) were fed from filler points located adjacent to the tank farm while the ASTs were gravity fed. It was observed on site that tanks T16 and T17 were fed from a separate filler point located in the vicinity of T16 and T17. The USTs were dipped before receiving product. ASTs and USTs were checked every two weeks as part of the leak detection program including physical site inspections of the ASTs and USTs being conducted every morning and evening.

RGM asked for copies of the borehole logs for existing monitoring wells but these were unavailable.

5.4 Site Reconnaissance and Housekeeping

The site walkover was carried out in order to locate any visible contamination or contamination sources within the footprint of the site. Only minor visual staining was noted at the dispensing pumps and parking bays. As the site was undergoing divestment and equipment and commercial product removal from the site, there were empty containers in marked areas and old equipment was noted in the area around monitoring well MW3 and MW6 (refer to Appendix A - Photographic Log). It was reported by the site managers that the remaining chemicals in the USTs and ASTs were being removed or emptied and were not in use. The site layout is illustrated in Figure 6-1 and Figure 6-2.

5.5 Chemicals Historically Stored on Site

During the site visit and interview with personnel from Protea Chemicals – Jacobs site, Table 5-2, Table 5-3, Table 5-4 provide a summary of the chemicals historically stored on the site. Additionally, see Table 5-5 for chemicals which were stored in the underground storage tanks (USTs) and the above ground storage tanks (ASTs).

Table 5-2: Class 3 (Flammable liquids)

Chemical Name	Chemical Name	Chemical Name	Chemical Name
Ethanol	Benzene	Butanol	Base thinners
Alcohol solvent	Hexane	Isopropyl alcohol	Tyzor AA 75 (titanium acetylacetonate)
White spirits	Toluene	Methylated spirits (ethyl alcohol/methyl alcohol mix)	Tyzor TnBT (tetra-n-butyl titanate)
Paraffin	Lacquer Thinners	Ethylene glycol mono butyl ether (EGMBE)	Ethylene glycol mono ethyl ether (EGMEE)
propylene glycol mono butyl ether (EGMBE)	Capstone FS60 Fluorosurfactant (anionic fluorinated surfactant)	Methyl ethyl ketone (MEK)	Capstone FS22 (30% solids in methyl isobutyl ketone (MIBK))
Kogasin solvent	Methanol	Etermino 9226-60 (amino resin)	Methylene diisocyanate, HEXA
Ethanol	Propanol	Acetate	Tyzor IAM (titanium-based phosphate complex)
Xylene	Shellsol 100/150	Shellsol D70	

Table 5-3: Class 5.1 (Oxidising Agents)

Chemical Name	Chemical Name	Chemical Name	Chemical Name
Ammonium persulphate	Calcium hypochlorite (HTH)	Calcium nitrate	Chromic acid crystals
Hydrogen peroxide (different grades)	Potassium permanganate	Sodium bromate	Sodium nitrate (different grades)

Table 5-4: Class 6.1 (Toxic Chemicals)

Chemical Name	Chemical Name	Chemical Name	Chemical Name
Methylene chloride (dichloromethane)	Trichloroethylene	Perchloroethylene (tetrachloroethene, persolve)	Phenol ice crystals
Cresylic acid			

5.6 Underground and Aboveground Storage Tanks

Table 5-5 provides a summary of the above ground storage tanks and underground storage tanks present on the site.

Table 5-5: ASTs and USTs on site

Tank Number	AST/UST	Capacity (L)	Chemical Storage	Tank Infrastructure
Tank 1	UST	10,000	Shellsol[1] 150	Stainless Steel
Tank 2	UST	10,000	Shellsol 150	Stainless Steel
Tank 3	UST	10,000	Shellsol 100	Stainless Steel
Tank 4	UST	10,000	Shellsol 100	Stainless Steel
Tank 5	UST	10,000	EGMBE[2]	Stainless Steel
Tank 6	UST	10,000	EGMBE	Stainless Steel
Tank 7	UST	10,000	IPA[3]	Stainless Steel
Tank 8	UST	10,000	IPA	Stainless Steel
Tank 9	UST	10,000	White spirits (Fluiden 1520)	Stainless Steel
Tank 10	UST	10,000	White spirits (Fluiden 1520)	Stainless Steel
Tank 11	UST	4,500	White spirits (Fluiden 1520)	Stainless Steel
Tank 12	UST	13,750	Shellsol D70[4]	Stainless Steel
Tank 13	UST	13,750	Xylene	Stainless Steel
Tank 14	UST	10,000	Kerosol	Stainless Steel
Tank 15	UST	10,000	Toluene	Stainless Steel
Tank 16	UST	10,000	Kogasin	Stainless Steel
Tank 17	UST	10,000	Methyl proxitol	Stainless Steel
Tank 18	UST	10,000	n-hexane	Stainless Steel
Tank 19	UST	10,000	Fluiden 512	Stainless Steel
Tank 20	AST	4,000	Solutac	Stainless Steel
Tank 21	AST	25,000	Ethyl Proxitol	Stainless Steel
Tank 22	AST	5,000	Spare Tank	Stainless Steel

[1] Shellsol – C_9-C_{10} aromatic hydrocarbon solvent
[2] EGMBE - Ethylene glycol mono butyl ether
[3] IPA – Iso Propyl Alcohol
[4] Shellsol D70 – predominantly C_{11}-C_{14} paraffin and naphthalene compound composition

5.7 Site Assessment History

A summary of the previous assessment undertaken at this site is presented in Table 5-6.

Table 5-6: Site Assessment History

Report Date	Description	Reference
August 2018	A round of monitoring was performed by GeoMeasure in June 2018 and the summary of the report is presented below: • No LNAPLs were detected during the monitoring event. • Monitoring well MW1 contained benzene, a limited number of bromo/ chlorobenzene compounds. It was noted that a slight increase in concentrations was observed from the previous round. No applicable screening guidelines were exceeded. • Monitoring wells MW2 and MW3 contained a limited number of GRO based compounds as well as a limited number of mono-aromatic hydrocarbons. No applicable screening guidelines were exceeded. • Monitoring wells MW4, MW5 and MW6 reported that all targeted hydrocarbon compounds were below laboratory detection limits.	Monitoring Report IX for The Protea Chemicals Facility – eThekwini Municipality – KwaZulu-Natal)

6 RESULTS OF GROUNDWATER MONITORING AND SAMPLING

This section details the results of groundwater monitoring conducted at the Protea Chemical Jacobs facility between 29 and 30 June 2020 and on 22 July 2020 and sampling with laboratory analysis on 22 July 2020. Additionally, it also details the soil sampling conducted on 10 September 2020.

6.1 Groundwater Monitoring

Details of the updated monitoring well data obtained in July 2020 are provided in Table 6-1. Please refer to previously issued letter "*20-0530_Protea Chemicals Phase I Letter Report*" for details of the monitoring well data obtained in June 2020. Details of the purge volumes are presented in Table 6-2. Details of the physio-chemical parameters for June 2020 and July 2020 are presented in Table 6-3 and Table 6-4 respectively, for comparative purposes.

During groundwater monitoring six (6) observation wells (TOW1-TOW6) and six existing monitoring wells (MW1-MW6) were investigated. Light non-aqueous phase liquid (LNAPL) was absent in the tank observation and dedicated groundwater monitoring wells. Additionally, Dense non-aqueous phase liquid (DNAPL) was not detected in the assessed wells. Note, tank observation wells were dry.

Table 6-1: Monitoring Well Details July 2020

ID	Co-ordinates (WGS 84, Geographic)		SWL (m bgl)	Measured Depth (m bgl)	Comments
	S	E			
MW1	-29.929882°	30.978768°	4.63	6.24	Monitoring well cap and casing in place. Water sample was brown in colour and no olfactory hydrocarbon odours noted. Fine sediment observed.
MW2	-29.930482°	30.978524°	2.26	5.20	Monitoring well cap and casing in place. Water sample was dark brown with a malodour. Observed a soapy texture on the bailer. Fine sediment observed.
MW3	-29.930816°	30.979054°	4.10	6.20	Monitoring well cap and casing in place. Water sample was clear and no olfactory hydrocarbon odours noted. Fine sediment observed.
MW4	-29.931053°	30.979813°	1.90	2.82	Monitoring well cap and casing in place. Water sample was brown in colour and no olfactory

ID	Co-ordinates (WGS 84, Geographic)		SWL (m bgl)	Measured Depth (m bgl)	Comments
	S	E			
					hydrocarbon odours noted. Fine sediment observed.
MW5	-29.929851°	30.979659°	3.18	3.65	Monitoring well cap and casing in place. Water sample was brown in colour and no olfactory hydrocarbon odours noted. Fine sediment observed.
MW6	-29.931363°	30.978993°	3.12	3.89	Monitoring well cap and casing in place. Water sample was brown in colour and no olfactory hydrocarbon odours noted. Fine sediment observed.
TMW1	-29.930830°	30.978800°	Dry	2.64	Tank monitoring well was dry. Slight olfactory hydrocarbon odours noted.
TMW2	-29.930879°	30.978774°	Dry	3.11	Tank monitoring well was dry. Slight olfactory hydrocarbon odours noted.
TMW3	-29.930867°	30.978819°	Dry	2.96	Tank monitoring well was dry. Moderate olfactory hydrocarbon odours noted.
TMW4	-29.930887°	30.978864°	Dry	2.81	Tank monitoring well was dry. Moderate olfactory hydrocarbon odours noted.
TMW5	-29.930918°	30.978878°	Dry	N/A	Could not remove the lid of the well. Small gap in the lid allowed for PID measurements. Olfactory hydrocarbon odours noted.
TMW6	-29.930879°	30.978906°	Dry	N/A	Could not remove the lid of the well. Small gap in the lid allowed for PID measurements. Olfactory hydrocarbon odours noted.

(m bgl) meters below ground level
*** Samples collected and submitted for analysis**

6.2 Monitoring well purging

The monitoring wells were purged by three times their water volume before sampling to enable collection of water samples representative of the surrounding aquifer and not from existing standing water.

The calculation to determine the required purge volumes is presented below:

$$(\pi \times r^2 \times \text{Water Colunm Thickness}) \times 1000\text{L} \times 3$$

Where:

π = 3.14159

r^2 = radius of the monitoring well (meters)

Water Column Thickness = Water Column Thickness (Measured Depth – Static Water Level (SWL))

Table 6-2: Purge Volumes

ID	SWL (mbgl)	Measured Depth (mbgl)	Water column in well (m)	Internal Diameter of Well (mm)	Purge Volume (L)
MW1	4.63	6.24	1.61	50	9.48
MW2	2.26	5.20	2.94	50	17.31
MW3	4.10	6.20	2.1	50	12.36
MW4	1.90	2.82	0.92	50	5.42
MW5	3.18	3.65	0.47	50	2.77
MW6	3.12	3.89	0.77	50	4.53

(m bgl) meters below ground level
(mm) millimeters
(L) Liters
Note: purge volumes do not account for water in the gravel pack

Figure 6-1: Site Layout Map – Entire Site

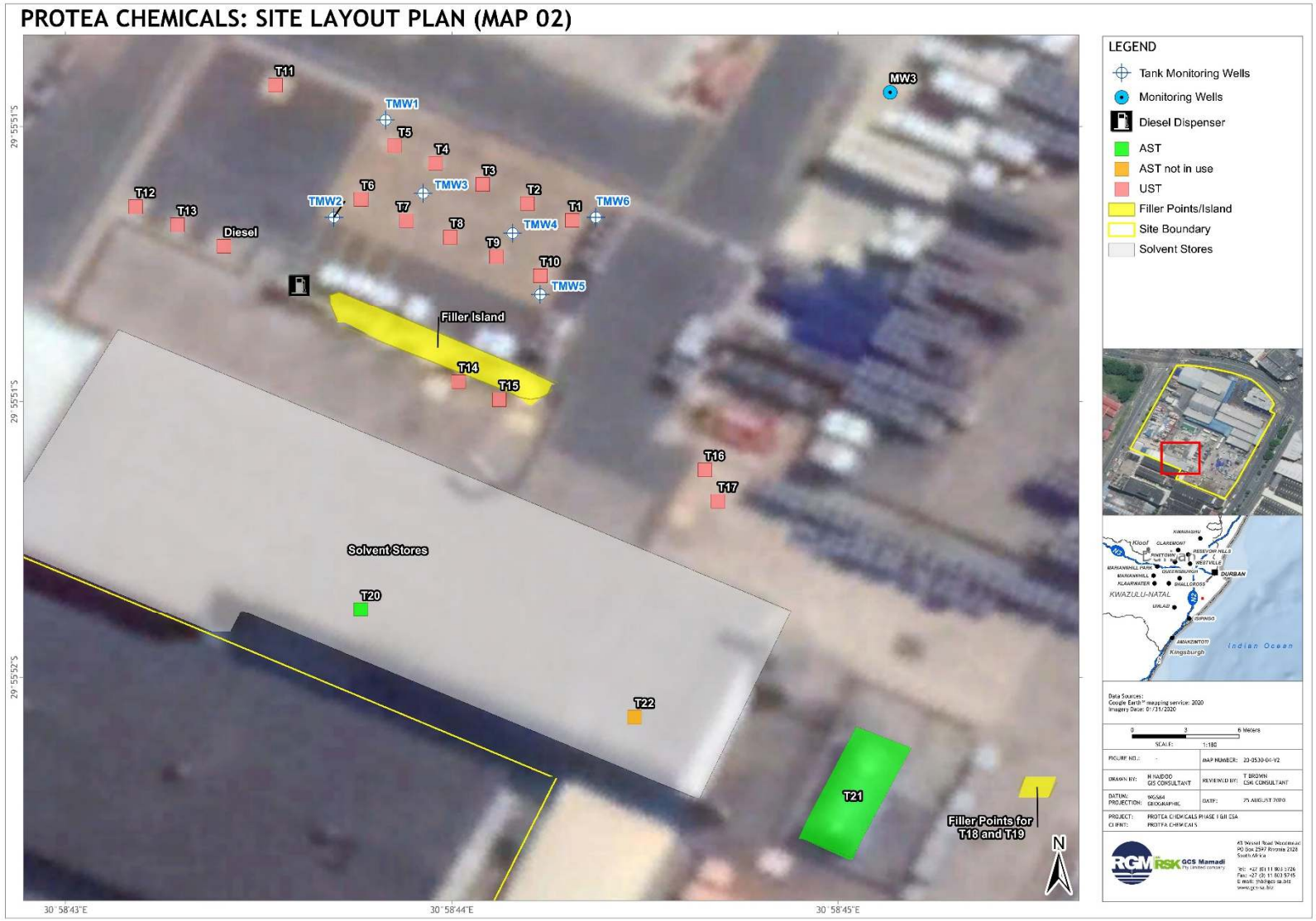

Figure 6-2: Site Layout Map – Of the USTs

Figure 6-3: Site Layout Map Indicating the Soil Sampling Positions

Physio-chemical parameters measured in the field during sampling using Extech probes (RE300, DO600 and EC500 probes) are provided in Table 6-3 and Table 6-4 for the July 2020 and June 2020 assessments, respectively.

Table 6-3: Field Parameters for July 2020

MW ID	PID (ppm)	pH	Temp (°C)	EC (µS/cm)	DO (mg/l)	ORP (mV)
SANS	NS	≥ 5 to ≤ 9,7	NS	≤ 1,700	NS	NS
MW1	0.0	7.16	28.1	1,420	1.93	-48
MW2	0.0	6.80	22.9	1,420	1.50	-71
MW3	0.0	6.79	26.1	1,343	1.84	-94
MW4	0.0	7.40	26.2	961	2.68	-31
MW5	0.0	6.92	28.1	1,417	2.72	34
MW6	0.0	6.97	23.0	1,151	2.44	33
TMW1	0.0	N/A	N/A	N/A	N/A	N/A
TMW2	0.0	N/A	N/A	N/A	N/A	N/A
TMW3	41.2	N/A	N/A	N/A	N/A	N/A
TMW4	12.1	N/A	N/A	N/A	N/A	N/A
TMW5	70.6	N/A	N/A	N/A	N/A	N/A
TMW6	1.7	N/A	N/A	N/A	N/A	N/A

Table 6-4: Field Parameters for June 2020

MW ID	PID (ppm)	pH	Temp (°C)	EC (µS/cm)	DO (mg/l)	ORP (mV)
SANS	NS	≥ 5 to ≤ 9,7	NS	≤ 1,700	NS	NS
MW1	0.0	7.15	22.7	1,420	1.74	33
MW2	0.0	6.83	22.5	1,420	1.52	-70
MW3	0.0	6.90	24.1	937	1.36	-105
MW4	0.0	7.36	24.3	381	2.51	14
MW5	0.0	6.81	26.7	1,367	2.21	23
MW6	0.0	6.80	24.0	1,890	1.72	60
TMW1	3.10	N/A	N/A	N/A	N/A	N/A
TMW2	3.10	N/A	N/A	N/A	N/A	N/A
TMW3	77.0	N/A	N/A	N/A	N/A	N/A
TMW4	22.4	N/A	N/A	N/A	N/A	N/A
TMW5	90.1	N/A	N/A	N/A	N/A	N/A
TMW6	9.4	N/A	N/A	N/A	N/A	N/A

N/A – Not applicable

SANS: South African National Standards

NS: No Standard

***Non-compliant with the SANS 241-1:2015 Standards**

6.3 Groundwater chemistry from field tests

The results from the field testing in June 2020 and in July 2020 indicated that the all the monitoring wells were complaint with the SANS 241-1:2015 drinking water standards (SABS, 2015) for the tested analyses. No LNAPLs or DNAPLS were detected in the assessed monitoring wells during both assessments. During the June 2020 assessment (refer to "*20-0530_Protea Chemicals Phase I Letter Report*"), red/brown precipitate was observed in the monitoring wells and was likely to be an iron oxide precipitate which occurs through biological breakdown of organic compounds. Following purging of the monitoring wells during the July 2020 assessment, no red/brown precipitate was observed.

The tank monitoring wells were dry since they are of insufficient depth to intercept the groundwater. During both assessments in June 2020 and July 2020 volatile organic compound concentrations were detected in headspace using a photo-ionisation detector at TMW3-TWM6; a maximum reading of 90.1 ppm was reported at TMW5. VOC concentrations of 3.10 ppm were detected in TMW1 and TMW2 during June 2020 assessment with no VOC concentrations detected during the July 2020 assessment at these two locations. Information provided by the site manager indicated that the detected VOC concentrations in these monitoring wells may have been due to staff washing equipment impacted by solvents in the vicinity of these tank monitoring wells. The tank monitoring wells do not have well caps and the tank monitoring well manhole lids have holes in the middle of the lid.

A comparison of the physio-chemicals parameters between June 2020 and July 2020 is presented in the following figures overleaf. The parameters presented for July 2020 were measured after the purging of the wells and before sampling.

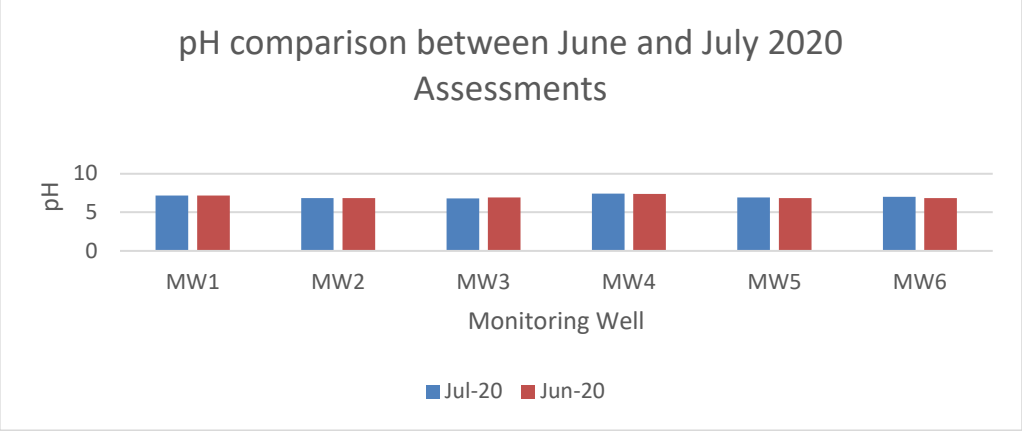

Figure 6-4: pH comparison between June and July 2020 Assessments

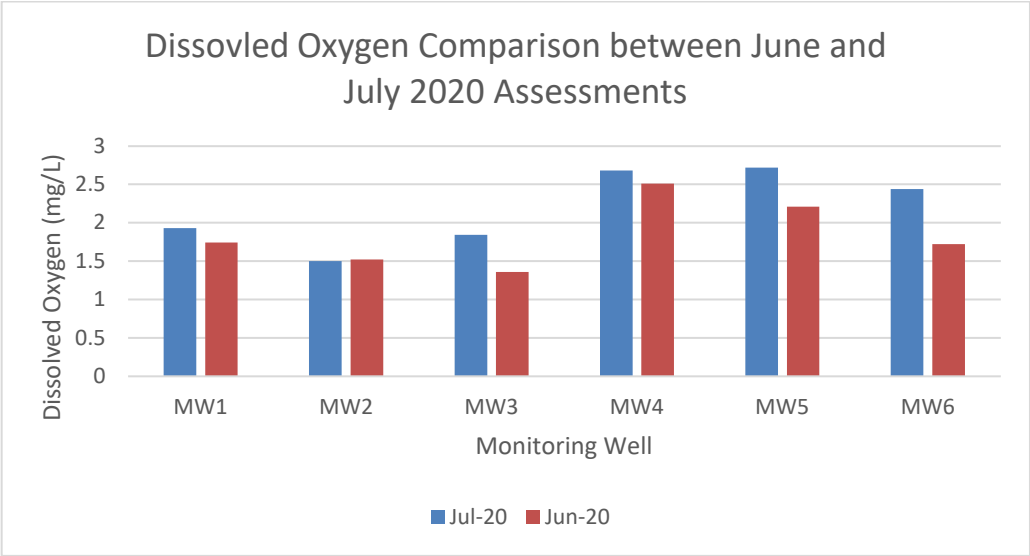

Figure 6-5: Dissolved Oxygen Comparison between June and July 2020 Assessments

The physio-chemical parameters between June 2020 and July 2020 remained stable for the pH and for the dissolved oxygen parameters. pH parameters have remained neutral before and following purging indicating that the natural receiving environment is neutral.

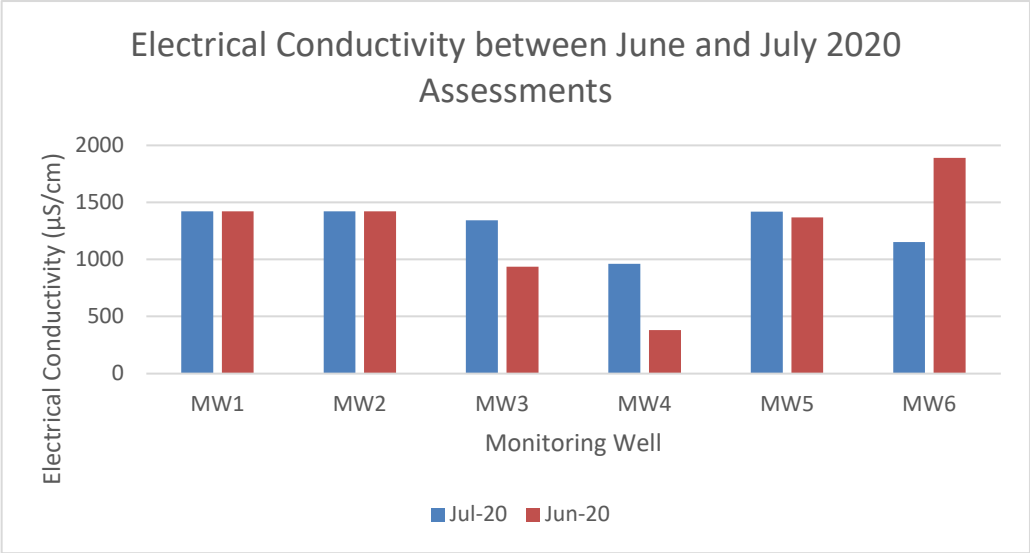

Figure 6-6: Electrical Conductivity comparison between June and July 2020 Assessments

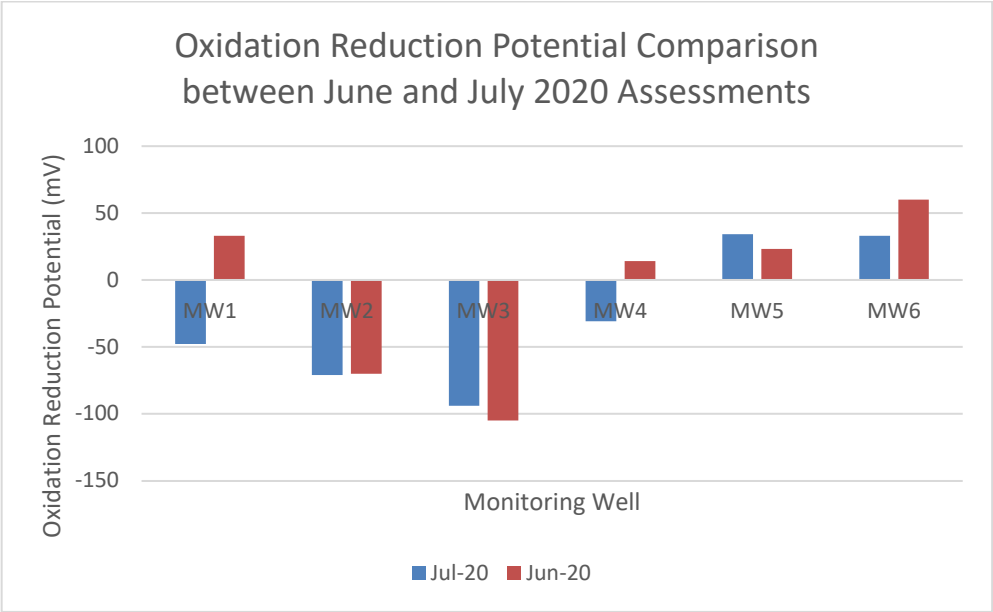

Figure 6-7: Oxidation Reduction Potential Comparison between June and July 2020 Assessments

The parameters for the electrical conductivity (EC) reported some discrepancies between the June and July assessments; Monitoring well MW4 reported an EC of 381 µS/cm in June 2020 however following purging in the July 2020 assessment, an EC of 961 µS/cm was reported. Conversely, MW6 reported a lower EC concentration in July 2020 assessment in comparison to the June 2020 assessment.

The oxidation reduction potential (ORP) reported discrepancies for monitoring wells MW1 and MW4. Monitoring well MW1 and MW4 reported an ORP of +33 and +14 in June 2020 however following purging the ORP was reported as -48 and -31, respectively.

6.4 Soil Sampling

Soil sampling was conducted at six (6) positions in the vicinity of the underground storage tanks. Table 6-5 presents the data obtained during auguring. The localities of the auger hole positions are presented in Figure 6-3. The soil logs are presented in Appendix D.

Table 6-5: Field Data - Soil Profiling

Auger Hole ID	Depth (m bgl)	PID (ppm)	Comments
SS1	0.5	22.5	Concrete surface at 0.0 m bgl Weathered with rock inclusions Unsorted grains, Fine sand with rock inclusions, Dark Brown, No moisture Sandy clay.

Auger Hole ID	Depth (m bgl)	PID (ppm)	Comments
	1.0	12.4	Weathered, Sorted grains, Fine sand texture, Dark Brown, No moisture, Sandy clay.
	1.5	6.3	Some sign of weathering, Sorted grains, Fine sand texture, Dark Brown/Yellow, No moisture, Sandy clay.
	2.0	9.1	No weathering, Sorted grains, Fine sand texture, Dark Brown/Yellow, No moisture, Sandy clay.
	2.5	29.3	No weathering, Sorted grains, Fine sand texture, Dark Brown/Orange, No moisture, Sandy clay.
	3.0	9.1	No weathering, Sorted grains, Fine sand texture, Light Brown/Yellow, No moisture, Sandy clay.
SS2	0.5	5.2	Concrete surface at 0.0 m bgl Weathered with rock inclusions, Unsorted grains, Fine sand with rock inclusions, Dark Orange, No moisture, Sandy clay.
	1.0	18.2	Weathered with rock inclusions, Unsorted grains, Fine sand with rock inclusions, Dark Orange/brown, No moisture, Sandy clay.
	1.5	10.6	No weathering, Sorted grains, Fine sand texture, Dark Red/orange, No moisture, Sandy clay.
	2.0	6.0	No weathering, Sorted grains, Fine sand texture, Light yellow/brown, No moisture, Sandy clay.
	2.5	5.1	No weathering, Sorted grains, Fine sand texture, Light yellow/orange, No moisture, Sandy clay.
	3.0	10.2	No weathering, Sorted grains, Fine sand texture, Orange/brown, No moisture, Sandy clay.
SS3	0.5	7.3	Concrete surface at 0.0 m bgl Weathered with rock inclusions, Mixed Unsorted grains, Fine sand with rock inclusions, Dark Brown/Orange, No moisture, Sandy clay.
	1.0	12.6	Not Weathered, Sorted grains, Fine sand texture, Red/orange, No moisture, Sandy clay.
	1.5	2.7	Not Weathered, Sorted grains, Fine sand texture, Orange, No moisture, Sandy clay.
	2.0	13.2	Not Weathered, Sorted grains, Fine sand texture, Orange, No moisture, Sandy clay
	2.5	3.2	Not Weathered, Sorted grains, Fine sand texture, Red/Orange, No moisture, Sandy clay.
	3.0	4.2	Not Weathered, Sorted grains, Fine sand texture, Red/Orange, No moisture, Sandy clay.
SS4	0.5	**226.4**	Concrete surface at 0.0 m bgl Weathered with rock inclusions, Mixed Unsorted grains, Fine sand with black rock inclusions, Dark Brown, No moisture, Sandy clay.
	1.0	36.7	Weathered with rock inclusions, Unsorted grains, Fine sand with black rock inclusions less than previous layer, Dark Brown/reddish, No moisture, Sandy clay.

Auger Hole ID	Depth (m bgl)	PID (ppm)	Comments
	1.5	85.9	Not Weathered, Sorted grains, Fine sand texture, Dark red/brown, Some moisture, Sandy clay.
	2.0	73.4	Some signs of weathered bedrock, Sorted grains, Fine sand texture with some rock inclusions as the bedrock is weathered, Dark brown, No moisture, Sandy clay.
	2.5	58.1	Signs of bedrock as the drill breaks some of the rocks, Sorted grains, Fine sand texture with some rock inclusions as the bedrock is broken, Dark brown, No moisture, Sandy clay.
	3.0	N/A	Bedrock after 2.5 m
SS5	0.5	12.5	Concrete surface at 0.0 m bgl Weathered with rock inclusions, Mixed Unsorted grains, Fine sand with black rock inclusions, Dark Brown/orange, Some moisture, Sandy clay.
	1.0	17.8	Not Weathered, Sorted grains, Fine sand texture, Dark brown, Some moisture, Sandy clay.
	1.5	46.3	Not Weathered, Sorted grains, Fine sand texture, Dark brown/yellow, Some moisture, Sandy clay.
	2.0	43.3	Not Weathered, Sorted grains, Fine sand texture, brown/yellow, Some moisture, Sandy clay.
	2.5	56.1	Not Weathered, Sorted grains, Fine sand texture, Yellow/brown, Some moisture, Sandy clay.
	3.0	32.7	Not Weathered, Sorted grains, Fine sand texture, Yellow/red, Some moisture, Sandy clay.
SS6	0.5	68.8	Made ground Black organic soil with tar underneath, Mixed Unsorted grains, Coarse grained, Black, no moisture, Organic soil.
	1.0	31.8	Weathered with black organic inclusions, Mixed Unsorted grains, Fine sand with black organic inclusions, Dark Brown with black inclusions, no moisture, Sandy clay.
	1.5	7.8	Not Weathered, Sorted grains, Fine sand texture, Dark brown, no moisture, Sandy clay.
	2.0	8.0	Weathered with rock inclusions, Mixed Unsorted grains, Fine sand with rock inclusions, Brown/Yellow, no moisture, Sandy clay.
	2.5	3.3	Not Weathered, Sorted grains, Fine sand texture, Light brown/yellow, no moisture, Sandy clay.
	3.0	4.1	Not Weathered, Sorted grains, Fine sand texture, Yellow, no moisture Sandy clay.

Figures in red indicate concentration was greater than 100ppm.

N/A – Not applicable

SANS: South African National Standards

NS: No Standard

***Non-compliant with the SANS 241-1:2015 Standards**

7 CHEMICAL ANALYSES

7.1 Groundwater Chemicals of Concern Analysis

Groundwater samples were collected from the existing groundwater monitoring wells (MW1-MW6) and transported to UIS Organic laboratory located in Centurion. The laboratory results obtained are presented in Table 7-1. The laboratory results are presented in Appendix C.

Table 7-1: Groundwater Laboratory Results

Chemical	Sample Location						Risk Based Screening Values						
							USEPA[a]	CRC HSL [b]	Aquatic Water Quality			MDEQ[f]	
	MW1	MW2	MW3	MW4	MW5	MW6	Drinking Water	Commercial/ Industrial Depth to GW 2 to <4m	UK EQS Salmonid [c]	BC Aquatics [d]	NOAA [e]	Residential drinking water	Commercial indoor inhalation
Benzene	**6**	<1	**12**	<1	<1	<1	0.46	4,900	30	5	30	5	35,000
Toluene	<10	<10	<10	<10	<10	<10	1,100	NV	50	60	NV	790	530,000
Ethyl Benzene	<2	<2	<2	<2	<2	<2	1.5	NV	NV	200	NV	74	170,000
m,p,o-Xylene	<2	2	**120**	<2	<2	<2	190	NV	30	90	NV	280	190,000
1,3,5 trimethyl benzene	<2	<2	<2	<2	<2	<2	60	NV	NV	NV	NV	72	61,000
1,2,4 trimethyl benzene	<2	<2	<2	<2	<2	<2	56	NV	NV	NV	NV	63	56,000
n-Propylbenzene	<2	<2	3	<2	<2	<2	660	NV			NV	80	NV
Naphthalene	<2	**41**	<2	<2	<2	<2	0.17	NV	NV	NV	70	520	31,000
Chlorobenzene	72	<2	<2	<2	<2	<2	78	NV	NV	NV	180	100	470,000
Bromobenzene	<2	<2	<2	<2	<2	<2	62	NV	NV	NV	NV	18	390,000
1,2 - Dichlorobenzene	2	<2	<2	<2	<2	<2	600	NV	NV	200	50	600	160,000
1,4 - Dichlorobenzene	3	<2	<2	<2	<2	<2	75	NV	NV	5	50	75	74,000
Styrene	<5	<5	<5	<5	<5	<5	1,200	NV	NV	NV	300	100	310,000
Chloroform	<5	**9**	<5	<5	<5	<5	0.22	NV	NV	NV	NV	80	180,000
Carbon Tetrachloride	<5	<5	<5	<5	<5	<5	5.0	NV	NV	2	10	5.0	2,400
Trichloroethene (TCE)	<5	<5	<5	<5	<5	<5	NV	NV	NV	10	500	5.0	4,900
Isopropyl benzene	<2	<2	26	<2	<2	<2	NV	NV	NV	NV	NV	800	56,000
GRO C6-C10	**44**	28	**250**	<10	<10	<10	33	6,200	NV	NV	NV	NV	NV
DRO C10-C28	<764	<764	<764	<764	<764	<764	5.5	NV	NV	NV	NV	NV	NV
DRO C28-C40	<764	<764	<764	<764	<764	<764	800	NV	NV	NV	NV	NV	NV
Vinyl Chloride	<1	<1	<1	<1	<1	<1	2.0	NV	NV	2	5	2.0	13,000
2-Butanone	<100	<100	<100	<100	<100	<100	5,600	NV	NV	NV	6,000	13,000	240,000,000

Table Notes:

All values stated in µg/l

Values in bold exceeds a screening value while values in bold red exceed two or more screening levels

(a) United States Environmental Protection Agency (US EPA) risk based screening levels (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables). All screening values stipu

(b) CRC for Contamination Assessment and Remediation of the Environment technical report No 10 - Health screening levels for petroleum hydrocarbons in soil and groundwater Summar

(c) United Kingdom Environmental Quality Standards for Salmonid 2010 (UK EQS)

(d) British Columbia Aquatic Guidelines 2006 (BC Aquatics) - BC represents safe levels of substances that protect different waters uses including aquatic life

(e) National Oceanic and Atmospheric Administration 2008 (NOAA) - Screening concentrations for inorganic and organic contaminations in various environmental media. Stated values for

(f) Michigan Department of Environmental Quality 2016 (MDEQ) generic cleanup criteria and risk based screening levels for corrective actions

NV - No Risk Based Screening specified

7.1.1 Chemical Analysis Discussion

The discussion of the results presented in Table 7-1 is presented below.

MW1: Benzene concentrations in MW1 exceeded the USEPA drinking water guidelines, the BC Aquatics guidelines for drinking water and the MDEQ Residential drinking water guidelines. In addition, chlorobenzene, 1,2-dichlorobenzene and 1,4-dichlorobenzene concentrations were detected in the water sample from MW1 however no screening guidelines were exceeded. TPH GRO C6-C10 concentrations exceeded the USEPA drinking water guidelines.

MW2: Xylene, naphthalene and chloroform concentrations were detected in MW2. Chloroform and naphthalene concentrations exceeded the USEPA drinking water guidelines.

MW3: Benzene, xylenes, n-propylbenzene and isopropyl benzene concentrations were detected in MW3. Benzene concentrations exceeded the USEPA drinking water guidelines, the BC Aquatics guidelines for drinking water and the MDEQ Residential drinking water guidelines. Xylene concentrations exceeded UK EQS Salmonid and BC Aquatics screening guidelines.

MW4, MW5 and MW6: No targeted hydrocarbon concentrations were detected in the samples.

7.1.2 Chemicals of Concern Toxicological Properties

Identified chemicals of concern based on carcinogenic concerns are briefly discussed below.

Benzene occurs as a colourless liquid at room temperature and has an aromatic odour. Benzene is less dense than water (0.877 g/cm^3 vs 1.00 g/cm^3 for water). Benzene has a very low flash point of -11^{o}C. Benzene is used in a variety of applications and naturally occurs in crude oil. It is used in the manufacture of petrol based fuels and also in rubbers, dyes, certain drugs and pesticides. From a toxicological viewpoint, benzene is categorized as a Group 1 carcinogenic compound meaning it is known to cause cancer in humans.

Isopropyl benzene also known as cumene occurs as a colourless liquid at room temperature however it does not have a distinguishable odour. Cumene is primarily used as an intermediate for the production of compounds such as phenols, acetone and methyl styrene however it is also used in the manufacture of rubber, pulp and paper. Cumene is categorized as a Group 2B carcinogenic compound meaning that it is considered possibly carcinogenic to humans however more data is required to determine for certain the carcinogenic properties of cumene.

Xylenes, naphthalene, chlorobenzene, 1,2 dichlorobenzene and 1,4 dichlorobenzene did not report carcinogenic properties.

7.1.3 Discussion of Results

Based on the results, benzene concentrations which exceeded the USEPA, BC Aquatics and MDEQ Residential guidelines were detected in MW1 and MW3. Other organic compounds such as xylenes were detected in MW2 and MW3 while chlorobenzene compounds were detected in MW1 and chloroform was detected in MW2. Additionally, isopropyl benzene was detected in MW3 however the concentration did not exceed the screening guidelines.

MW1 is located in the north western boundary of the site in the vicinity of storage containers and based on topography is likely to be the hydraulic downgradient well. MW2 is located in eastern boundary of the site and MW3 is located in the middle of the site in the vicinity of the underground storage tanks. Although exceedances of the drinking water standards were reported, this water is not being abstracted for drinking water purposes and concentrations at the likely hydraulic downgradient well, MW1, are in the same order of magnitude as the drinking water standards. Furthermore, surface water features are not present within 250m of the site so are also unlikely to be adversely affected by the determinants detected. None of the concentrations exceed the commercial vapour inhalation screening values.

No targeted hydrocarbon compounds were detected in MW4, MW5 and MW6 located on the eastern boundary, southern boundary and northern boundary, respectively.

7.1.4 Groundwater MNA analysis

In groundwater contaminated with hydrocarbons microorganisms that are present use organic contaminants for their growth. Other compounds that are required for their growth are major nutrients such as nitrogen in the form of nitrite and nitrate; minor nutrients such as sulphur in the form of sulphate; and various other trace elements. As the microorganisms degrade hydrocarbons these compounds are consumed. This process can be fast (aerobic biodegradation of hydrocarbons) or slow (anaerobic biodegradation of hydrocarbons when oxygen has been depleted). By analysing for attenuation parameters insight is gained into the degradation state (microbial respiration) of the sub-surface environment.

Groundwater samples were collected from MW1-MW6 and transported to UIS Organic laboratory to be analysed for monitored natural attenuation (MNA) parameters including dissolved Fe, Mn, NO3 and SO4, as presented in Table 7-2. Note that the parameters provided for pH, ORP and DO are referenced from *in-situ* data collected on site and the results contradict each other; the reason for which is unclear. Refer to Table 6-3 for the referenced data. The laboratory results are presented in Appendix C.

Table 7-2: Groundwater laboratory results - MNA Parameters

Determinant	Sample Location						
	Degradation Priority	MW1	MW2	MW3	MW4	MW5	MW6
pH	-	7.16	6.80	6.79	7.40	6.92	6.97
ORP (mV)	-	-48	-71	-94	-31	34	33
DO (mg/L)	1	1.93	1.50	1.84	2.68	2.72	2.44
NO_3 (mg/L)	2	<0.5	2.40	<0.5	2.89	16.62	4.70
Mn^{2+} (mg/L)	3	0.15	0.38	0.11	<0.05	<0.05	<0.05
Fe^{2+} (mg/L)	4	0.67	0.77	0.17	<0.2	0.11	0.18
SO_4 (mg/L)	5	82.12	810.10	5.59	42.97	53.91	60.16
TPH (GRO C6-C10)	-	0.044	0.028	0.250	<0.010	<0.010	<0.010

7.1.5 MNA Results Discussion

From the results presented in Table 7-2 the following can be noted with respect to the current MNA occurring on the site:

- It has been established that biological activity is pH sensitive. A baseline sample from off-site could not be collected as no off-site boreholes could be located. However, utilising the pH value of MW5, which has historically not reported any targeted hydrocarbon contamination, of 6.92 it is evident that the groundwater collected from the monitoring wells are neutral (all pH values are within 6.00 - 7.00).
- Negative and low oxidation-reduction potential (ORP) values (<700 mV) are indicative of anaerobic conditions. All locations are presenting evidence of anaerobic conditions. All the monitoring wells had dissolved oxygen levels above 0.5 mg/l. Dissolved oxygen levels above 1mg/l are indicative of aerobic conditions. Currently, there is a conflict between ORP and dissolved oxygen concentrations in that one indicates anaerobic and the other aerobic degradation as the primary mechanism of degradation. The reason for this is uncertain.
- Monitoring wells MW1 and MW3 had nitrate (NO_3) concentrations below laboratory detection limits. Nitrate concentrations decrease under anaerobic conditions because they act as electron acceptors when oxygen is depleted under nitrate-reducing conditions and denitrification. Monitoring wells MW2, MW4, MW5 and MW6 reported nitrate concentrations greater than >0.5 mg/L indicating that nitrification is unlikely to be occurring. MW5, the baseline sample well, reported a nitrate concentration of 16.62 which correlates with the monitoring well not presenting detectable targeted hydrocarbon concentrations.
- Monitoring well MW5, the baseline well, reported manganese concentrations that were below detection limits which suggests that nitrification is still occurring in this location. Similarly, MW4 and MW6 reported manganese concentrations which were below detection limits and suggests nitrification is the main reduction process present at these locations. However, manganese concentrations were detected in MW1, MW2 and MW3 while nitrate concentrations in MW1 and MW3 were below detection limits. This would suggest that reduction of targeted hydrocarbons is occurring by manganese reduction processes indicating an anaerobic environment.

- Monitoring well MW5, the baseline well, reported ferrous ion concentrations suggesting that ferrous iron may be naturally occurring in this area. Ferrous iron (Fe^{2+}) is present in monitoring wells MW1, MW2, MW3, MW5 and MW6, indicating ferric iron (Fe^{3+}) breakdown under anaerobic conditions. The trend observed in Mn2+ is mimicked by Fe2+ in monitoring wells MW1, MW2 and MW3 with the exception of MW4, MW5 and MW6 which indicates that ferric ion reduction is very limited currently.
- The sulphate (SO_4) concentrations in monitoring wells MW1, MW2, MW3, MW4, MW5 and MW6 were all detected in concentrations ranging from 5.59 mg/L to 810.10 mg/L. The baseline sample, MW5, reported a sulphate concentration of 53.91 mg/L. Monitoring well MW3 reported a sulphate concentration of 5.59 mg/L which suggests that sulphate oxidation is occurring in this location. The concentration of sulphate reported in MW2 may be present due to other chemical factors from the surrounding environment or chemical use.

The sequence in which chemical parameters are used as electron acceptors (EA) by organisms as they degrade hydrocarbons is as follows:

Dissolved oxygen (DO) > Nitrate (NO_3) > Manganese (MN^{+4}) > Ferric Iron (Fe^{+3}) > Sulphate (SO_4)

Therefore, when the oxygen is depleted, nitrate is next in line to be used as an electron acceptor (EA) which leads to a decrease in the nitrate (NO_3) concentration in the groundwater.

Source zone groundwater usually exhibits the greatest depletion of electron acceptors and an increased ferrous ion and manganese ion concentrations. (Wisconsin, D.N.R., 2003). Therefore, the hydrocarbon source zone is currently situated in the vicinity, or upgradient, of monitoring wells MW1 and MW3, based on the MNA parameters.

7.2 Soil Analysis

Six soil samples (SS1-SS6) were collected and submitted for analysis. The samples were submitted to UIS Organic Laboratory in Centurion. The laboratory certificate of analyses is included in Appendix B.

The results obtained from the laboratory were compared against the soil screening values adapted from the Department of Environmental Affairs, May 2010 (Framework for the Management of Contaminated Land, Government Printer, Republic of South Africa).

At the first tier for site screening, Soil Screening Value 1 (SSV1) is a conservative concentration that is the lowest of three potential source-pathway-receptor model calculations:

- Direct pathways for the protection of the child receptor, is taken as the most sensitive receptor in the context of potentially high exposures anticipated for informal residential settlements in South Africa;
- Indirect pathways for the protection of water resources in terms of human health is based on the ingestion of drinking water. The model for contaminant transfer from soil to water is based on simplified partitioning model with allowance for finite limited dispersion, dilution and attenuation within the groundwater-surface water medium, assuming a shallow water table within a typical porous sand aquifer;
- Indirect pathway for the protection of aquatic ecosystems by applying aquatic ecotoxicology to the same assumptions used to define the soil-to-surface water pathway used in the calculation of the human-health related water resource protection.

The lowest concentration provided by the three pathway-receptor models is selected as the Soil Screening Value 1. This is a multi-functional soil quality criterion that is conservative.

Soil Screening Value 2 (SSV2) has three sub-categories (SSV2 – Informal Residential, SSV2 – Standard Residential and SSV2 – Commercial/Industrial) which are based on risk to receptors that are defined by activity patterns and associated exposures related to land use. There are two values derived for residential land use and development.

- The most sensitive is the child receptor, taken as the sensitive receptor for informal settlements (SSV2 – Informal Residential), since the exposure levels for the child on a standard residential development defines a slightly higher level of contaminant concentration (SSV2 – Standard Residential).

- Commercial and industrial land use is defined by exposure criteria for an adult maintenance worker based on outdoor exposure criteria (SSV2 – Commercial/ Industrial).

If the values are less than the most appropriate of the three categories of Soil Screening Value 2, then the site is not a risk to human health and is not defined as being contaminated. The laboratory results from UIS are presented in Table 7-3 for the soil samples collected.

Table 7-3: Soil laboratory results

Chemical	Unit	ample						Soil Screening Values [1]		
		SS1 (2.5m)	SS2 (1.0m)	SS3 (2.0m)	SS4 (0.5m)	SS5 (1.5m)	SS6 (0.5m)	SSV1 [2]	SSV2 [3]	SSV2 [4]
Benzene	ug/kg	<20	<20	<20	<20	<20	24	30	1,400	10,000
Toluene	ug/kg	<200	<200	<200	<200	<200	<200	25,000	120,000	1,100,000
Ethyl Benzene	ug/kg	<40	120	<40	3,900	<40	<40	26,000	60,000	540,000
m,p,o-Xylene	ug/kg	<80	100	<80	2,020	<80	<80	45,000	95,000	890,000
1,3,5 trimethyl benzene	ug/kg	<40	<40	<40	<40	<40	<40	NV	NV	NV
1,2,4 trimethyl benzene	ug/kg	<40	200	<40	46	<40	<40	NV	NV	NV
n-Propylbenzene	ug/kg	<40	83	<40	<40	<40	<40			
Isopropyl benzene	ug/kg	<40	<40	<40	46	<40	<40			
Acenaphthylene	ug/kg	<4	<4	<4	21	<4	47	NV	NV	NV
Acenaphthene	ug/kg	<4	<4	<4	4.4	<4	<4	NV	NV	NV
Fluorene	ug/kg	<4	<4	<4	5.6	12	16	NV	NV	NV
Phenanthrene	ug/kg	<4	7.9	<4	68	12	<4	NV	NV	NV
Anthracene	ug/kg	<4	<4	<4	24	6.1	64	NV	NV	NV
Naphthalene	ug/kg	<4	310	7.3	7.2	76	530	28,000	33,000	290,000
Pyrene	ug/kg	<4	6.7	<4	310	5.6	370	5,300	1900,000	15,000,000
Benzo(a)pyrene	ug/kg	<4	4.9	<4	290	<4	**350**	340	710	1,700
Fluoranthene	ug/kg	<4	6.5	<4	<4	5.8	350	NV	NV	NV
Benzo(a)anthracene	ug/kg	<4	<4	<4	180	<4	220	NV	NV	NV
Chrysene	ug/kg	<4	<4	<4	250	<4	320	NV	NV	NV
Benzo(b+k)fluoranthene	ug/kg	<8	10	<8	590	<8	950	NV	NV	NV
Benzo(g,h,i)perylene	ug/kg	<8	<8	<8	<8	<8	690	NV	NV	NV
Dibenz(a,h)anthracene	ug/kg	<8	<8	<8	<8	<8	95	NV	NV	NV
Indeno(123-cd)pyrene	ug/kg	<8	<8	<8	210	<8	390	NV	NV	NV
TPH GRO C7-C9	ug /kg	<200	390	<200	**6,400**	<200	2,100	2,300	2,400	23,000
TPH DRO C10-C14	mg/kg	<20	130	<20	<20	<20	<20	440	500	4,400
TPH DRO C15-C36	mg/kg	<22	61	<22	<22	<22	<22	45,000	91,000	740,000
1,2-Dichlorobenzene	ug /kg	<40	<40	<40	<40	<40	<40	89,000	5,800,000	47,000,000
1,4-Dichlorobenzene	ug /kg	<40	<40	<40	<40	<40	<40	26,000	1,200,000	19,000,000
Chloroform	ug /kg	<40	<40	<40	<40	<40	<40	110	110	1,700

Notes:
Bold value exceeds SSV1 and **Bold** indicate that value also exceeds SSV2

Quoted depths for each sample relate to the relative depths at that specific location and not to the topographic depth or height above mean sea level (amsl).
[1] Soil Screening Values (SSV): Republic of South Africa, Department of Environmental Affairs, NEMWA (2008) Norms and Standards for the Remediation of Contaminated Land and Soil Quality.
[2] All land uses Protective of the Water Resources.
[3] Standard Residential
[4] Commercial Industrial
NV- No Value present for screening criteria

7.3 Soil Analysis Results

The results of the analysis are discussed below:

SS1: Soil analysis indicated that none of the targeted hydrocarbon concentrations exceeded the soil screening guidelines.

SS2: Soil analysis of sample SS2 reported VOC concentrations of ethyl benzene, xylenes, 1,2,4 trimethyl benzene and n-propyl benzene which did not exceed the soil screening values where these are available. SVOC concentrations of phenanthrene, naphthalene, pyrene, benzo(a)pyrene, fluoranthene and benzo(b+k)fluoranthene were detected in the sample however no applicable soil screening guidelines were exceeded. TPH GRO C7-C9, TPH DRO C10-C14 and TPH DRO C15-C36 did not exceed the soil screening guidelines.

SS3: Soil analysis of SS3 indicated that none of the targeted hydrocarbon concentrations exceeded the soil screening guidelines.

SS4: Soil sample SS4 reported VOC concentrations of ethyl benzene, xylenes, 1,2,4 trimethyl benzene and isopropyl benzene which did not exceed the soil screening values. SVOC concentrations of acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, naphthalene, pyrene, benzo(a)pyrene, benzo(a)anthracene, chrysene, benzo(b+k)fluoranthene and indeno(123-cd)pyrene were detected in the sample however no applicable soil screening guidelines were exceeded. TPH GRO C7-C9 concentration exceeded the soil screening value pertaining to all land uses protective of the water resources (SSV1) and for residential land use scenario (SSV2) but not the industrial use scenario screening value.

SS5: Soil analysis of sample SS5 reported that all VOC concentrations were below laboratory detection limits. SVOC concentrations of fluorene, phenanthrene, naphthalene, anthracene, pyrene and fluoranthene were detected in the sample however no applicable soil screening guidelines were exceeded. TPH GRO C7-C9, TPH DRO C10-C14 and TPH DRO C15-C36 were reported as being below laboratory detection limits.

SS6: Soil sample SS6 reported VOC concentrations of benzene which did not exceed the soil screening values. SVOC concentrations of acenaphthylene, fluorene, anthracene, fluoranthene, naphthalene, pyrene, benzo(a)pyrene, benzo(a)anthracene, chrysene, benzo(b+k)fluoranthene, benzo(g,h,i)perylene, dibenz(a,h)anthracene and indeno(123-cd)pyrene were detected in the sample however no applicable soil screening guidelines were exceeded with the exception of benzo(a)pyrene. Benzo(a)pyrene exceeded the soil screening value pertaining to all land uses protective of the water resources (SSV1). TPH GRO C7-C9 concentration did not exceed the soil screening value guidelines.

8 GROUNDWATER CHEMICALS OF CONCERN TREND ANALYSIS

Identified chemicals of concern underwent data analysis to determine any potential trends in the concentrations. These trends can be utilised to determine if there are any increasing or upward trend behaviours in the concentrations.

Trending analysis was conducted using the GSI Mann-Kendall Toolkit, a statistical analysis toolkit which allows for the identification of trends in concentrations. Note that the confidence factor is reported after each section for each modelled chemical of concern. The confidence factor is used by the GSI Mann-Kendall Toolkit to indicate the degree of confidence in the trend result as in 'Decreasing" vs. "Probably Decreasing" or "Increasing" vs. "Probably Increasing.". If the confidence factor is low, due either to considerable variability in concentrations vs. time or little change in concentrations vs. time, the confidence factor is used to apply a preliminary "No Trend" classification.

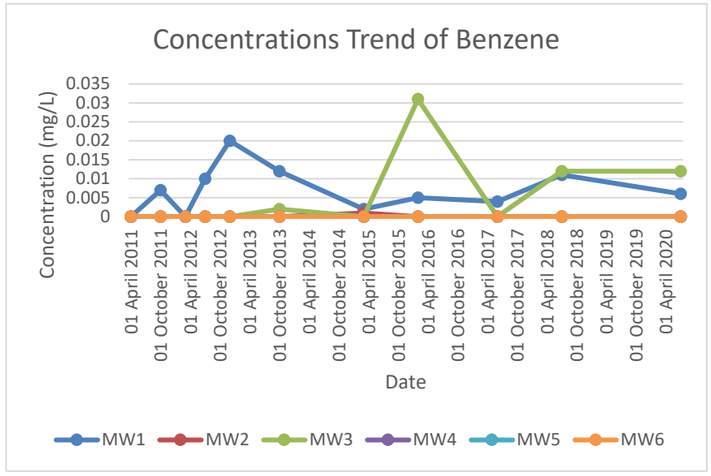

Figure 8-1: Concentration Temporal Trend of Benzene

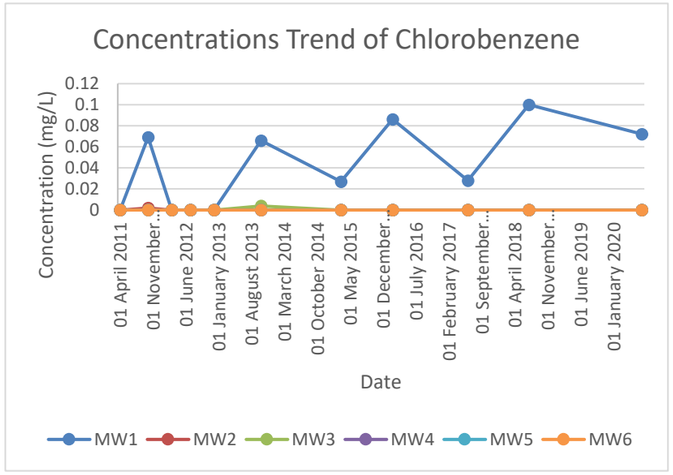

Figure 8-2: Concentration Temporal Trend of Chlorobenzene

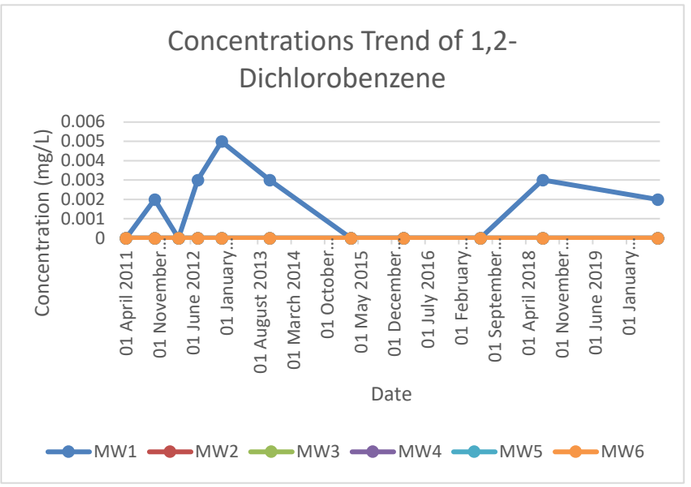

Figure 8-3: Concentration Temporal Trend of 1,2 Dichlorobenzene

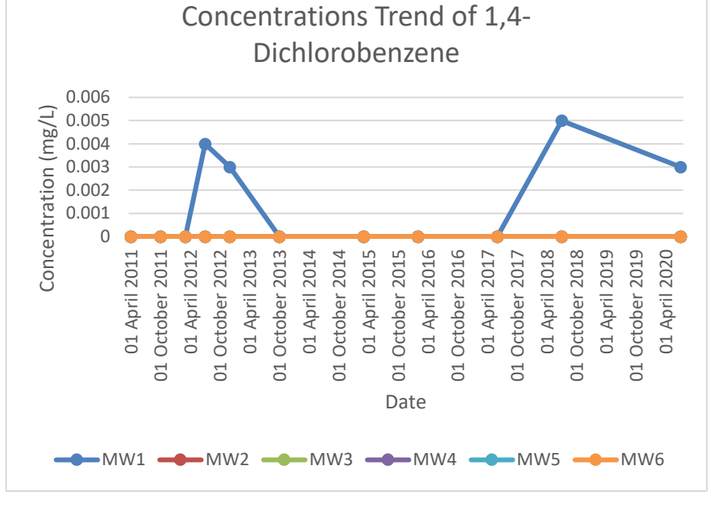

Figure 8-4: Concentration Temporal Trend of 1,4 Dichlorobenzene

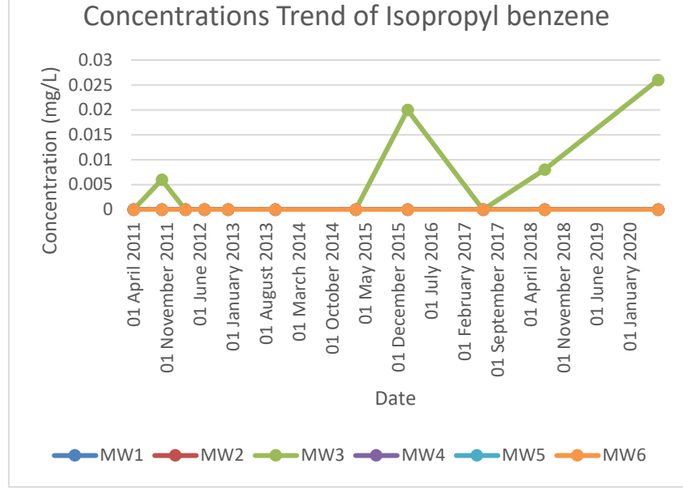

Figure 8-5: Concentration Temporal Trend of Isopropyl Benzene

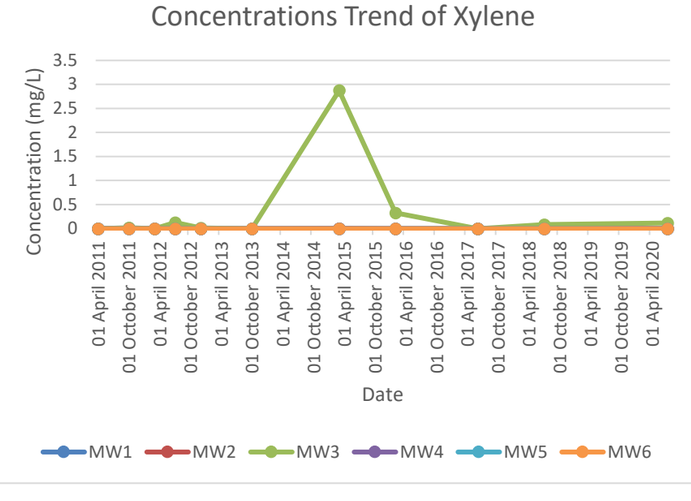

Figure 8-6: Concentration Temporal Trend of Xylene

8.1 Temporal Trend Analysis for Benzene

A temporal concentration trend analysis for benzene between 2011 and 2020 is presented in Figure 8-1. The data utilised for the trend analysis is presented in Table 8-1 below. From the figure there was a spike in benzene concentrations in MW1 in 2012 and MW3 in 2016. Following these spikes, the concentrations have remained stable with MW1 displaying a decreasing concentration trend. The benzene concentrations in the other wells (MW2, MW4, MW5 and MW6) have remained below detection limits.

An analysis utilising the GSI Mann Kendall analysis tool was performed on the benzene concentrations for MW1 and MW3. The analysis tool indicates that the concentration trend is "Stable" with a 69.4% confidence factor for MW1 and reported a "No Trend" which can be interpreted as been stable. The confidence factor was 50.0%.

Table 8-1: Temporal Trend Data for Benzene

	12 April 2011	27 October 2011	07 March 2012	02 July 2012	12 December 2012	09 October 2013	13 March 2015	18 February 2016	12 June 2017	18 July 2018	20 July 2020
MW1	<0.002	0.007	<0.002	0.01	0.02	0.012	0.002	0.005	0.004	0.011	0.006
MW2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.001	<0.001	<0.001	<0.001	<0.001
MW3	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.001	0.031	<0.001	0.012	0.012
MW4	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001
MW5	not sampled	not sampled	not sampled	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001
MW6	not sampled	not sampled	not sampled	<0.002	not sampled	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001

Notes:
All units reported as mg/L

8.2 Temporal Trend Analysis for Chlorobenzene

A temporal concentration trend analysis for Chlorobenzene between 2011 and 2020 is presented in Figure 8-2. The data utilised for the trend analysis is presented in Table 8-2 overleaf. From the figure there has been a fluctuating trend in chlorobenzene in MW1 with a maximum concentration of 0.1 mg/L or 100 µg/L reported in 2018. Following this noted maximum concentration, the concentration in 2020 has decreased. A minor spike of chlorobenzene was also reported in MW2 during 2011 and MW3 during 2013. The Chlorobenzene concentrations in the other wells (MW4, MW5 and MW6) have remained below detection limits.

An analysis utilising the GSI Mann Kendall analysis tool was performed on the chlorobenzene concentrations in MW1 only as the chlorobenzene concentration in MW2 and MW3 have remained below detection limits subsequent to their concentration peaks. The analysis tool indicates that the concentration trend has "No Trend" which can be interpreted as been stable. The confidence factor was 71.9%.

Table 8-2: Temporal Trend Data for Chlorobenzene

	12 April 2011	27 October 2011	07 March 2012	02 July 2012	12 December 2012	09 October 2013	13 March 2015	18 February 2016	12 June 2017	18 July 2018	20 July 2020
MW1	<0.002	0.069	<0.002	<0.002	<0.002	0.066	0.027	0.086	0.028	0.1	0.072
MW2	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW3	<0.002	<0.002	<0.002	<0.002	<0.002	0.004	<0.002	<0.002	<0.002	<0.002	<0.002
MW4	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW5	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW6	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Notes:
All units reported as mg/L

8.3 Temporal Trend Analysis for 1,2 Dichlorobenzene

A temporal concentration trend analysis for 1,2 Dichlorobenzene between 2011 and 2020 is presented in Figure 8-3. The data utilised for the trend analysis is presented in Table 8-3 below. From the figure there has been a fluctuating trend in 1,2 dichlorobenzene concentrations in MW1 with a maximum concentration of 0.005 mg/L or 5 µg/L reported in 2012. The concentration trend decreased to below detection limits between 2015 and 2017 and increased to 0.003 mg/L in 2018. The concentration reported in July was 0.002 mg/L indicating a decrease in concentration and showing a decreasing trend. The 1,2 dichlorobenzene concentrations in the other wells (MW2, MW3, MW4, MW5 and MW6) have remained below detection limits.

An analysis utilising the GSI Mann Kendall analysis tool was performed on the 1,2 Dichlorobenzene concentrations. The analysis tool indicates that the concentration trend is "Stable" with a confidence factor of 50.0%.

Table 8-3: Temporal Trend Data for 1,2 Dichlorobenzene

	12 April 2011	27 October 2011	07 March 2012	02 July 2012	12 December 2012	09 October 2013	13 March 2015	18 February 2016	12 June 2017	18 July 2018	20 July 2020
MW 1	<0.002	0.002	<0.002	0.003	0.005	0.003	<0.002	<0.002	<0.002	0.003	0.002
MW 2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 3	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 4	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 5	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 6	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Notes:
All units reported as mg/L

8.4 Temporal Trend Analysis for 1,4 Dichlorobenzene

A temporal concentration trend analysis for 1,2 Dichlorobenzene between 2011 and 2020 is presented in Figure 8-4. The data utilised for the trend analysis is presented in Table 8-4 below. From the figure there has been a fluctuating trend in 1,4 dichlorobenzene concentrations in MW1. Of interest is that the trend has mimicked the trend noted in 1,2 dichlorobenzene. Similar concentration spikes were noted between 1,4 dichlorobenzene and 1,2 dichlorobenzene. The reason for these similar trends is that these compounds are isomers. The 1,4 dichlorobenzene concentrations in the other wells (MW2, MW3, MW4, MW5 and MW6) have remained below detection limits.

An analysis utilising the GSI Mann Kendall analysis tool was performed on the 1,4 Dichlorobenzene concentrations. The analysis tool indicates that, like 1,2 Dichlorobenzene, the concentration trend is “Stable” with a confidence factor of 50.0%.

Table 8-4: Temporal Trend Data for 1,4 Dichlorobenzene

	12 April 2011	27 October 2011	07 March 2012	02 July 2012	12 December 2012	09 October 2013	13 March 2015	18 February 2016	12 June 2017	18 July 2018	20 July 2020
MW 1	<0.002	<0.002	<0.002	0.004	0.003	<0.002	<0.002	<0.002	<0.002	0.005	0.003
MW 2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 3	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 4	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 5	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 6	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Notes:
All units reported as mg/L

8.5 Temporal Trend Analysis for Isopropyl Benzene

A temporal concentration trend analysis for isopropyl benzene between 2011 and 2020 is presented in Figure 8-5. The data utilised for the trend analysis is presented in Table 8-5 overleaf. From the figure there has been a fluctuating trend in isopropyl benzene concentrations in MW3. A concentration spike was reported in 2016 following which a decrease in concentration was noted in 2017. Subsequently, an increase in concentration was reported in 2018 and in 2020. The isopropyl benzene concentrations in the other wells (MW1, MW2, MW4, MW5 and MW6) have remained below detection limits.

An analysis utilising the GSI Mann Kendall analysis tool was performed on the isopropyl benzene concentrations. The analysis tool indicates that the concentration trend has “No Trend” which can be interpreted as been stable. The confidence factor was 83.3%.

Table 8-5: Temporal Trend Data for Isopropyl benzene

	12 April 2011	27 October 2011	07 March 2012	02 July 2012	12 December 2012	09 October 2013	13 March 2015	18 February 2016	12 June 2017	18 July 2018	20 July 2020
MW 1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 3	<0.002	0.006	<0.002	<0.002	<0.002	<0.002	<0.002	0.02	<0.002	0.008	0.026
MW 4	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 5	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 6	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Notes:
All units reported as mg/L

8.6 Temporal Trend Analysis for Xylene

A temporal concentration trend analysis for xylene between 2011 and 2020 is presented in Figure 8-6. The data utilised for the trend analysis is presented in Table 8-6 below. From the figure there has been a fluctuating trend in xylene concentrations in MW2 and MW3. Xylene concentrations in MW2 reported minor concentration spikes in 2011, 2015, 2018 and 2020. Xylene concentrations in MW3 reported fluctuations throughout the 2011 – 2020 period. A site maximum concentration of 2.875 mg/L or 2,875 µg/L of xylene was reported in 2015 following which a sharp decrease in concentration was noted in 2016. An increase in xylene concentration was observed between 2018 and 2020. The xylene concentrations in the other wells (MW1, MW4, MW5 and MW6) have remained below detection limits.

An analysis utilising the GSI Mann Kendall analysis tool was performed on the xylene concentrations in MW2 and MW3. The analysis tool indicates that the concentration trend has “Stable trend” in MW2 while the xylene concentration in MW3 reported “No Trend” which can be interpreted as been stable. The confidence factor was 72.9% and 61.4%, respectively.

Table 8-6: Temporal Trend Data for Xylene

	12 April 2011	27 October 2011	07 March 2012	02 July 2012	12 December 2012	09 October 2013	13 March 2015	18 February 2016	12 June 2017	18 July 2018	20 July 2020
MW 1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 2	<0.002	0.007	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002	0.005	0.002
MW 3	<0.002	0.018	<0.002	0.126	0.014	<0.002	2.875	0.33	<0.002	0.084	0.12
MW 4	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 5	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
MW 6	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Notes:
All units reported as mg/L

9 GROUNDWATER CHEMICALS OF CONCERN SPATIAL TEMPORAL ANALYSIS

From the identified chemicals of concern, benzene and isopropyl benzene underwent spatial temporal analysis determine if there were any concerns for contaminant migration off-site (refer to 7.1.2 Chemicals of Concern Toxicological Properties). These compounds were chosen as benzene is a known carcinogen and isopropyl benzene is considered possibly carcinogenic to humans according to IARC (International Agency for Research on Cancer).

The GroundWater Spatiotemporal Data Analysis Tool (GWSDAT) was used to produce the graphical illustrations. GWSDAT uses statistical analysis combined with Ruby (a Python based programming module for statistical analysis) to provide spatiotemporal graphical illustrations. These illustrations are provided overleaf from Figure 9-1 to Figure 9-6 for benzene and from Figure 9-7 to Figure 9-12 for isopropyl benzene.

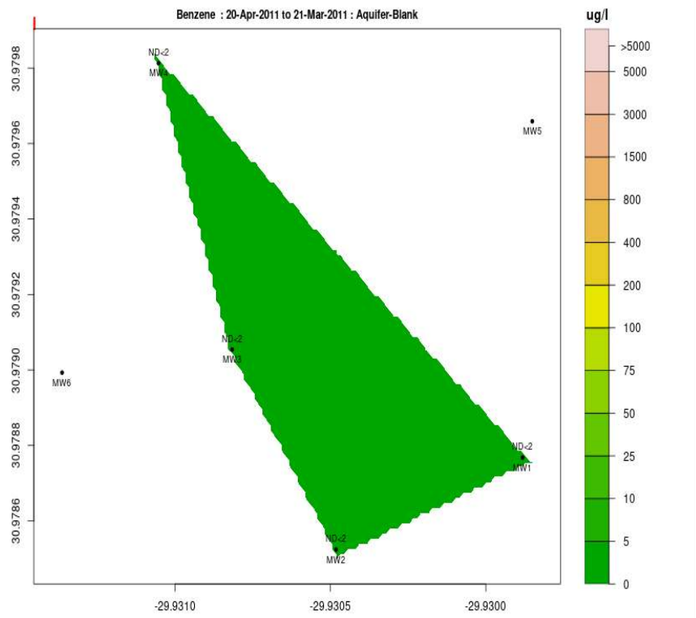

Figure 9-1: Spatial Temporal Illustration for site conditions in 2011 for benzene

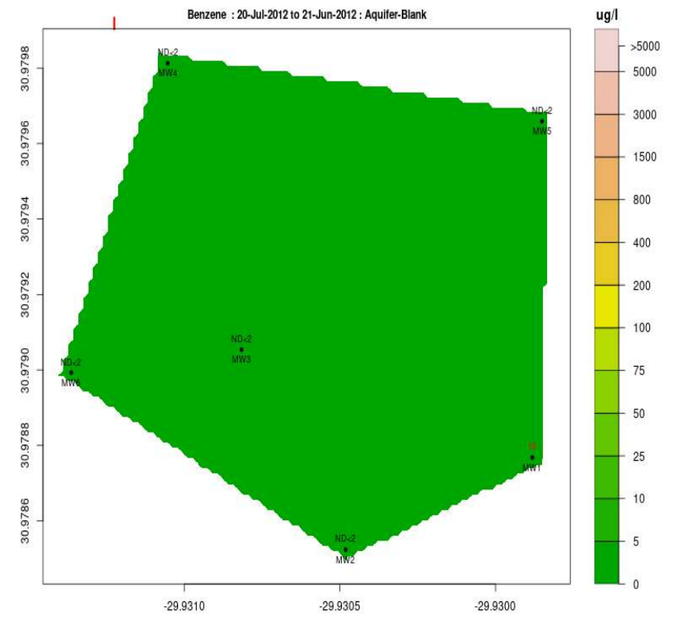

Figure 9-2: Spatial Temporal Illustration for site conditions in 2012 for benzene

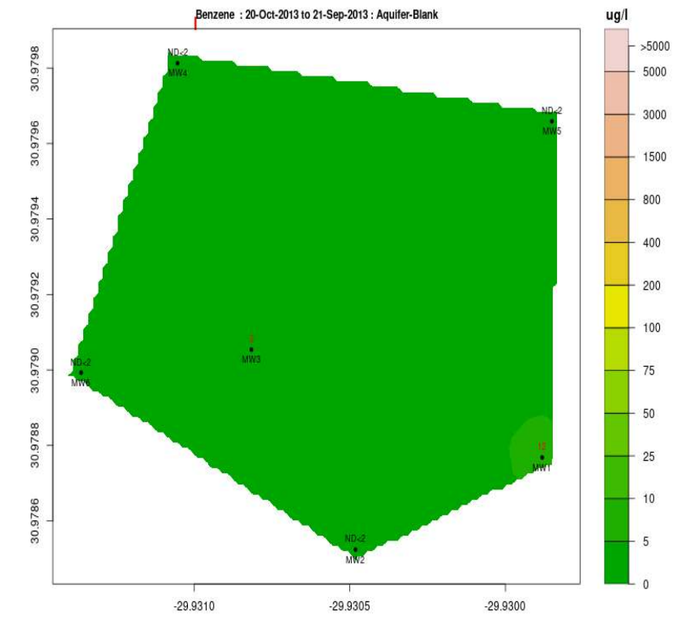

Figure 9-3: Spatial Temporal Illustration for site conditions in 2013 for benzene

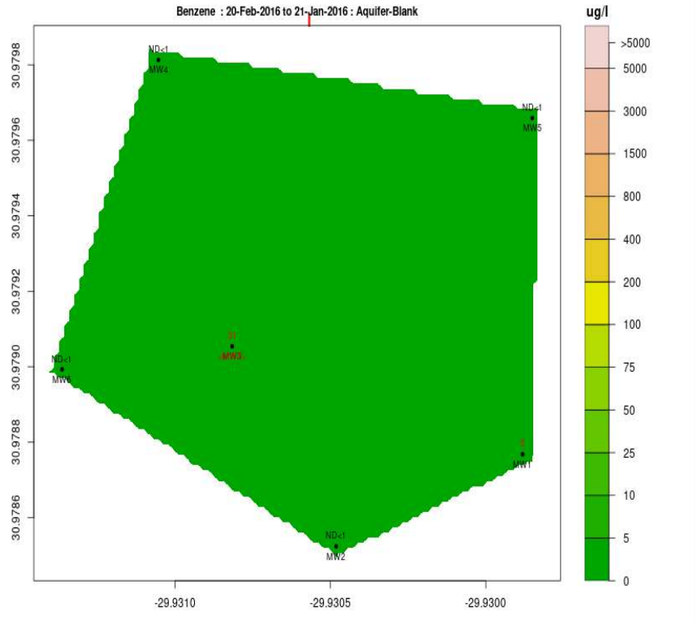

Figure 9-4: Spatial Temporal Illustration for site conditions in 2016 for benzene

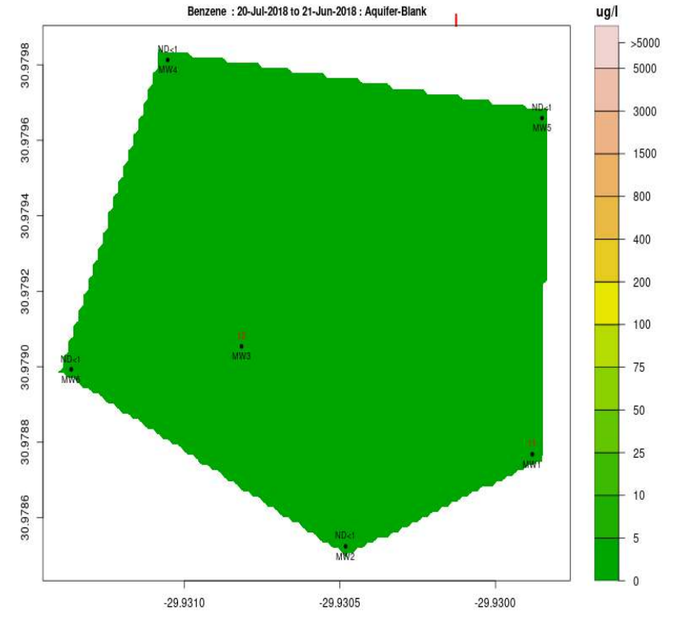

Figure 9-5: Spatial Temporal Illustration for site conditions in 2018 for benzene

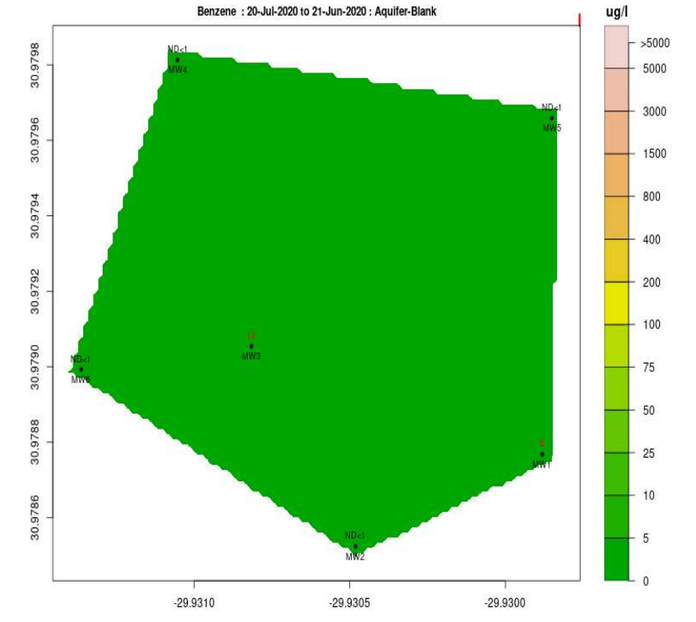

Figure 9-6: Spatial Temporal Illustration for site conditions in 2020 for benzene

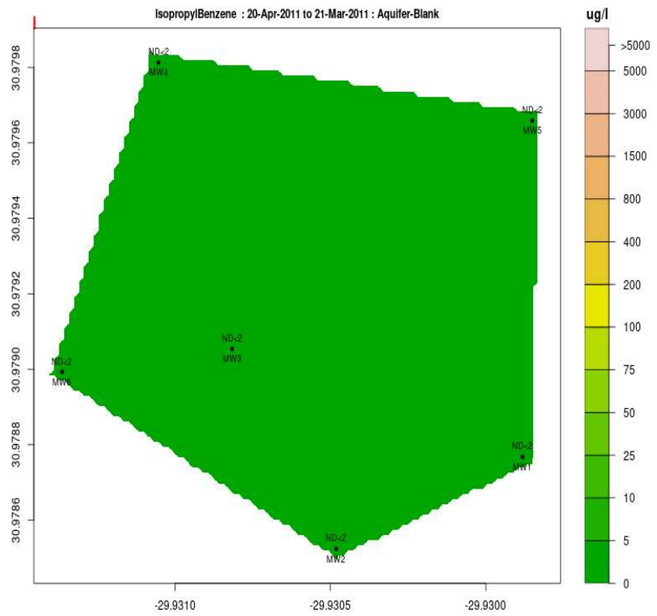

Figure 9-7: Spatial Temporal Illustration for site conditions in 2011 for isopropyl benzene

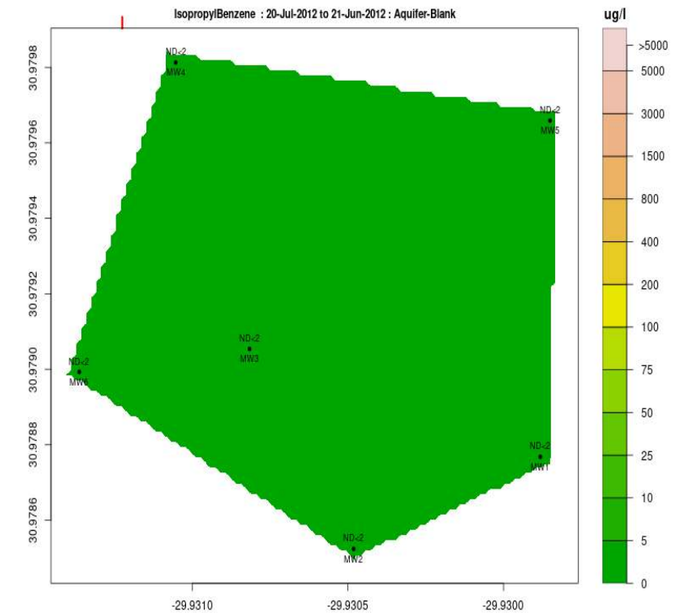

Figure 9-8: Spatial Temporal Illustration for site conditions in 2012 for isopropyl benzene

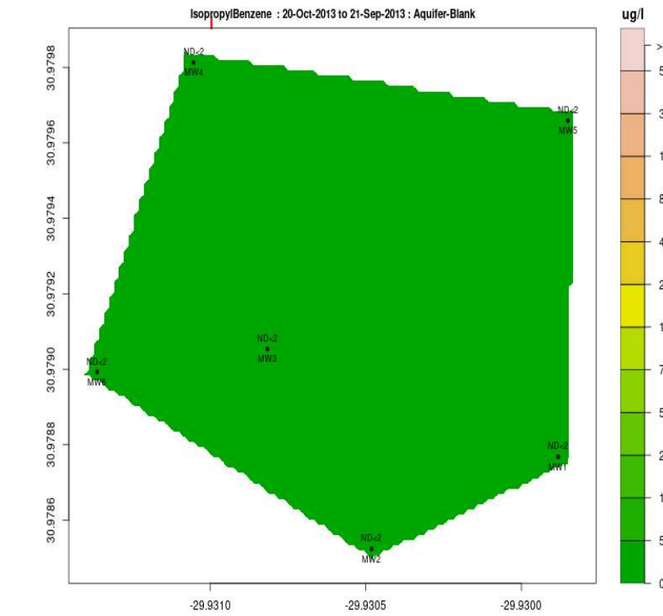

Figure 9-9: Spatial Temporal Illustration for site conditions in 2013 for isopropyl benzene

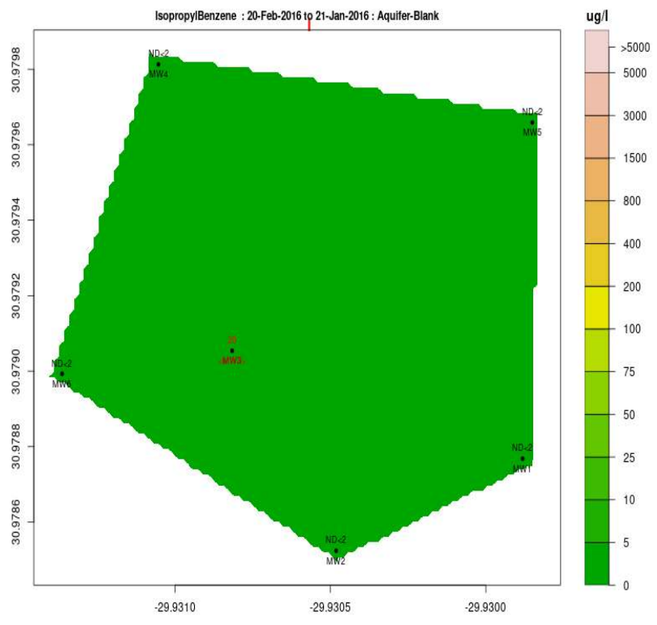

Figure 9-10: Spatial Temporal Illustration for site conditions in 2016 for isopropyl benzene

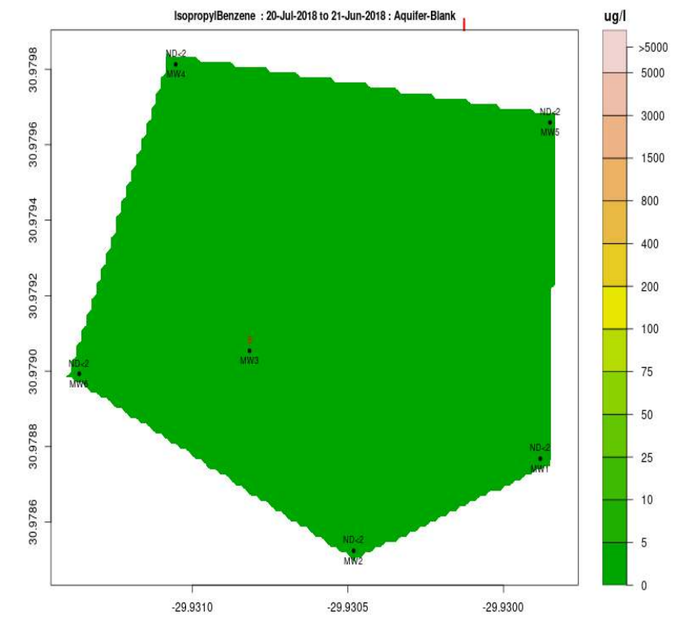

Figure 9-11: Spatial Temporal Illustration for site conditions in 2018 for isopropyl benzene

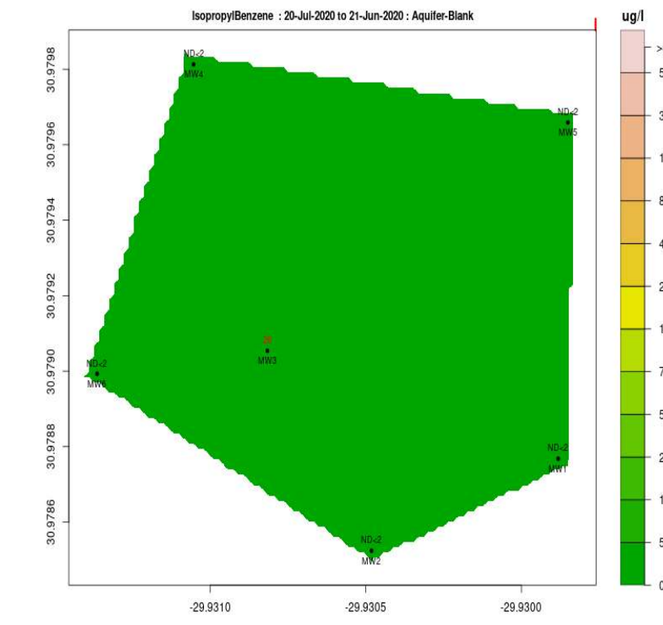

Figure 9-12: Spatial Temporal Illustration for site conditions in 2020 for isopropyl benzene

9.1 Discussion of Spatial Temporal Diagrams

Benzene concentrations have primarily been detected at locations MW1 and MW3 throughout the 2011 to 2020 period and a benzene concentration has appeared briefly at MW2 in 2015. Concentrations have remained stable throughout this period as demonstrated by the trend analysis for benzene during this same period. Based on the results, it is likely that any benzene plume present has remained onsite.

Similarly, isopropyl benzene concentrations have been detected at MW3 only during the 2011 to 2020 period. No detection of isopropyl benzene concentrations has been detected in any of the boundary wells (MW1, MW2, MW4, MW5 and MW6) and any isopropyl benzene plume that may be present on site appears to be contained onsite.

10 CONCEPTUAL SITE MODEL

The current section presents the Conceptual Site Model (CSM), identifying 'source-pathway-receptor' or pollution linkage relationship(s) for the site. The CSM identifies potentially complete linkages between a source of impact and whether it can impact receptors through selected pathways. For a risk to be present, a source, pathway and receptor must all be present. Without all three elements there is no risk. The summarised tabular CSM is presented in Table 10-1. The CSM has been updated to incorporate the soil data and laboratory results obtained following the soil sampling conducted on 10 September 2020.

10.1 Source

As discussed in Section 5, there are 22 underground storage tanks which store LNAPL and DNAPL based compounds and 3 above ground storage tanks which store inorganic compounds. According to the site history provided by Protea Chemicals staff, there has not been any recorded product or containment loss which has occurred during the last five years (five-year duration of their tenure). Additionally, the Protea Chemical staff indicated that they were not aware of any incidents before 2015.

The analysis during this assessment indicated that benzene concentrations were present in MW1 and MW3 while chlorobenzene, xylenes, 1,2-dichlorobenzene and 1,4-dichlorobenzene were only detected in MW1. Similarly, n-propyl benzene was only detected in MW3. MW2 reported xylenes, chloroform and naphthalene concentrations. The benzene and xylene concentrations reported in MW1 exceeded drinking water screening guidelines and similarly drinking water screening guidelines were exceeded for the xylene concentrations in MW3. Additionally, naphthalene and chloroform, detected in MW2, exceeded drinking water guidelines. However, no vapour intrusion screening guidelines were exceeded at any of the sampled locations. Analysis of the historical results from 2011 to 2018 indicated that concentrations had remained stable and below adopted screening guidelines for the chemicals of concern.

Soil samples were retrieved in the vicinity of the aforementioned underground storage tanks to depths of 3.0m bgl. Analysis indicated that VOC concentrations in all the soil samples did not exceed the soil screening guidelines. SVOC concentrations were detected in five of the six samples, with SS1 reporting all concentrations being below detection limits. None of the SVOC concentrations

exceeded the applicable soil screening guidelines. TPH GRO C7-C9 concentrations in SS4 exceeded the SSV1 (all land uses – protective of the water resource) and SSV2 (residential land use scenario) soil screening guidelines but did not exceed the SSV2 industrial land use scenario guideline.

10.2 Pathway

Shallow water levels were recorded on the site, which ranged between 1.90 and 4.63 mbgl. The shallow water level may act as a transport medium for contaminants to migrate. Given the site is used for commercial/industrial purposes vapour intrusion is a plausible pathway.

The site is primarily covered with hardstanding so direct contact with soil is not considered a plausible pathway and neither is direct contact with groundwater since it is not abstracted on site or within 250 m of the site.

Leaching of impacted soil was considered a potential pathway. Impacted soil may leach to the groundwater by being carried down by water vertically, following the local topography, into groundwater below the impacted zone. The permeability of the sub-surface strata effects the movement of contaminants through the soil. Additionally, the adsorption properties of the contaminant will also affect the movement through the soil.

The underground storage tanks are being planned to be excavated and removed from the site. Potential pathways of concern are potential trapped vapours present in the soil strata around the tanks and the potentially impacted soil beneath the tanks. Any excavation operations to remove the tank could release any trapped vapours and excavation worker may come into contact with impacted soil.

10.3 Receptors

The following potential receptors were identified:

Human Health:

The identified human receptors of concern include:

- Staff that work on the site.
- Commercial staff on neighbouring properties.
- Excavation workers during the removal of the underground storage tanks.

No off-site and privately owned abstraction wells were located during the hydrocensus within the site location within a 200 m radius. All persons, available

for interview during the hydrocensus, indicated that water was received from municipal water lines.

Environmental:
The identified environmental receptors include surface water features including the unnamed tributary located approximately 387 m to the northeast.

10.4 Summary

Based on the findings of the investigation there is a possible linkage present when the underground storage tanks are removed in the form of potential vapours being released and excavation workers coming into contact with potentially impacted soil during tank removals.

The evaluation of the pollution linkages is summarised in Table 10-1 overleaf.

Table 10-1: Summary of Exposure Pathways for the Site

Source	Exposure Pathway	Receptors				Comments
		Workers (During UST Removal)	On-site Employees	Off-site Commercial Staff	Environmental Receptors	
Ground water	Incidental ingestion/ dermal contact	X	X	X	X	Benzene, xylene and naphthalene exceeded USEPA drinking water guidelines and/or MDEQ Residential drinking water guidelines. However, there is no abstraction wells present on the site and no off-site abstraction wells were identified in the 300m radius around the site. Additionally, private persons interviewed during the hydrocensus within the area, indicated that water was obtained from municipal sources.
	Impact to surface water and sediment	X	X	X	X	The nearest surface water features are is the unnamed tributary located approximately 378 m to the northeast. The most likely pathway for groundwater to have impacted surface water is if the groundwater contaminants observed at MW1 and MW2 migrates off site in the anticipated direction of groundwater flow and impacts the tributary. However, based on the contaminant concentrations observed on site at these locations and the distance to this tributary, this pathway is considered incomplete.
	Inhalation of chemicals of concern	X	X	X	X	None of the targeted hydrocarbon compounds exceeded the CRC HSL Commercial/ Industrial guidelines for vapour intrusion risk. There are no monitoring wells in close proximity to the office complex area with the exception of MW5. However, based on the results of MW5 which reported all targeted hydrocarbon compound to be below detection limits, it is unlikely that a vapour risk is present.
Soil	Incidental ingestion/ dermal contact	X	X	X	X	Sampled locations SS2, SS4 and SS6 reported VOC concentrations which did not exceed soil screening guidelines. SS2, SS3, SS4, SS5 and SS6 reported the presence of SVOCs concentrations of which benzo(a)pyrene in SS6 exceeded the SSV1 soil screening guidelines. TPH GRO C7-C9 in SS4 exceeded the soil screening values for SSV1 and SSV2 (Residential land use scenario) but not for industrial. SS4 is located south and downgradient of the USTs and site users would not typically come into contact with the below-ground soil. No values specific to maintenance / construction workers are available but risks can be mitigated through the use of appropriate method statements and risk assessments.

	Inhalation of chemicals of concern	X	X	X	X	There were VOC concentrations detected around the tank farm during the phase I and II assessments. The tank monitoring wells were dry. There exists the possibility that the vapours may have emanated from impacted soil around the tank. Only SS4 exceeds the screening critieria and only the SSV1 and SSV2 rather than the industrial land use criteria. No values specific to maintenance / construction workers are available but risks can be mitigated through the use of permit to work systems, method statements and risk assessments before and during the removal of the tanks.
	Leaching to groundwater	√	X	X	X	The groundwater depth and quality in the near vicinity of the underground storage tanks is unknown as the water quality could not be assessed. This was due to the tank monitoring wells being dry during both assessments. Soil sampling in the vicinity of the tanks reported TPH GRO C7-C9 concentrations at SS4 and benzo(a)pyrene concentrations at SS6. The majority of the area is hardstanding which will inhibit infiltration and the leaching pathway but in the vicinity of SS6, hardstanding is absent. Therefore, there may be a possible linkage of leaching of contaminants from the sub-surface soil to the groundwater locally. Should groundwater be encountered during excavation operations to remove the underground storage tanks, utilise permit to work and safe working practises.

Notes:

X	Incomplete exposure pathway
√	Potentially complete exposure pathway
√√	Considered complete exposure pathway
-	Exposure scenario is not applicable

11 CONCLUSIONS

Based on the available information from the phase I and II assessments and from the soil sampling conducted in September 2020 in the vicinity of the underground storage tanks, RGM concludes that liabilities associated with ownership and continued commercial/industrial use are unlikely to be realised. Precautions such as method statements, risk assessments and permits to work should of course be adopted during tank removal including contingency plans since the quality of groundwater, if present, in the immediate vicinity of the UST is unknown. These conclusions are based on the following:

- The site walkover did not reveal observable leaks or issues on the site and the interview with the Protea Chemicals Jacob facility site manager indicated that there has not been any leaks or incidents during his 5-year tenure at the site. Additionally, he was not aware of any incidents on the site prior to his acceptance of site manager of the facility.
- The assessment in July 2020 noted that tank monitoring wells (TMW1-TMW6) were dry with VOC concentrations detected in headspace at TMW3 - TMW6; this is not abnormal for tank monitoring wells.
- No LNAPLs were observed during the June and July 2020 assessments and no DNAPLs were detected in both assessments.
- Groundwater sampling of the monitoring wells was conducted in July 2020. The analysis indicated that benzene concentrations were present in MW1 and MW3 while chlorobenzene, xylenes, 1,2-dichlorobenzene and 1,4-dichlorobenzene were only detected in MW1. Similarly, n-propyl benzene was only detected in MW3. MW2 reported xylenes, chloroform and naphthalene concentrations. Although concentrations did in some instances exceed the drinking water standards, the water is not being abstracted. Concentrations at MW1, the likely downgradient well, are in the same order of magnitude as the drinking water standards.
- The trend analysis of the identified chemicals of concern indicated that all compounds concentrations were stable according to the statistical analysis by the GSI Mann-Kendal Toolkit.
- VOC concentrations during the soil profiling to a maximum depth of 3m bgl noted that SS4 at 0.5m bgl reported a concentration of 226.4ppm.

- Soil sampling reported concentrations of benzo(a)pyrene and TPH GRO C7-C9 locally above the SSV1 and SSV2 screening criteria, but not the industrial land use criteria.

12 REFERENCES

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APPENDIX A – PHOTOGRAPHIC LOG

APPENDIX A - PHOTOGRAPHIC LOG

Client Name: Protea Chemicals	Date: 29 and 30 June 2020 and 22 July 2020	Site Location: Protea Chemicals - Jacobs	Project Number: 20-0530

Photo No. 1

View of the site looking from northwest to southeast by MW1

Photo No. 2

View of packaging and materials by MW1

Photo No. 3

View of monitoring well MW1

Photo No. 4

View of monitoring well MW1 in relation to the surrounds.

	
Photo No. 5	**Photo No. 6**
View of monitoring well MW2	View of monitoring well MW2 in relation to the surrounds.
	
Photo No. 7	**Photo No. 8**
View of the Gantry loading area	View of the side entrance on Balfour Road for commercial and heavy vehicles.

	
Photo No. 9	**Photo No. 10**
View of the main on-site sump located in the vicinity of MW2 and adjacent to the second side entrance on Balfour Road.	View of the second side entrance on Balfour Road. The main on-site sump is located to the east of the gate.
	
Photo No. 11	**Photo No. 12**
View of the product dispensing island in the centre of the picture. To the right is the solvent stores and to the left is the tank farm.	View of the dispensing island.

	
Photo No. 13	**Photo No. 14**
View of the tank farm. Dispensing island in the background followed by the solvent stores.	View of the second small tank farm located in the southern corner of the site in the vicinity of MW6.
	
Photo No. 15	**Photo No. 16**
View of monitoring well MW6	View of the small tank farm and material debris in the vicinity.

	
Photo No. 17	**Photo No. 18**
View of the debris and empty storage tanks in the vicinity of MW6	View of tank 21 in the southern corner of the site in the vicinity of MW6.
	
Photo No. 19	**Photo No. 20**
View of storage containers in the south eastern corner of the site.	View of the old rail line. Monitoring well MW4 located across from the blue storage containers.

	
Photo No. 21	**Photo No. 22**
View of the containers and debris in the vicinity of MW3.	View of monitoring well MW3 and surrounds.
	
Photo No. 23	**Photo No. 24**
View of monitoring well MW3	View of the water present in monitoring well MW5

	
Photo No. 25	**Photo No. 26**
View of the water in monitoring well MW1	View of the water in monitoring well MW2
	
Photo No. 27	**Photo No. 28**
View of the water in monitoring well MW3	View of the water in monitoring well MW4

	
Photo No. 29	**Photo No. 30**
View of the water in monitoring well MW6	View of operations at location SS1.
	
Photo No. 31	**Photo No. 32**
View of operations at location SS2.	View of the spoil material from location SS2.

	
Photo No. 33	**Photo No. 34**
View of the spoil material from location SS3.	View of the spoil material from location SS4.
	
Photo No. 35	**Photo No. 36**
View of the spoil material from location SS5.	View of the spoil material from location SS6.

APPENDIX B – LABORATORY RESULTS

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29687A

Test Description: Gasoline Range Organics and Total Petroleum Hydrocarbons
Test Method: UISOL-T-012 (GRO) and UISOL-T-011 (TPH)

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: Protea Chemicals

Sample Information

Matrix: Soil
Storage: Fridge at 0-6°C
Container: Glass

Date Received: 2020/09/13
Date Analysed: 2020/09/14
Date Issued: 2020/09/15

SAMPLE ID	GRO C7-C9	TPH C10-C14	TPH C15-C36	DILUTIONS
SS1 @ 2.5 m	<200 µg/kg	<20 mg/kg	<22 mg/kg	GRO=20, TPH=1
SS2 @ 1 m	390 µg/kg	130 mg/kg	61 mg/kg	GRO=20, TPH=1
SS3 @ 2 m	<200 µg/kg	<20 mg/kg	<22 mg/kg	GRO=20, TPH=1
SS4 @ 0.5 m	6400 µg/kg	<20 mg/kg	<22 mg/kg	GRO=20, TPH=1
SS5 @ 1.5 m	<200 µg/kg	<20 mg/kg	<22 mg/kg	GRO=20, TPH=1
SS6 @ 0.5 m	2100 µg/kg	<20 mg/kg	<22 mg/kg	GRO=20, TPH=1

Disclaimers

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2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.
3) Parameters marked " * " are not included in the SANAS Schedule of Accreditation for this laboratory.
4) A = Concentration outside calibration range, O = Outsourced analysis, UTD = Unable to Determine.
5) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.

Reinardt Cromhout
Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29687A

Test Description: Volatile Organic Compounds
Test Method: UISOL-T-012

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: Protea Chemicals

Sample Information

Sample ID: SS1 @ 2.5m
Dilution: 20
Container: Glass

Matrix: Soil
Storage: Fridge at 0-6°C

Date Received: 2020/09/13
Date Analysed: 2020/09/14
Date Issued: 2020/09/15

Mono-Aromatic Hydrocarbons

PARAMETER	RESULT
Benzene	<20 µg/kg
Toluene	<200 µg/kg
Ethylbenzene	<40 µg/kg
m+p-Xylene	<80 µg/kg
o-Xylene	<40 µg/kg
1,3,5-Trimethylbenzene	<40 µg/kg
1,2,4-Trimethylbenzene	<40 µg/kg
n-Propylbenzene	<40 µg/kg
tert-Butylbenzene	<40 µg/kg
sec-Butylbenzene	<40 µg/kg
n-Butylbenzene	<40 µg/kg
Isopropylbenzene	<40 µg/kg
Styrene	<100 µg/kg
4-Isopropyltoluene	<100 µg/kg

Bromo/Chlorobenzenes

PARAMETER	RESULT
Bromobenzene	<40 µg/kg
Chlorobenzene	<40 µg/kg
1,2-Dichlorobenzene	<40 µg/kg
1,3-Dichlorobenzene	<40 µg/kg
1,4-Dichlorobenzene	<40 µg/kg
1,2,3-Trichlorobenzene	<40 µg/kg
1,2,4-Trichlorobenzene	<40 µg/kg
1,3,5-Trichlorobenzene	<40 µg/kg

Polyaromatic Compounds

PARAMETER	RESULT
Naphthalene	<40 µg/kg

Volatile Brominated/Chlorinated Hydrocarbons

PARAMETER	RESULT
Bromoform	<100 µg/kg
Chloroform	<100 µg/kg
Carbon Tetrachloride	<100 µg/kg
Trichloroethene (TCE)	<100 µg/kg
Dibromomethane	<200 µg/kg
Dichloromethane	<1000 µg/kg
Bromochloromethane	<1000 µg/kg
Bromodichloromethane	<200 µg/kg
Dibromochloromethane	<40 µg/kg
1,2-Dibromoethane	<40 µg/kg
1,2-Dichloroethane	<200 µg/kg
Tetrachloroethene	<40 µg/kg
1,1,1-Trichloroethane	<100 µg/kg
1,1,2-Trichloroethane	<100 µg/kg
Hexachlorobutadiene	<40 µg/kg
1,1,1,2-Tetrachloroethane	<200 µg/kg
1,1,2,2-Tetrachloroethane	<200 µg/kg
2-Chlorotoluene	<40 µg/kg
4-Chlorotoluene	<40 µg/kg
1,1-Dichloroethene	<200 µg/kg
1,1-Dichloroethane	<200 µg/kg
cis-1,2-Dichloroethene	<200 µg/kg
trans-1,2-Dichloroethene	<200 µg/kg
1,2-Dichloropropane	<200 µg/kg
1,3-Dichloropropane	<200 µg/kg
2,2-Dichloropropane	<200 µg/kg
1,2,3-Trichloropropane	<200 µg/kg
1,1-Dichloropropene	<100 µg/kg
cis-1,3-Dichloropropene	<100 µg/kg
trans-1,3-Dichloropropene	<100 µg/kg

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4) A = Concentration outside calibration range, O = Outsourced analysis, UTD = Unable to Determine.
5) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.

Reinardt Cromhout
Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29687A

Test Description: Volatile Organic Compounds
Test Method: UISOL-T-012

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: Protea Chemicals

Sample Information

Sample ID: SS2 @ 1m
Dilution: 20
Container: Glass

Matrix: Soil
Storage: Fridge at 0-6°C

Date Received: 2020/09/13
Date Analysed: 2020/09/14
Date Issued: 2020/09/15

Mono-Aromatic Hydrocarbons

PARAMETER	RESULT
Benzene	<20 µg/kg
Toluene	<200 µg/kg
Ethylbenzene	120 µg/kg
m+p-Xylene	100 µg/kg
o-Xylene	<40 µg/kg
1,3,5-Trimethylbenzene	<40 µg/kg
1,2,4-Trimethylbenzene	200 µg/kg
n-Propylbenzene	83 µg/kg
tert-Butylbenzene	<40 µg/kg
sec-Butylbenzene	<40 µg/kg
n-Butylbenzene	<40 µg/kg
Isopropylbenzene	<40 µg/kg
Styrene	<100 µg/kg
4-Isopropyltoluene	<100 µg/kg

Bromo/Chlorobenzenes

PARAMETER	RESULT
Bromobenzene	<40 µg/kg
Chlorobenzene	<40 µg/kg
1,2-Dichlorobenzene	<40 µg/kg
1,3-Dichlorobenzene	<40 µg/kg
1,4-Dichlorobenzene	<40 µg/kg
1,2,3-Trichlorobenzene	<40 µg/kg
1,2,4-Trichlorobenzene	<40 µg/kg
1,3,5-Trichlorobenzene	<40 µg/kg

Polyaromatic Compounds

PARAMETER	RESULT
Naphthalene	310 µg/kg

Volatile Brominated/Chlorinated Hydrocarbons

PARAMETER	RESULT
Bromoform	<100 µg/kg
Chloroform	<100 µg/kg
Carbon Tetrachloride	<100 µg/kg
Trichloroethene (TCE)	<100 µg/kg
Dibromomethane	<200 µg/kg
Dichloromethane	<1000 µg/kg
Bromochloromethane	<1000 µg/kg
Bromodichloromethane	<200 µg/kg
Dibromochloromethane	<40 µg/kg
1,2-Dibromoethane	<40 µg/kg
1,2-Dichloroethane	<200 µg/kg
Tetrachloroethene	<40 µg/kg
1,1,1-Trichloroethane	<100 µg/kg
1,1,2-Trichloroethane	<100 µg/kg
Hexachlorobutadiene	<40 µg/kg
1,1,1,2-Tetrachloroethane	<200 µg/kg
1,1,2,2-Tetrachloroethane	<200 µg/kg
2-Chlorotoluene	<40 µg/kg
4-Chlorotoluene	<40 µg/kg
1,1-Dichloroethene	<200 µg/kg
1,1-Dichloroethane	<200 µg/kg
cis-1,2-Dichloroethene	<200 µg/kg
trans-1,2-Dichloroethene	<200 µg/kg
1,2-Dichloropropane	<200 µg/kg
1,3-Dichloropropane	<200 µg/kg
2,2-Dichloropropane	<200 µg/kg
1,2,3-Trichloropropane	<200 µg/kg
1,1-Dichloropropene	<100 µg/kg
cis-1,3-Dichloropropene	<100 µg/kg
trans-1,3-Dichloropropene	<100 µg/kg

Disclaimers

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Reinardt Cromhout
Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29687A

Test Description: Volatile Organic Compounds
Test Method: UISOL-T-012

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: Protea Chemicals

Sample Information

Sample ID: SS3 @ 2m
Dilution: 20
Container: Glass

Matrix: Soil
Storage: Fridge at 0-6°C

Date Received: 2020/09/13
Date Analysed: 2020/09/14
Date Issued: 2020/09/15

Mono-Aromatic Hydrocarbons

PARAMETER	RESULT
Benzene	<20 µg/kg
Toluene	<200 µg/kg
Ethylbenzene	<40 µg/kg
m+p-Xylene	<80 µg/kg
o-Xylene	<40 µg/kg
1,3,5-Trimethylbenzene	<40 µg/kg
1,2,4-Trimethylbenzene	<40 µg/kg
n-Propylbenzene	<40 µg/kg
tert-Butylbenzene	<40 µg/kg
sec-Butylbenzene	<40 µg/kg
n-Butylbenzene	<40 µg/kg
Isopropylbenzene	<40 µg/kg
Styrene	<100 µg/kg
4-Isopropyltoluene	<100 µg/kg

Bromo/Chlorobenzenes

PARAMETER	RESULT
Bromobenzene	<40 µg/kg
Chlorobenzene	<40 µg/kg
1,2-Dichlorobenzene	<40 µg/kg
1,3-Dichlorobenzene	<40 µg/kg
1,4-Dichlorobenzene	<40 µg/kg
1,2,3-Trichlorobenzene	<40 µg/kg
1,2,4-Trichlorobenzene	<40 µg/kg
1,3,5-Trichlorobenzene	<40 µg/kg

Polyaromatic Compounds

PARAMETER	RESULT
Naphthalene	<40 µg/kg

Volatile Brominated/Chlorinated Hydrocarbons

PARAMETER	RESULT
Bromoform	<100 µg/kg
Chloroform	<100 µg/kg
Carbon Tetrachloride	<100 µg/kg
Trichloroethene (TCE)	<100 µg/kg
Dibromomethane	<200 µg/kg
Dichloromethane	<1000 µg/kg
Bromochloromethane	<1000 µg/kg
Bromodichloromethane	<200 µg/kg
Dibromochloromethane	<40 µg/kg
1,2-Dibromoethane	<40 µg/kg
1,2-Dichloroethane	<200 µg/kg
Tetrachloroethene	<40 µg/kg
1,1,1-Trichloroethane	<100 µg/kg
1,1,2-Trichloroethane	<100 µg/kg
Hexachlorobutadiene	<40 µg/kg
1,1,1,2-Tetrachloroethane	<200 µg/kg
1,1,2,2-Tetrachloroethane	<200 µg/kg
2-Chlorotoluene	<40 µg/kg
4-Chlorotoluene	<40 µg/kg
1,1-Dichloroethene	<200 µg/kg
1,1-Dichloroethane	<200 µg/kg
cis-1,2-Dichloroethene	<200 µg/kg
trans-1,2-Dichloroethene	<200 µg/kg
1,2-Dichloropropane	<200 µg/kg
1,3-Dichloropropane	<200 µg/kg
2,2-Dichloropropane	<200 µg/kg
1,2,3-Trichloropropane	<200 µg/kg
1,1-Dichloropropene	<100 µg/kg
cis-1,3-Dichloropropene	<100 µg/kg
trans-1,3-Dichloropropene	<100 µg/kg

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Reinardt Cromhout
Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29687A

Test Description: Volatile Organic Compounds
Test Method: UISOL-T-012

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: Protea Chemicals

Sample Information

Sample ID: SS4 @ 0.5m
Dilution: 20
Container: Glass

Matrix: Soil
Storage: Fridge at 0-6°C

Date Received: 2020/09/13
Date Analysed: 2020/09/14
Date Issued: 2020/09/15

Mono-Aromatic Hydrocarbons

PARAMETER	RESULT
Benzene	<20 µg/kg
Toluene	<200 µg/kg
Ethylbenzene	3900 µg/kg
m+p-Xylene	1900 µg/kg
o-Xylene	120 µg/kg
1,3,5-Trimethylbenzene	<40 µg/kg
1,2,4-Trimethylbenzene	46 µg/kg
n-Propylbenzene	<40 µg/kg
tert-Butylbenzene	<40 µg/kg
sec-Butylbenzene	<40 µg/kg
n-Butylbenzene	<40 µg/kg
Isopropylbenzene	46 µg/kg
Styrene	<100 µg/kg
4-Isopropyltoluene	<100 µg/kg

Bromo/Chlorobenzenes

PARAMETER	RESULT
Bromobenzene	<40 µg/kg
Chlorobenzene	<40 µg/kg
1,2-Dichlorobenzene	<40 µg/kg
1,3-Dichlorobenzene	<40 µg/kg
1,4-Dichlorobenzene	<40 µg/kg
1,2,3-Trichlorobenzene	<40 µg/kg
1,2,4-Trichlorobenzene	<40 µg/kg
1,3,5-Trichlorobenzene	<40 µg/kg

Polyaromatic Compounds

PARAMETER	RESULT
Naphthalene	<40 µg/kg

Volatile Brominated/Chlorinated Hydrocarbons

PARAMETER	RESULT
Bromoform	<100 µg/kg
Chloroform	<100 µg/kg
Carbon Tetrachloride	<100 µg/kg
Trichloroethene (TCE)	<100 µg/kg
Dibromomethane	<200 µg/kg
Dichloromethane	<1000 µg/kg
Bromochloromethane	<1000 µg/kg
Bromodichloromethane	<200 µg/kg
Dibromochloromethane	<40 µg/kg
1,2-Dibromoethane	<40 µg/kg
1,2-Dichloroethane	<200 µg/kg
Tetrachloroethene	<40 µg/kg
1,1,1-Trichloroethane	<100 µg/kg
1,1,2-Trichloroethane	<100 µg/kg
Hexachlorobutadiene	<40 µg/kg
1,1,1,2-Tetrachloroethane	<200 µg/kg
1,1,2,2-Tetrachloroethane	<200 µg/kg
2-Chlorotoluene	<40 µg/kg
4-Chlorotoluene	<40 µg/kg
1,1-Dichloroethene	<200 µg/kg
1,1-Dichloroethane	<200 µg/kg
cis-1,2-Dichloroethene	<200 µg/kg
trans-1,2-Dichloroethene	<200 µg/kg
1,2-Dichloropropane	<200 µg/kg
1,3-Dichloropropane	<200 µg/kg
2,2-Dichloropropane	<200 µg/kg
1,2,3-Trichloropropane	<200 µg/kg
1,1-Dichloropropene	<100 µg/kg
cis-1,3-Dichloropropene	<100 µg/kg
trans-1,3-Dichloropropene	<100 µg/kg

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Reinardt Cromhout
Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29687A

Test Description: Volatile Organic Compounds
Test Method: UISOL-T-012

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: Protea Chemicals

Sample Information

Sample ID: SS5 @ 1.5m
Dilution: 20
Container: Glass

Matrix: Soil
Storage: Fridge at 0-6°C

Date Received: 2020/09/13
Date Analysed: 2020/09/14
Date Issued: 2020/09/15

Mono-Aromatic Hydrocarbons

PARAMETER	RESULT
Benzene	<20 µg/kg
Toluene	<200 µg/kg
Ethylbenzene	<40 µg/kg
m+p-Xylene	<80 µg/kg
o-Xylene	<40 µg/kg
1,3,5-Trimethylbenzene	<40 µg/kg
1,2,4-Trimethylbenzene	<40 µg/kg
n-Propylbenzene	<40 µg/kg
tert-Butylbenzene	<40 µg/kg
sec-Butylbenzene	<40 µg/kg
n-Butylbenzene	<40 µg/kg
Isopropylbenzene	<40 µg/kg
Styrene	<100 µg/kg
4-Isopropyltoluene	<100 µg/kg

Bromo/Chlorobenzenes

PARAMETER	RESULT
Bromobenzene	<40 µg/kg
Chlorobenzene	<40 µg/kg
1,2-Dichlorobenzene	<40 µg/kg
1,3-Dichlorobenzene	<40 µg/kg
1,4-Dichlorobenzene	<40 µg/kg
1,2,3-Trichlorobenzene	<40 µg/kg
1,2,4-Trichlorobenzene	<40 µg/kg
1,3,5-Trichlorobenzene	<40 µg/kg

Polyaromatic Compounds

PARAMETER	RESULT
Naphthalene	76 µg/kg

Volatile Brominated/Chlorinated Hydrocarbons

PARAMETER	RESULT
Bromoform	<100 µg/kg
Chloroform	<100 µg/kg
Carbon Tetrachloride	<100 µg/kg
Trichloroethene (TCE)	<100 µg/kg
Dibromomethane	<200 µg/kg
Dichloromethane	<1000 µg/kg
Bromochloromethane	<1000 µg/kg
Bromodichloromethane	<200 µg/kg
Dibromochloromethane	<40 µg/kg
1,2-Dibromoethane	<40 µg/kg
1,2-Dichloroethane	<200 µg/kg
Tetrachloroethene	<40 µg/kg
1,1,1-Trichloroethane	<100 µg/kg
1,1,2-Trichloroethane	<100 µg/kg
Hexachlorobutadiene	<40 µg/kg
1,1,1,2-Tetrachloroethane	<200 µg/kg
1,1,2,2-Tetrachloroethane	<200 µg/kg
2-Chlorotoluene	<40 µg/kg
4-Chlorotoluene	<40 µg/kg
1,1-Dichloroethene	<200 µg/kg
1,1-Dichloroethane	<200 µg/kg
cis-1,2-Dichloroethene	<200 µg/kg
trans-1,2-Dichloroethene	<200 µg/kg
1,2-Dichloropropane	<200 µg/kg
1,3-Dichloropropane	<200 µg/kg
2,2-Dichloropropane	<200 µg/kg
1,2,3-Trichloropropane	<200 µg/kg
1,1-Dichloropropene	<100 µg/kg
cis-1,3-Dichloropropene	<100 µg/kg
trans-1,3-Dichloropropene	<100 µg/kg

Reinardt Cromhout
Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29687A

Test Description: Volatile Organic Compounds
Test Method: UISOL-T-012

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: Protea Chemicals

Sample Information

Sample ID: SS6 @ 0.5m
Dilution: 20
Container: Glass

Matrix: Soil
Storage: Fridge at 0-6°C

Date Received: 2020/09/13
Date Analysed: 2020/09/14
Date Issued: 2020/09/15

Mono-Aromatic Hydrocarbons

PARAMETER	RESULT
Benzene	24 µg/kg
Toluene	<200 µg/kg
Ethylbenzene	<40 µg/kg
m+p-Xylene	<80 µg/kg
o-Xylene	<40 µg/kg
1,3,5-Trimethylbenzene	<40 µg/kg
1,2,4-Trimethylbenzene	<40 µg/kg
n-Propylbenzene	<40 µg/kg
tert-Butylbenzene	<40 µg/kg
sec-Butylbenzene	<40 µg/kg
n-Butylbenzene	<40 µg/kg
Isopropylbenzene	<40 µg/kg
Styrene	<100 µg/kg
4-Isopropyltoluene	<100 µg/kg

Bromo/Chlorobenzenes

PARAMETER	RESULT
Bromobenzene	<40 µg/kg
Chlorobenzene	<40 µg/kg
1,2-Dichlorobenzene	<40 µg/kg
1,3-Dichlorobenzene	<40 µg/kg
1,4-Dichlorobenzene	<40 µg/kg
1,2,3-Trichlorobenzene	<40 µg/kg
1,2,4-Trichlorobenzene	<40 µg/kg
1,3,5-Trichlorobenzene	<40 µg/kg

Polyaromatic Compounds

PARAMETER	RESULT
Naphthalene	530 µg/kg

Volatile Brominated/Chlorinated Hydrocarbons

PARAMETER	RESULT
Bromoform	<100 µg/kg
Chloroform	<100 µg/kg
Carbon Tetrachloride	<100 µg/kg
Trichloroethene (TCE)	<100 µg/kg
Dibromomethane	<200 µg/kg
Dichloromethane	<1000 µg/kg
Bromochloromethane	<1000 µg/kg
Bromodichloromethane	<200 µg/kg
Dibromochloromethane	<40 µg/kg
1,2-Dibromoethane	<40 µg/kg
1,2-Dichloroethane	<200 µg/kg
Tetrachloroethene	<40 µg/kg
1,1,1-Trichloroethane	<100 µg/kg
1,1,2-Trichloroethane	<100 µg/kg
Hexachlorobutadiene	<40 µg/kg
1,1,1,2-Tetrachloroethane	<200 µg/kg
1,1,2,2-Tetrachloroethane	<200 µg/kg
2-Chlorotoluene	<40 µg/kg
4-Chlorotoluene	<40 µg/kg
1,1-Dichloroethene	<200 µg/kg
1,1-Dichloroethane	<200 µg/kg
cis-1,2-Dichloroethene	<200 µg/kg
trans-1,2-Dichloroethene	<200 µg/kg
1,2-Dichloropropane	<200 µg/kg
1,3-Dichloropropane	<200 µg/kg
2,2-Dichloropropane	<200 µg/kg
1,2,3-Trichloropropane	<200 µg/kg
1,1-Dichloropropene	<100 µg/kg
cis-1,3-Dichloropropene	<100 µg/kg
trans-1,3-Dichloropropene	<100 µg/kg

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Reinardt Cromhout
Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29687A

Test Description: Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client:	GCS (Pty) Ltd				
Address:	4a Old Main Road;Judges walk;Kloof KZN 3610	**Attention:** **Tel:** **Email:**	Thomas Brown (031) 764 7130 thomasb@gcs-sa.biz	**Project number:** **Project name:**	20-0530 Protea Chemicals

Sample Information

Sample ID:	**SS1 @ 2.5 m**	**Matrix:**	Soil	**Date Received:**	2020/09/13
Dilution:	No Dilution	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2020/09/15
Container:	Glass			**Date Issued:**	2020/09/15

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	<4 µg/kg
Acenaphthene *	<4 µg/kg
Acenaphthylene	<4 µg/kg
Fluorene *	<4 µg/kg
Phenanthrene	<4 µg/kg
Anthracene	<4 µg/kg
Fluoranthene	<4 µg/kg
Pyrene	<4 µg/kg
Benzo(a)anthracene	<4 µg/kg
Chrysene	<4 µg/kg
Benzo(b+k)fluoranthene	<8 µg/kg
Benzo(a)pyrene	<4 µg/kg
Benzo(g,h,i)perylene	<8 µg/kg
Dibenz(a,h)anthracene	<8 µg/kg
Indeno(123-cd)pyrene	<8 µg/kg

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<8 µg/kg
1,3-Dichlorobenzene*	<8 µg/kg
1,4-Dichlorobenzene*	<8 µg/kg
2-Chloronaphthalene*	<8 µg/kg
Hexachlorobenzene*	<8 µg/kg
Hexachloroethane*	<8 µg/kg
1,2,4-Trichlorobenzene*	<8 µg/kg
4-Chlorophenylphenyl ether*	<8 µg/kg
4-Bromophenylphenyl ether*	<8 µg/kg

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<200 µg/kg
Butyl benzyl phthalate*	<200 µg/kg
Bis(2-ethylhexyl) phthalate*	<200 µg/kg

Disclaimers

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UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29687A

Test Description: Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client:	GCS (Pty) Ltd				
Address:	4a Old Main Road;Judges walk;Kloof KZN 3610	**Attention:** **Tel:** **Email:**	Thomas Brown (031) 764 7130 thomasb@gcs-sa.biz	**Project number:** **Project name:**	20-0530 Protea Chemicals

Sample Information

Sample ID:	**SS2 @ 1 m**	**Matrix:**	Soil	**Date Received:**	2020/09/13
Dilution:	No Dilution	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2020/09/15
Container:	Glass			**Date Issued:**	2020/09/15

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	310 µg/kg
Acenaphthene *	<4 µg/kg
Acenaphthylene	<4 µg/kg
Fluorene *	<4 µg/kg
Phenanthrene	7.9 µg/kg
Anthracene	<4 µg/kg
Fluoranthene	6.5 µg/kg
Pyrene	6.7 µg/kg
Benzo(a)anthracene	<4 µg/kg
Chrysene	<4 µg/kg
Benzo(b+k)fluoranthene	10 µg/kg
Benzo(a)pyrene	4.9 µg/kg
Benzo(g,h,i)perylene	<8 µg/kg
Dibenz(a,h)anthracene	<8 µg/kg
Indeno(123-cd)pyrene	<8 µg/kg

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<8 µg/kg
1,3-Dichlorobenzene*	<8 µg/kg
1,4-Dichlorobenzene*	<8 µg/kg
2-Chloronaphthalene*	<8 µg/kg
Hexachlorobenzene*	<8 µg/kg
Hexachloroethane*	<8 µg/kg
1,2,4-Trichlorobenzene*	<8 µg/kg
4-Chlorophenylphenyl ether*	<8 µg/kg
4-Bromophenylphenyl ether*	<8 µg/kg

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<200 µg/kg
Butyl benzyl phthalate*	<200 µg/kg
Bis(2-ethylhexyl) phthalate*	<200 µg/kg

Disclaimers

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UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29687A

Test Description: Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client:	GCS (Pty) Ltd				
Address:	4a Old Main Road;Judges walk;Kloof KZN 3610	**Attention:** **Tel:** **Email:**	Thomas Brown (031) 764 7130 thomasb@gcs-sa.biz	**Project number:** **Project name:**	20-0530 Protea Chemicals

Sample Information

Sample ID:	**SS3 @ 2 m**	**Matrix:**	Soil	**Date Received:**	2020/09/13
Dilution:	No Dilution	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2020/09/15
Container:	Glass			**Date Issued:**	2020/09/15

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	7.3 µg/kg
Acenaphthene *	<4 µg/kg
Acenaphthylene	<4 µg/kg
Fluorene *	<4 µg/kg
Phenanthrene	<4 µg/kg
Anthracene	<4 µg/kg
Fluoranthene	<4 µg/kg
Pyrene	<4 µg/kg
Benzo(a)anthracene	<4 µg/kg
Chrysene	<4 µg/kg
Benzo(b+k)fluoranthene	<8 µg/kg
Benzo(a)pyrene	<4 µg/kg
Benzo(g,h,i)perylene	<8 µg/kg
Dibenz(a,h)anthracene	<8 µg/kg
Indeno(123-cd)pyrene	<8 µg/kg

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<8 µg/kg
1,3-Dichlorobenzene*	<8 µg/kg
1,4-Dichlorobenzene*	<8 µg/kg
2-Chloronaphthalene*	<8 µg/kg
Hexachlorobenzene*	<8 µg/kg
Hexachloroethane*	<8 µg/kg
1,2,4-Trichlorobenzene*	<8 µg/kg
4-Chlorophenylphenyl ether*	<8 µg/kg
4-Bromophenylphenyl ether*	<8 µg/kg

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<200 µg/kg
Butyl benzyl phthalate*	<200 µg/kg
Bis(2-ethylhexyl) phthalate*	<200 µg/kg

Disclaimers

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Reinardt Cromhout
Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29687A

Test Description: Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client:	GCS (Pty) Ltd				
Address:	4a Old Main Road;Judges walk;Kloof KZN 3610	**Attention:** **Tel:** **Email:**	Thomas Brown (031) 764 7130 thomasb@gcs-sa.biz	**Project number:** **Project name:**	20-0530 Protea Chemicals

Sample Information

Sample ID:	**SS4 @ 0.5 m**	**Matrix:**	Soil	**Date Received:**	2020/09/13
Dilution:	No Dilution	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2020/09/15
Container:	Glass			**Date Issued:**	2020/09/15

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	7.2 µg/kg
Acenaphthene *	4.4 µg/kg
Acenaphthylene	21 µg/kg
Fluorene *	5.6 µg/kg
Phenanthrene	68 µg/kg
Anthracene	24 µg/kg
Fluoranthene	290 µg/kg
Pyrene	310 µg/kg
Benzo(a)anthracene	180 µg/kg
Chrysene	250 µg/kg
Benzo(b+k)fluoranthene	590 µg/kg
Benzo(a)pyrene	290 µg/kg
Benzo(g,h,i)perylene	<8 µg/kg
Dibenz(a,h)anthracene	<8 µg/kg
Indeno(123-cd)pyrene	210 µg/kg

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<8 µg/kg
1,3-Dichlorobenzene*	<8 µg/kg
1,4-Dichlorobenzene*	<8 µg/kg
2-Chloronaphthalene*	<8 µg/kg
Hexachlorobenzene*	<8 µg/kg
Hexachloroethane*	<8 µg/kg
1,2,4-Trichlorobenzene*	<8 µg/kg
4-Chlorophenylphenyl ether*	<8 µg/kg
4-Bromophenylphenyl ether*	<8 µg/kg

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<200 µg/kg
Butyl benzyl phthalate*	<200 µg/kg
Bis(2-ethylhexyl) phthalate*	<200 µg/kg

Disclaimers

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Reinardt Cromhout
Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29687A

Test Description: Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client:	GCS (Pty) Ltd				
Address:	4a Old Main Road;Judges walk;Kloof KZN 3610	**Attention:** **Tel:** **Email:**	Thomas Brown (031) 764 7130 thomasb@gcs-sa.biz	**Project number:** **Project name:**	20-0530 Protea Chemicals

Sample Information

Sample ID:	**SS5 @ 1.5 m**	**Matrix:**	Soil	**Date Received:**	2020/09/13
Dilution:	No Dilution	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2020/09/15
Container:	Glass			**Date Issued:**	2020/09/15

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	76 µg/kg
Acenaphthene *	6.1 µg/kg
Acenaphthylene	<4 µg/kg
Fluorene *	12 µg/kg
Phenanthrene	12 µg/kg
Anthracene	<4 µg/kg
Fluoranthene	5.8 µg/kg
Pyrene	5.6 µg/kg
Benzo(a)anthracene	<4 µg/kg
Chrysene	<4 µg/kg
Benzo(b+k)fluoranthene	<8 µg/kg
Benzo(a)pyrene	<4 µg/kg
Benzo(g,h,i)perylene	<8 µg/kg
Dibenz(a,h)anthracene	<8 µg/kg
Indeno(123-cd)pyrene	<8 µg/kg

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<8 µg/kg
1,3-Dichlorobenzene*	<8 µg/kg
1,4-Dichlorobenzene*	<8 µg/kg
2-Chloronaphthalene*	<8 µg/kg
Hexachlorobenzene*	<8 µg/kg
Hexachloroethane*	<8 µg/kg
1,2,4-Trichlorobenzene*	<8 µg/kg
4-Chlorophenylphenyl ether*	<8 µg/kg
4-Bromophenylphenyl ether*	<8 µg/kg

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<200 µg/kg
Butyl benzyl phthalate*	<200 µg/kg
Bis(2-ethylhexyl) phthalate*	<200 µg/kg

Disclaimers

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www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29687A

Test Description: Semi-Volatile Organic Compounds
Test Method: UISOL-T-020

Client and Project Information

Client:	GCS (Pty) Ltd				
Address:	4a Old Main Road;Judges walk;Kloof KZN 3610	**Attention:** **Tel:** **Email:**	Thomas Brown (031) 764 7130 thomasb@gcs-sa.biz	**Project number:** **Project name:**	20-0530 Protea Chemicals

Sample Information

Sample ID:	**SS6 @ 0.5 m**	**Matrix:**	Soil	**Date Received:**	2020/09/13
Dilution:	No Dilution	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2020/09/15
Container:	Glass			**Date Issued:**	2020/09/15

Polycyclic Aromatic Hydrocarbons

PARAMETER	RESULT
Naphthalene	530 µg/kg
Acenaphthene *	<4 µg/kg
Acenaphthylene	47 µg/kg
Fluorene *	19 µg/kg
Phenanthrene	340 µg/kg
Anthracene	64 µg/kg
Fluoranthene	350 µg/kg
Pyrene	370 µg/kg
Benzo(a)anthracene	220 µg/kg
Chrysene	320 µg/kg
Benzo(b+k)fluoranthene	950 µg/kg
Benzo(a)pyrene	350 µg/kg
Benzo(g,h,i)perylene	690 µg/kg
Dibenz(a,h)anthracene	95 µg/kg
Indeno(123-cd)pyrene	390 µg/kg

Chlorinated Compounds

PARAMETER	RESULT
1,2-Dichlorobenzene*	<8 µg/kg
1,3-Dichlorobenzene*	<8 µg/kg
1,4-Dichlorobenzene*	<8 µg/kg
2-Chloronaphthalene*	<8 µg/kg
Hexachlorobenzene*	<8 µg/kg
Hexachloroethane*	<8 µg/kg
1,2,4-Trichlorobenzene*	<8 µg/kg
4-Chlorophenylphenyl ether*	<8 µg/kg
4-Bromophenylphenyl ether*	<8 µg/kg

Phthalates

PARAMETER	RESULT
Di-n-butyl phthalate*	<200 µg/kg
Butyl benzyl phthalate*	<200 µg/kg
Bis(2-ethylhexyl) phthalate*	<200 µg/kg

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Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT 29041A

Test Description: Volatile Organic Compounds
Test Method: UISOL-T-012

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: 20-0530

Sample Information

Sample ID: MW1
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2020/07/27
Date Analysed: 2020/07/28
Date Issued: 2020/08/13

Mono-Aromatic Hydrocarbons

PARAMETER	RESULT
Benzene	6 µg/liter
Toluene	<10 µg/liter
Ethylbenzene	<2 µg/liter
m+p-Xylene	<4 µg/liter
o-Xylene	<2 µg/liter
1,3,5-Trimethylbenzene	<2 µg/liter
1,2,4-Trimethylbenzene	<2 µg/liter
n-Propylbenzene	<2 µg/liter
tert-Butylbenzene	<2 µg/liter
sec-Butylbenzene	<2 µg/liter
n-Butylbenzene	<2 µg/liter
Isopropylbenzene	<2 µg/liter
Styrene	<5 µg/liter
4-Isopropyltoluene	<5 µg/liter

Bromo/Chlorobenzenes

PARAMETER	RESULT
Bromobenzene	<2 µg/liter
Chlorobenzene	72 µg/liter
1,2-Dichlorobenzene	2 µg/liter
1,3-Dichlorobenzene	<2 µg/liter
1,4-Dichlorobenzene	3 µg/liter
1,2,3-Trichlorobenzene	<2 µg/liter
1,2,4-Trichlorobenzene	<2 µg/liter
1,3,5-Trichlorobenzene	<2 µg/liter

Polyaromatic Compounds

PARAMETER	RESULT
Naphthalene	<2 µg/liter

Volatile Brominated/Chlorinated Hydrocarbons

PARAMETER	RESULT
Bromoform	<5 µg/liter
Chloroform	<5 µg/liter
Carbon Tetrachloride	<5 µg/liter
Trichloroethene (TCE)	<5 µg/liter
Dibromomethane	<10 µg/liter
Dichloromethane	<50 µg/liter
Bromochloromethane	<50 µg/liter
Bromodichloromethane	<10 µg/liter
Dibromochloromethane	<2 µg/liter
1,2-Dibromoethane	<2 µg/liter
1,2-Dichloroethane	<10 µg/liter
Tetrachloroethene	<2 µg/liter
1,1,1-Trichloroethane	<5 µg/liter
1,1,2-Trichloroethane	<5 µg/liter
Hexachlorobutadiene	<2 µg/liter
1,1,1,2-Tetrachloroethane	<10 µg/liter
1,1,2,2-Tetrachloroethane	<10 µg/liter
2-Chlorotoluene	<2 µg/liter
4-Chlorotoluene	<2 µg/liter
1,1-Dichloroethene	<10 µg/liter
1,1-Dichloroethane	<10 µg/liter
cis-1,2-Dichloroethene	<10 µg/liter
trans-1,2-Dichloroethene	<10 µg/liter
1,2-Dichloropropane	<10 µg/liter
1,3-Dichloropropane	<10 µg/liter
2,2-Dichloropropane	<10 µg/liter
1,2,3-Trichloropropane	<10 µg/liter
1,1-Dichloropropene	<5 µg/liter
cis-1,3-Dichloropropene	<5 µg/liter
trans-1,3-Dichloropropene	<5 µg/liter

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Hugonette Richter
Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT 29041A

Test Description: Volatile Organic Compounds
Test Method: UISOL-T-012

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: 20-0530

Sample Information

Sample ID: MW2
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2020/07/27
Date Analysed: 2020/07/28
Date Issued: 2020/08/13

Mono-Aromatic Hydrocarbons

PARAMETER	RESULT
Benzene	<1 µg/liter
Toluene	<10 µg/liter
Ethylbenzene	<2 µg/liter
m+p-Xylene	<4 µg/liter
o-Xylene	2 µg/liter
1,3,5-Trimethylbenzene	<2 µg/liter
1,2,4-Trimethylbenzene	<2 µg/liter
n-Propylbenzene	<2 µg/liter
tert-Butylbenzene	<2 µg/liter
sec-Butylbenzene	<2 µg/liter
n-Butylbenzene	<2 µg/liter
Isopropylbenzene	<2 µg/liter
Styrene	<5 µg/liter
4-Isopropyltoluene	<5 µg/liter

Bromo/Chlorobenzenes

PARAMETER	RESULT
Bromobenzene	<2 µg/liter
Chlorobenzene	<2 µg/liter
1,2-Dichlorobenzene	<2 µg/liter
1,3-Dichlorobenzene	<2 µg/liter
1,4-Dichlorobenzene	<2 µg/liter
1,2,3-Trichlorobenzene	<2 µg/liter
1,2,4-Trichlorobenzene	<2 µg/liter
1,3,5-Trichlorobenzene	<2 µg/liter

Polyaromatic Compounds

PARAMETER	RESULT
Naphthalene	41 µg/liter

Volatile Brominated/Chlorinated Hydrocarbons

PARAMETER	RESULT
Bromoform	<5 µg/liter
Chloroform	9 µg/liter
Carbon Tetrachloride	<5 µg/liter
Trichloroethene (TCE)	<5 µg/liter
Dibromomethane	<10 µg/liter
Dichloromethane	<50 µg/liter
Bromochloromethane	<50 µg/liter
Bromodichloromethane	<10 µg/liter
Dibromochloromethane	<2 µg/liter
1,2-Dibromoethane	<2 µg/liter
1,2-Dichloroethane	<10 µg/liter
Tetrachloroethene	<2 µg/liter
1,1,1-Trichloroethane	<5 µg/liter
1,1,2-Trichloroethane	<5 µg/liter
Hexachlorobutadiene	<2 µg/liter
1,1,1,2-Tetrachloroethane	<10 µg/liter
1,1,2,2-Tetrachloroethane	<10 µg/liter
2-Chlorotoluene	<2 µg/liter
4-Chlorotoluene	<2 µg/liter
1,1-Dichloroethene	<10 µg/liter
1,1-Dichloroethane	<10 µg/liter
cis-1,2-Dichloroethene	<10 µg/liter
trans-1,2-Dichloroethene	<10 µg/liter
1,2-Dichloropropane	<10 µg/liter
1,3-Dichloropropane	<10 µg/liter
2,2-Dichloropropane	<10 µg/liter
1,2,3-Trichloropropane	<10 µg/liter
1,1-Dichloropropene	<5 µg/liter
cis-1,3-Dichloropropene	<5 µg/liter
trans-1,3-Dichloropropene	<5 µg/liter

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Hugonette Richter
Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT 29041A

Test Description: Volatile Organic Compounds
Test Method: UISOL-T-012

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: 20-0530

Sample Information

Sample ID: MW3
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2020/07/27
Date Analysed: 2020/07/28
Date Issued: 2020/08/13

Mono-Aromatic Hydrocarbons

PARAMETER	RESULT
Benzene	12 µg/liter
Toluene	<10 µg/liter
Ethylbenzene	<2 µg/liter
m+p-Xylene	120 µg/liter
o-Xylene	<2 µg/liter
1,3,5-Trimethylbenzene	<2 µg/liter
1,2,4-Trimethylbenzene	<2 µg/liter
n-Propylbenzene	3 µg/liter
tert-Butylbenzene	<2 µg/liter
sec-Butylbenzene	<2 µg/liter
n-Butylbenzene	<2 µg/liter
Isopropylbenzene	26 µg/liter
Styrene	<5 µg/liter
4-Isopropyltoluene	<5 µg/liter

Bromo/Chlorobenzenes

PARAMETER	RESULT
Bromobenzene	<2 µg/liter
Chlorobenzene	<2 µg/liter
1,2-Dichlorobenzene	<2 µg/liter
1,3-Dichlorobenzene	<2 µg/liter
1,4-Dichlorobenzene	<2 µg/liter
1,2,3-Trichlorobenzene	<2 µg/liter
1,2,4-Trichlorobenzene	<2 µg/liter
1,3,5-Trichlorobenzene	<2 µg/liter

Polyaromatic Compounds

PARAMETER	RESULT
Naphthalene	<2 µg/liter

Volatile Brominated/Chlorinated Hydrocarbons

PARAMETER	RESULT
Bromoform	<5 µg/liter
Chloroform	<5 µg/liter
Carbon Tetrachloride	<5 µg/liter
Trichloroethene (TCE)	<5 µg/liter
Dibromomethane	<10 µg/liter
Dichloromethane	<50 µg/liter
Bromochloromethane	<50 µg/liter
Bromodichloromethane	<10 µg/liter
Dibromochloromethane	<2 µg/liter
1,2-Dibromoethane	<2 µg/liter
1,2-Dichloroethane	<10 µg/liter
Tetrachloroethene	<2 µg/liter
1,1,1-Trichloroethane	<5 µg/liter
1,1,2-Trichloroethane	<5 µg/liter
Hexachlorobutadiene	<2 µg/liter
1,1,1,2-Tetrachloroethane	<10 µg/liter
1,1,2,2-Tetrachloroethane	<10 µg/liter
2-Chlorotoluene	<2 µg/liter
4-Chlorotoluene	<2 µg/liter
1,1-Dichloroethene	<10 µg/liter
1,1-Dichloroethane	<10 µg/liter
cis-1,2-Dichloroethene	<10 µg/liter
trans-1,2-Dichloroethene	<10 µg/liter
1,2-Dichloropropane	<10 µg/liter
1,3-Dichloropropane	<10 µg/liter
2,2-Dichloropropane	<10 µg/liter
1,2,3-Trichloropropane	<10 µg/liter
1,1-Dichloropropene	<5 µg/liter
cis-1,3-Dichloropropene	<5 µg/liter
trans-1,3-Dichloropropene	<5 µg/liter

Hugonette Richter
Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT 29041A

Test Description: Volatile Organic Compounds
Test Method: UISOL-T-012

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: 20-0530

Sample Information

Sample ID: MW4
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2020/07/27
Date Analysed: 2020/07/28
Date Issued: 2020/08/13

Mono-Aromatic Hydrocarbons

PARAMETER	RESULT
Benzene	<1 µg/liter
Toluene	<10 µg/liter
Ethylbenzene	<2 µg/liter
m+p-Xylene	<4 µg/liter
o-Xylene	<2 µg/liter
1,3,5-Trimethylbenzene	<2 µg/liter
1,2,4-Trimethylbenzene	<2 µg/liter
n-Propylbenzene	<2 µg/liter
tert-Butylbenzene	<2 µg/liter
sec-Butylbenzene	<2 µg/liter
n-Butylbenzene	<2 µg/liter
Isopropylbenzene	<2 µg/liter
Styrene	<5 µg/liter
4-Isopropyltoluene	<5 µg/liter

Bromo/Chlorobenzenes

PARAMETER	RESULT
Bromobenzene	<2 µg/liter
Chlorobenzene	<2 µg/liter
1,2-Dichlorobenzene	<2 µg/liter
1,3-Dichlorobenzene	<2 µg/liter
1,4-Dichlorobenzene	<2 µg/liter
1,2,3-Trichlorobenzene	<2 µg/liter
1,2,4-Trichlorobenzene	<2 µg/liter
1,3,5-Trichlorobenzene	<2 µg/liter

Polyaromatic Compounds

PARAMETER	RESULT
Naphthalene	<2 µg/liter

Volatile Brominated/Chlorinated Hydrocarbons

PARAMETER	RESULT
Bromoform	<5 µg/liter
Chloroform	<5 µg/liter
Carbon Tetrachloride	<5 µg/liter
Trichloroethene (TCE)	<5 µg/liter
Dibromomethane	<10 µg/liter
Dichloromethane	<50 µg/liter
Bromochloromethane	<50 µg/liter
Bromodichloromethane	<10 µg/liter
Dibromochloromethane	<2 µg/liter
1,2-Dibromoethane	<2 µg/liter
1,2-Dichloroethane	<10 µg/liter
Tetrachloroethene	<2 µg/liter
1,1,1-Trichloroethane	<5 µg/liter
1,1,2-Trichloroethane	<5 µg/liter
Hexachlorobutadiene	<2 µg/liter
1,1,1,2-Tetrachloroethane	<10 µg/liter
1,1,2,2-Tetrachloroethane	<10 µg/liter
2-Chlorotoluene	<2 µg/liter
4-Chlorotoluene	<2 µg/liter
1,1-Dichloroethene	<10 µg/liter
1,1-Dichloroethane	<10 µg/liter
cis-1,2-Dichloroethene	<10 µg/liter
trans-1,2-Dichloroethene	<10 µg/liter
1,2-Dichloropropane	<10 µg/liter
1,3-Dichloropropane	<10 µg/liter
2,2-Dichloropropane	<10 µg/liter
1,2,3-Trichloropropane	<10 µg/liter
1,1-Dichloropropene	<5 µg/liter
cis-1,3-Dichloropropene	<5 µg/liter
trans-1,3-Dichloropropene	<5 µg/liter

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Hugonette Richter
Authorised Signatory

www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29041A

Test Description: Volatile Organic Compounds
Test Method: UISOL-T-012

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: 20-0530

Sample Information

Sample ID: MW5
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2020/07/27
Date Analysed: 2020/07/28
Date Issued: 2020/08/13

Mono-Aromatic Hydrocarbons

PARAMETER	RESULT
Benzene	<1 µg/liter
Toluene	<10 µg/liter
Ethylbenzene	<2 µg/liter
m+p-Xylene	<4 µg/liter
o-Xylene	<2 µg/liter
1,3,5-Trimethylbenzene	<2 µg/liter
1,2,4-Trimethylbenzene	<2 µg/liter
n-Propylbenzene	<2 µg/liter
tert-Butylbenzene	<2 µg/liter
sec-Butylbenzene	<2 µg/liter
n-Butylbenzene	<2 µg/liter
Isopropylbenzene	<2 µg/liter
Styrene	<5 µg/liter
4-Isopropyltoluene	<5 µg/liter

Bromo/Chlorobenzenes

PARAMETER	RESULT
Bromobenzene	<2 µg/liter
Chlorobenzene	<2 µg/liter
1,2-Dichlorobenzene	<2 µg/liter
1,3-Dichlorobenzene	<2 µg/liter
1,4-Dichlorobenzene	<2 µg/liter
1,2,3-Trichlorobenzene	<2 µg/liter
1,2,4-Trichlorobenzene	<2 µg/liter
1,3,5-Trichlorobenzene	<2 µg/liter

Polyaromatic Compounds

PARAMETER	RESULT
Naphthalene	<2 µg/liter

Volatile Brominated/Chlorinated Hydrocarbons

PARAMETER	RESULT
Bromoform	<5 µg/liter
Chloroform	<5 µg/liter
Carbon Tetrachloride	<5 µg/liter
Trichloroethene (TCE)	<5 µg/liter
Dibromomethane	<10 µg/liter
Dichloromethane	<50 µg/liter
Bromochloromethane	<50 µg/liter
Bromodichloromethane	<10 µg/liter
Dibromochloromethane	<2 µg/liter
1,2-Dibromoethane	<2 µg/liter
1,2-Dichloroethane	<10 µg/liter
Tetrachloroethene	<2 µg/liter
1,1,1-Trichloroethane	<5 µg/liter
1,1,2-Trichloroethane	<5 µg/liter
Hexachlorobutadiene	<2 µg/liter
1,1,1,2-Tetrachloroethane	<10 µg/liter
1,1,2,2-Tetrachloroethane	<10 µg/liter
2-Chlorotoluene	<2 µg/liter
4-Chlorotoluene	<2 µg/liter
1,1-Dichloroethene	<10 µg/liter
1,1-Dichloroethane	<10 µg/liter
cis-1,2-Dichloroethene	<10 µg/liter
trans-1,2-Dichloroethene	<10 µg/liter
1,2-Dichloropropane	<10 µg/liter
1,3-Dichloropropane	<10 µg/liter
2,2-Dichloropropane	<10 µg/liter
1,2,3-Trichloropropane	<10 µg/liter
1,1-Dichloropropene	<5 µg/liter
cis-1,3-Dichloropropene	<5 µg/liter
trans-1,3-Dichloropropene	<5 µg/liter

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UIS ORGANIC LABORATORY

sanas Testing Laboratory T0419

TEST REPORT
29041A

Test Description: Volatile Organic Compounds
Test Method: UISOL-T-012

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: 20-0530

Sample Information

Sample ID: MW6
Dilution: No Dilution
Container: Glass

Matrix: Water
Storage: Fridge at 0-6°C

Date Received: 2020/07/27
Date Analysed: 2020/07/28
Date Issued: 2020/08/13

Mono-Aromatic Hydrocarbons

PARAMETER	RESULT
Benzene	<1 µg/liter
Toluene	<10 µg/liter
Ethylbenzene	<2 µg/liter
m+p-Xylene	<4 µg/liter
o-Xylene	<2 µg/liter
1,3,5-Trimethylbenzene	<2 µg/liter
1,2,4-Trimethylbenzene	<2 µg/liter
n-Propylbenzene	<2 µg/liter
tert-Butylbenzene	<2 µg/liter
sec-Butylbenzene	<2 µg/liter
n-Butylbenzene	<2 µg/liter
Isopropylbenzene	<2 µg/liter
Styrene	<5 µg/liter
4-Isopropyltoluene	<5 µg/liter

Bromo/Chlorobenzenes

PARAMETER	RESULT
Bromobenzene	<2 µg/liter
Chlorobenzene	<2 µg/liter
1,2-Dichlorobenzene	<2 µg/liter
1,3-Dichlorobenzene	<2 µg/liter
1,4-Dichlorobenzene	<2 µg/liter
1,2,3-Trichlorobenzene	<2 µg/liter
1,2,4-Trichlorobenzene	<2 µg/liter
1,3,5-Trichlorobenzene	<2 µg/liter

Polyaromatic Compounds

PARAMETER	RESULT
Naphthalene	<2 µg/liter

Volatile Brominated/Chlorinated Hydrocarbons

PARAMETER	RESULT
Bromoform	<5 µg/liter
Chloroform	<5 µg/liter
Carbon Tetrachloride	<5 µg/liter
Trichloroethene (TCE)	<5 µg/liter
Dibromomethane	<10 µg/liter
Dichloromethane	<50 µg/liter
Bromochloromethane	<50 µg/liter
Bromodichloromethane	<10 µg/liter
Dibromochloromethane	<2 µg/liter
1,2-Dibromoethane	<2 µg/liter
1,2-Dichloroethane	<10 µg/liter
Tetrachloroethene	<2 µg/liter
1,1,1-Trichloroethane	<5 µg/liter
1,1,2-Trichloroethane	<5 µg/liter
Hexachlorobutadiene	<2 µg/liter
1,1,1,2-Tetrachloroethane	<10 µg/liter
1,1,2,2-Tetrachloroethane	<10 µg/liter
2-Chlorotoluene	<2 µg/liter
4-Chlorotoluene	<2 µg/liter
1,1-Dichloroethene	<10 µg/liter
1,1-Dichloroethane	<10 µg/liter
cis-1,2-Dichloroethene	<10 µg/liter
trans-1,2-Dichloroethene	<10 µg/liter
1,2-Dichloropropane	<10 µg/liter
1,3-Dichloropropane	<10 µg/liter
2,2-Dichloropropane	<10 µg/liter
1,2,3-Trichloropropane	<10 µg/liter
1,1-Dichloropropene	<5 µg/liter
cis-1,3-Dichloropropene	<5 µg/liter
trans-1,3-Dichloropropene	<5 µg/liter

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www.uisorganiclaboratory.co.za 13 Sovereign Drive Route21 Corporate Park Irene South Africa Tel: +27 12 345 1004 info@uisol.co.za

TEST REPORT
29041A

Test Description: Gasoline Range Organics and Total Petroleum Hydrocarbons
Test Method: UISOL-T-012 (GRO) and UISOL-T-011 (TPH)

Client and Project Information

Client: GCS (Pty) Ltd
Address: 4a Old Main Road;Judges walk;Kloof
KZN
3610

Attention: Thomas Brown
Tel: (031) 764 7130
Email: thomasb@gcs-sa.biz

Project number: 20-0530
Project name: 20-0530

Sample Information

Matrix: Water
Storage: Fridge at 0-6°C
Container: Glass

Date Received: 2020/07/27
Date Analysed: 2020/07/27
Date Issued: 2020/08/13

SAMPLE ID	GRO C6-C10	TPH C10-C28	TPH C28-C40	DILUTIONS
MW1	44 µg/liter	<764 µg/liter	<764 µg/liter	GRO=1, TPH=2
MW2	28 µg/liter	<764 µg/liter	<764 µg/liter	GRO=1, TPH=2
MW3	250 µg/liter	<764 µg/liter	<764 µg/liter	GRO=1, TPH=2
MW4	<10 µg/liter	<764 µg/liter	<764 µg/liter	GRO=1, TPH=2
MW5	<10 µg/liter	<764 µg/liter	<764 µg/liter	GRO=1, TPH=2
MW6	<10 µg/liter	<764 µg/liter	<764 µg/liter	GRO=1, TPH=2

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UIS SEDIBA LABORATORY

sanas Testing Laboratory T0584

AMENDMENT TO TEST REPORT 10685A

Client and Project Information

Client:	UIS Organic Laboratory (Pty) Ltd				
Address:	Unit 3 Carrera House, 17 Sovereign St, Route 21	**Attention:**	F Havenga	**Project number:**	20-0530
	Irene	**Tel:**	(012) 345 1004	**Project name:**	20-0530
	0061	**Email:**	info@uisol.co.za		

Sample Information

Sample ID:	**MW1**	**Matrix:**	Water	**Date Received:**	2020/07/27
Units:	mg/l [ppm] (unless stated elsewhere)	**Container:**	Glass	**Date Issued:**	2020/08/17

Cations and Metals

Ca	92.01	**Fe(II)***	0.67
K	25.09	**Fe**	1.55
Na	158.90	**Mn**	0.15

Anions (Discrete Analyser)

SO4	82.12
NO3 as N	<0.5

Other Parameters

NH3 as N*	24.16
Total Phenol*	<0.01

Disclaimers

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UIS SEDIBA LABORATORY

sanas Testing Laboratory T0584

AMENDMENT TO TEST REPORT 10685A

Client and Project Information

Client:	UIS Organic Laboratory (Pty) Ltd				
Address:	Unit 3 Carrera House, 17 Sovereign St, Route 21	**Attention:**	F Havenga	**Project number:**	20-0530
	Irene	**Tel:**	(012) 345 1004	**Project name:**	20-0530
	0061	**Email:**	info@uisol.co.za		

Sample Information

Sample ID:	**MW2**	**Matrix:**	Water	**Date Received:**	2020/07/27
Units:	mg/l [ppm] (unless stated elsewhere)	**Container:**	Glass	**Date Issued:**	2020/08/17

Cations and Metals

Ca	93.67	**Fe(II)***	0.77
K	31.17	**Fe**	1.56
Na	978.50	**Mn**	0.38

Anions (Discrete Analyser)

SO4	810.10
NO3 as N	2.40

Other Parameters

NH3 as N*	17.21
Total Phenol*	0.02

Disclaimers

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UIS SEDIBA LABORATORY

sanas Testing Laboratory T0584

AMENDMENT TO TEST REPORT 10685A

Client and Project Information

Client:	UIS Organic Laboratory (Pty) Ltd				
Address:	Unit 3 Carrera House, 17 Sovereign St, Route 21	**Attention:**	F Havenga	**Project number:**	20-0530
	Irene	**Tel:**	(012) 345 1004	**Project name:**	20-0530
	0061	**Email:**	info@uisol.co.za		

Sample Information

Sample ID:	**MW3**	**Matrix:**	Water	**Date Received:**	2020/07/27
Units:	mg/l [ppm] (unless stated elsewhere)	**Container:**	Glass	**Date Issued:**	2020/08/17

Cations and Metals

Ca	70.40	**Fe(II)***	0.17
K	8.41	**Fe**	19.73
Na	73.66	**Mn**	0.11

Anions (Discrete Analyser)

SO4	5.59
NO3 as N	<0.5

Other Parameters

NH3 as N*	1.08
Total Phenol*	<0.01

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UIS SEDIBA LABORATORY

sanas Testing Laboratory T0584

AMENDMENT TO TEST REPORT 10685A

Client and Project Information

Client:	UIS Organic Laboratory (Pty) Ltd				
Address:	Unit 3 Carrera House, 17 Sovereign St, Route 21	**Attention:**	F Havenga	**Project number:**	20-0530
	Irene	**Tel:**	(012) 345 1004	**Project name:**	20-0530
	0061	**Email:**	info@uisol.co.za		

Sample Information

Sample ID:	**MW4**	**Matrix:**	Water	**Date Received:**	2020/07/27
Units:	mg/l [ppm] (unless stated elsewhere)	**Container:**	Glass	**Date Issued:**	2020/08/17

Cations and Metals

Ca	33.75	**Fe(II)***	<0.2
K	2.74	**Fe**	0.32
Na	40.98	**Mn**	<0.05

Anions (Discrete Analyser)

SO4	42.97
NO3 as N	2.89

Other Parameters

NH3 as N*	0.04
Total Phenol*	<0.01

Disclaimers

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UIS SEDIBA LABORATORY

sanas Testing Laboratory T0584

AMENDMENT TO TEST REPORT 10685A

Client and Project Information

Client:	UIS Organic Laboratory (Pty) Ltd				
Address:	Unit 3 Carrera House, 17 Sovereign St, Route 21	**Attention:**	F Havenga	**Project number:**	20-0530
	Irene	**Tel:**	(012) 345 1004	**Project name:**	20-0530
	0061	**Email:**	info@uisol.co.za		

Sample Information

Sample ID:	**MW5**	**Matrix:**	Water	**Date Received:**	2020/07/27
Units:	mg/l [ppm] (unless stated elsewhere)	**Container:**	Glass	**Date Issued:**	2020/08/17

Cations and Metals

Ca	42.19	**Fe(II)***	0.11
K	4.22	**Fe**	0.17
Na	28.42	**Mn**	<0.05

Anions (Discrete Analyser)

SO4	53.91
NO3 as N	16.62

Other Parameters

NH3 as N*	0.06
Total Phenol*	<0.01

Disclaimers

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UIS SEDIBA LABORATORY

sanas Testing Laboratory T0584

AMENDMENT TO TEST REPORT 10685A

Client and Project Information

Client:	UIS Organic Laboratory (Pty) Ltd				
Address:	Unit 3 Carrera House, 17 Sovereign St, Route 21	**Attention:**	F Havenga	**Project number:**	20-0530
	Irene	**Tel:**	(012) 345 1004	**Project name:**	20-0530
	0061	**Email:**	info@uisol.co.za		

Sample Information

Sample ID:	**MW6**	**Matrix:**	Water	**Date Received:**	2020/07/27
Units:	mg/l [ppm] (unless stated elsewhere)	**Container:**	Glass	**Date Issued:**	2020/08/17

Cations and Metals

Ca	62.80	**Fe(II)***	0.18
K	7.70	**Fe**	0.77
Na	54.89	**Mn**	<0.05

Anions (Discrete Analyser)

SO4	60.16
NO3 as N	4.70

Other Parameters

NH3 as N*	0.02
Total Phenol*	<0.01

Disclaimers

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TEST REPORT
29041A

Test Description: Polars by SPME
Test Method: UISOL-T-016

Client and Project Information

Client:	GCS (Pty) Ltd				
Address:	4a Old Main Road;Judges walk;Kloof KZN 3610	**Attention:** **Tel:** **Email:**	Thomas Brown (031) 764 7130 thomasb@gcs-sa.biz	**Project number:** **Project name:**	20-0530 20-0530

Sample Information

Sample ID:	**DUP1**	**Matrix:**	Water	**Date Received:**	2020/07/27
Dilution:	No Dilution	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2020/08/02
Container:	Glass			**Date Issued:**	2020/08/13

PARAMETER	RESULT
Vinyl Chloride	<1 µg/liter
2-Butanone / MEK	<100 µg/liter

Disclaimers

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Hugonette Richter
Authorised Signatory

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TEST REPORT
29041A

Test Description: Polars by SPME
Test Method: UISOL-T-016

Client and Project Information

Client:	GCS (Pty) Ltd				
Address:	4a Old Main Road;Judges walk;Kloof KZN 3610	**Attention:** **Tel:** **Email:**	Thomas Brown (031) 764 7130 thomasb@gcs-sa.biz	**Project number:** **Project name:**	20-0530 20-0530

Sample Information

Sample ID:	**MW1**	**Matrix:**	Water	**Date Received:**	2020/07/27
Dilution:	10	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2020/08/02
Container:	Glass			**Date Issued:**	2020/08/13

PARAMETER	RESULT
Vinyl Chloride	<10 µg/liter
2-Butanone / MEK	<1000 µg/liter

Disclaimers

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TEST REPORT
29041A

Test Description: Polars by SPME
Test Method: UISOL-T-016

Client and Project Information

Client:	GCS (Pty) Ltd				
Address:	4a Old Main Road;Judges walk;Kloof KZN 3610	**Attention:** **Tel:** **Email:**	Thomas Brown (031) 764 7130 thomasb@gcs-sa.biz	**Project number:** **Project name:**	20-0530 20-0530

Sample Information

Sample ID:	**MW2**	**Matrix:**	Water	**Date Received:**	2020/07/27
Dilution:	No Dilution	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2020/08/02
Container:	Glass			**Date Issued:**	2020/08/13

PARAMETER	RESULT
Vinyl Chloride	<1 µg/liter
2-Butanone / MEK	<100 µg/liter

Disclaimers

1) The results only relate to the test items provided, in the condition as received.

2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.

3) A = Concentration outside calibration range, O = Outsourced analysis, UTD = Unable to Determine.

Hugonette Richter
Authorised Signatory

www.uisorganiclaboratory.co.za **13 Sovereign Drive Route21 Corporate Park Irene South Africa** **Tel: +27 12 345 1004 info@uisol.co.za**

TEST REPORT
29041A

Test Description: Polars by SPME
Test Method: UISOL-T-016

Client and Project Information

Client:	GCS (Pty) Ltd				
Address:	4a Old Main Road;Judges walk;Kloof KZN 3610	**Attention:** **Tel:** **Email:**	Thomas Brown (031) 764 7130 thomasb@gcs-sa.biz	**Project number:** **Project name:**	20-0530 20-0530

Sample Information

Sample ID:	**MW3**	**Matrix:**	Water	**Date Received:**	2020/07/27
Dilution:	No Dilution	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2020/08/02
Container:	Glass			**Date Issued:**	2020/08/13

PARAMETER	RESULT
Vinyl Chloride	<1 µg/liter
2-Butanone / MEK	<100 µg/liter

Disclaimers

1) The results only relate to the test items provided, in the condition as received.

2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.

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Hugonette Richter
Authorised Signatory

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TEST REPORT
29041A

Test Description: Polars by SPME
Test Method: UISOL-T-016

Client and Project Information

Client:	GCS (Pty) Ltd				
Address:	4a Old Main Road;Judges walk;Kloof KZN 3610	**Attention:** **Tel:** **Email:**	Thomas Brown (031) 764 7130 thomasb@gcs-sa.biz	**Project number:** **Project name:**	20-0530 20-0530

Sample Information

Sample ID:	**MW4**	**Matrix:**	Water	**Date Received:**	2020/07/27
Dilution:	No Dilution	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2020/08/02
Container:	Glass			**Date Issued:**	2020/08/13

PARAMETER	RESULT
Vinyl Chloride	<1 µg/liter
2-Butanone / MEK	<100 µg/liter

Disclaimers

1) The results only relate to the test items provided, in the condition as received.

2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.

3) A = Concentration outside calibration range, O = Outsourced analysis, UTD = Unable to Determine.

Hugonette Richter
Authorised Signatory

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TEST REPORT
29041A

Test Description: Polars by SPME
Test Method: UISOL-T-016

Client and Project Information

Client:	GCS (Pty) Ltd				
Address:	4a Old Main Road;Judges walk;Kloof KZN 3610	**Attention:** **Tel:** **Email:**	Thomas Brown (031) 764 7130 thomasb@gcs-sa.biz	**Project number:** **Project name:**	20-0530 20-0530

Sample Information

Sample ID:	**MW5**	**Matrix:**	Water	**Date Received:**	2020/07/27
Dilution:	No Dilution	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2020/08/02
Container:	Glass			**Date Issued:**	2020/08/13

PARAMETER	RESULT
Vinyl Chloride	<1 µg/liter
2-Butanone / MEK	<100 µg/liter

Disclaimers

1) The results only relate to the test items provided, in the condition as received.

2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.

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Hugonette Richter
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TEST REPORT
29041A

Test Description: Polars by SPME
Test Method: UISOL-T-016

Client and Project Information

Client:	GCS (Pty) Ltd				
Address:	4a Old Main Road;Judges walk;Kloof KZN 3610	**Attention:** **Tel:** **Email:**	Thomas Brown (031) 764 7130 thomasb@gcs-sa.biz	**Project number:** **Project name:**	20-0530 20-0530

Sample Information

Sample ID:	**MW6**	**Matrix:**	Water	**Date Received:**	2020/07/27
Dilution:	No Dilution	**Storage:**	Fridge at 0-6°C	**Date Analysed:**	2020/08/02
Container:	Glass			**Date Issued:**	2020/08/13

PARAMETER	RESULT
Vinyl Chloride	<1 µg/liter
2-Butanone / MEK	<100 µg/liter

Disclaimers

1) The results only relate to the test items provided, in the condition as received.

2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.

3) A = Concentration outside calibration range, O = Outsourced analysis, UTD = Unable to Determine.

Hugonette Richter
Authorised Signatory

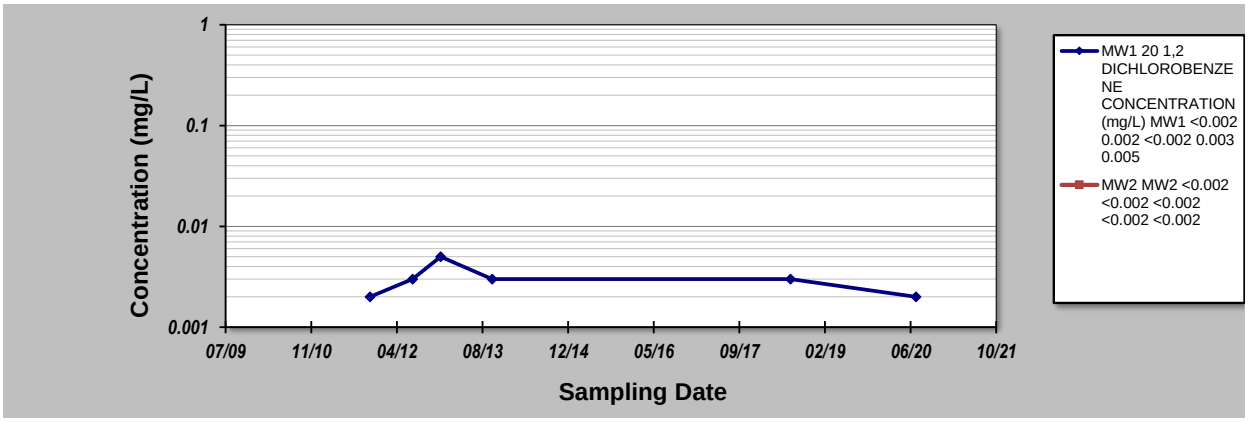
www.uisorganiclaboratory.co.za **13 Sovereign Drive Route21 Corporate Park Irene South Africa** **Tel: +27 12 345 1004 info@uisol.co.za**

APPENDIX C – GSI MANN-KENDALL DATA

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	19-Aug-20	Job ID:	20-0530
Facility Name:	RGM	Constituent:	1,2 Dichlorobenzene
Conducted By:	T.Brown	Concentration Units:	mg/L

Sampling Point ID:	MW1	MW2	MW3	MW4	MW5	MW6	
Sampling Event	Sampling Date	1,2 DICHLOROBENZENE CONCENTRATION (mg/L)						
1	12-Apr-11	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
2	27-Oct-11	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
3	7-Mar-12	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
4	2-Jul-12	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	
5	12-Dec-12	0.005	<0.002	<0.002	<0.002	<0.002	<0.002	
6	9-Oct-13	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	
7	13-Mar-15	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
8	18-Feb-16	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
9	12-Jun-17	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
10	18-Jul-18	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	
11	20-Jul-20	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.37						
Mann-Kendall Statistic (S):		-1						
Confidence Factor:		50.0%						
Concentration Trend:		Stable						



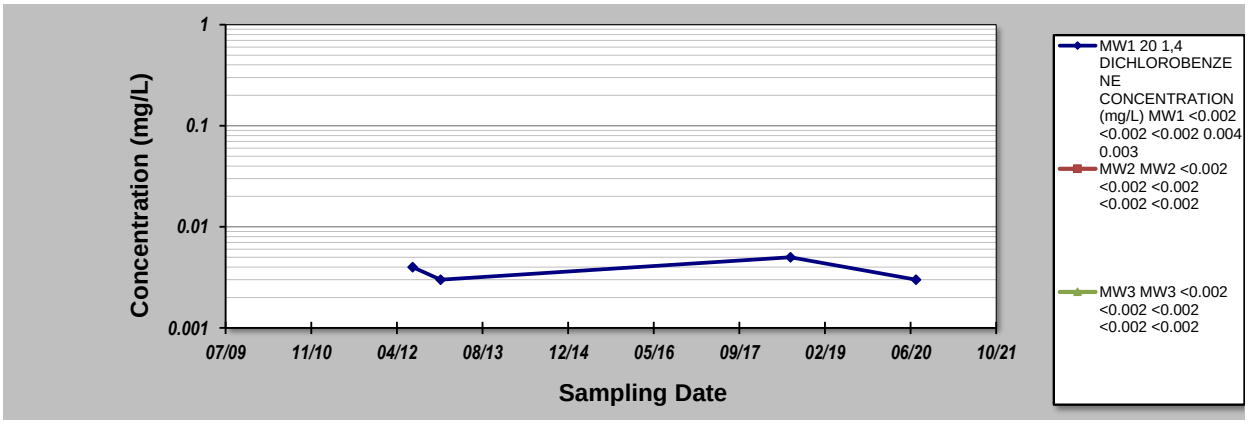
Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	19-Aug-20	Job ID:	20-0530
Facility Name:	RGM	Constituent:	1,4 Dichlorobenzene
Conducted By:	T.Brown	Concentration Units:	mg/L

Sampling Point ID:	MW1	MW2	MW3	MW4	MW5	MW6	
Sampling Event	Sampling Date	1,4 DICHLOROBENZENE CONCENTRATION (mg/L)						
1	12-Apr-11	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
2	27-Oct-11	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
3	7-Mar-12	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
4	2-Jul-12	0.004	<0.002	<0.002	<0.002	<0.002	<0.002	
5	12-Dec-12	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	
6	9-Oct-13	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
7	13-Mar-15	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
8	18-Feb-16	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
9	12-Jun-17	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
10	18-Jul-18	0.005	<0.002	<0.002	<0.002	<0.002	<0.002	
11	20-Jul-20	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.26						
Mann-Kendall Statistic (S):		-1						
Confidence Factor:		50.0%						
Concentration Trend:		Stable						



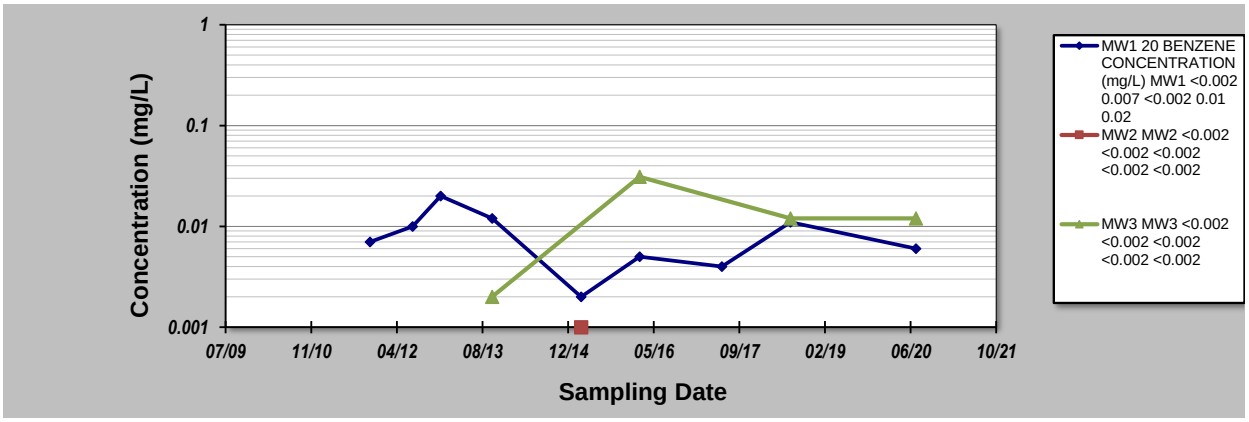
Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	19-Aug-20	Job ID:	20-0530
Facility Name:	RGM	Constituent:	Benzene
Conducted By:	T.Brown	Concentration Units:	mg/L

Sampling Point ID:	MW1	MW2	MW3	MW4	MW5	MW6	
Sampling Event	Sampling Date	BENZENE CONCENTRATION (mg/L)						
1	12-Apr-11	<0.002	<0.002	<0.002	<0.002	not sampled	not sampled	
2	27-Oct-11	0.007	<0.002	<0.002	<0.002	not sampled	not sampled	
3	7-Mar-12	<0.002	<0.002	<0.002	<0.002	not sampled	not sampled	
4	2-Jul-12	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	
5	12-Dec-12	0.02	<0.002	<0.002	<0.002	<0.002	not sampled	
6	9-Oct-13	0.012	<0.002	0.002	<0.002	<0.002	<0.002	
7	13-Mar-15	0.002	0.001	<0.001	<0.001	<0.001	<0.001	
8	18-Feb-16	0.005	<0.001	0.031	<0.001	<0.001	<0.001	
9	12-Jun-17	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	
10	18-Jul-18	0.011	<0.001	0.012	<0.001	<0.001	<0.001	
11	20-Jul-20	0.006	<0.001	0.012	<0.001	<0.001	<0.001	
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.64		0.85				
Mann-Kendall Statistic (S):		-6		1				
Confidence Factor:		69.4%		50.0%				
Concentration Trend:		Stable		No Trend				



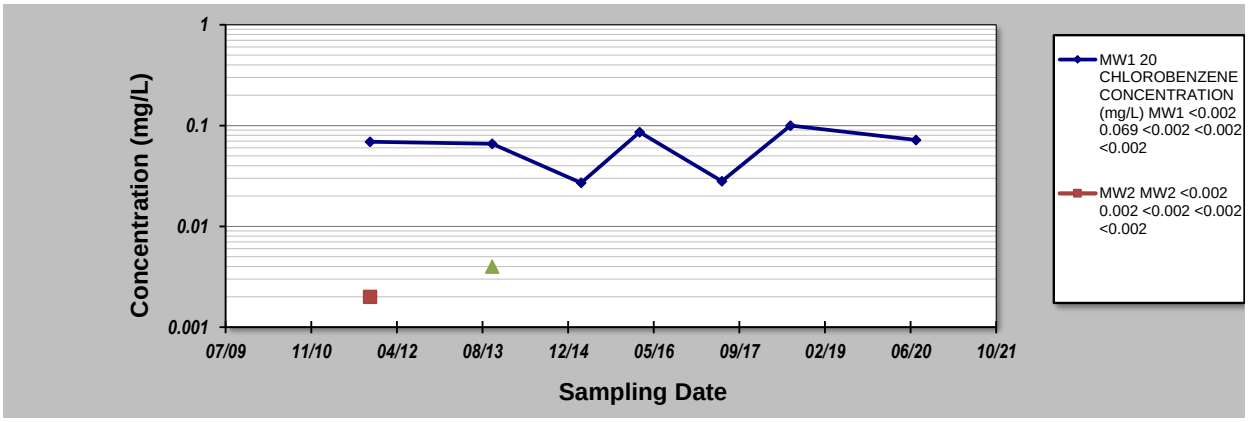
Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	19-Aug-20	Job ID:	20-0530
Facility Name:	RGM	Constituent:	Chlorobenzene
Conducted By:	T.Brown	Concentration Units:	mg/L

Sampling Point ID:	MW1	MW2	MW3	MW4	MW5	MW6	
Sampling Event	Sampling Date	CHLOROBENZENE CONCENTRATION (mg/L)						
1	12-Apr-11	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
2	27-Oct-11	0.069	0.002	<0.002	<0.002	<0.002	<0.002	
3	7-Mar-12	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
4	2-Jul-12	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
5	12-Dec-12	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
6	9-Oct-13	0.066	<0.002	0.004	<0.002	<0.002	<0.002	
7	13-Mar-15	0.027	<0.002	<0.002	<0.002	<0.002	<0.002	
8	18-Feb-16	0.086	<0.002	<0.002	<0.002	<0.002	<0.002	
9	12-Jun-17	0.028	<0.002	<0.002	<0.002	<0.002	<0.002	
10	18-Jul-18	0.1	<0.002	<0.002	<0.002	<0.002	<0.002	
11	20-Jul-20	0.072	<0.002	<0.002	<0.002	<0.002	<0.002	
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.43						
Mann-Kendall Statistic (S):		5						
Confidence Factor:		71.9%						
Concentration Trend:		No Trend						



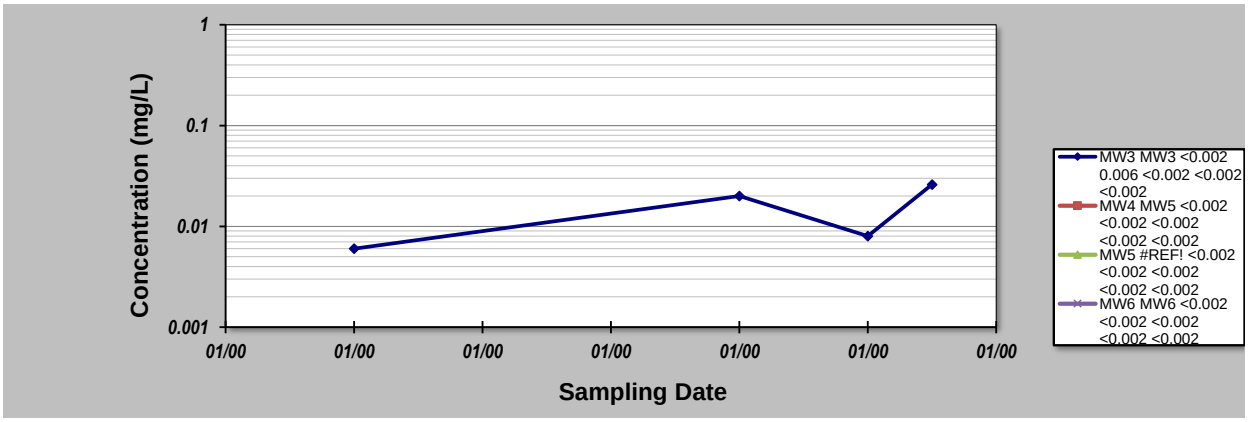
Notes:

1. At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	19-Aug-20	Job ID:	20-0530
Facility Name:	RGM	Constituent:	Isopropyl Benzene
Conducted By:	T.Brown	Concentration Units:	mg/L

Sampling Point ID:	MW1	MW2	MW3	MW4	MW5	MW6	
Sampling Event	Sampling Date	ISOPROPYL BENZENE CONCENTRATION (mg/L)						
1	12-Apr-11	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
2	27-Oct-11	<0.002	<0.002	0.006	<0.002	<0.002	<0.002	
3	7-Mar-12	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
4	2-Jul-12	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
5	12-Dec-12	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
6	9-Oct-13	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
7	13-Mar-15	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
8	18-Feb-16	<0.002	<0.002	0.02	<0.002	<0.002	<0.002	
9	12-Jun-17	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
10	18-Jul-18	<0.002	<0.002	0.008	<0.002	<0.002	<0.002	
11	20-Jul-20	<0.002	<0.002	0.026	<0.002	<0.002	<0.002	
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:				0.64				
Mann-Kendall Statistic (S):				4				
Confidence Factor:				83.3%				
Concentration Trend:				No Trend				



Notes:

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2. Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
3. Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water* , 41(3):355-367, 2003.

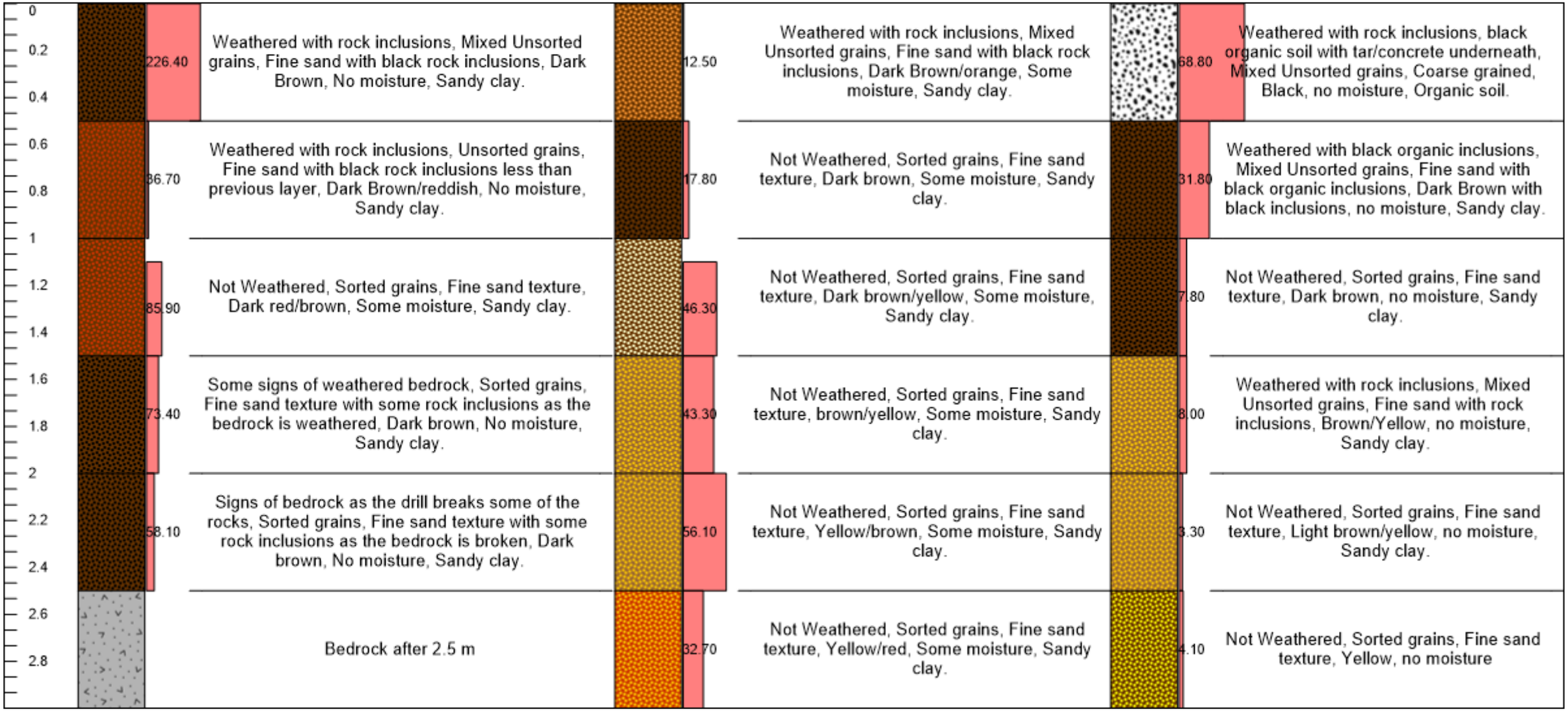
APPENDIX D – SOIL LOGS

PROJECT: 20-0530 Protea Chemicals | LOCATION: Durban | DATE COMPLETED: Sep-20

AUGER HOLE ID: SS1				AUGER HOLE ID: SS2				AUGER HOLE ID: SS3			
LONGITUDE: -29.930838°				LONGITUDE: -29.930813°				LONGITUDE: -29.930955°			
LATITUDE: 30.978646°				LATITUDE: 30.978836°				LATITUDE: 30.978914°			
DEPTH: 3m				DEPTH: 3m				DEPTH: 3m			
Depth (m)	Graphic log	PID (ppm)	Description	Graphic log	PID (ppm)	Description		Graphic log	PID (ppm)	Description	
0 – 0.4		22.50	Weathered with rock inclusions Unsorted grains, Fine sand with rock inclusions, Dark Brown, No moisture. Sandy clay		5.20	Weathered with rock inclusions Unsorted grains, Fine sand with rock inclusions, Dark Brown, No moisture. Sandy clay			7.30	Weathered with rock inclusions, Mixed Unsorted grains, Fine sand with rock inclusions, Dark Brown/Orange, No moisture, Sandy clay.	
0.4 – 0.8		12.40	Weathered, Sorted grains, Fine sand texture, Dark Brown, No moisture, Sandy clay.		18.20	Weathered, Sorted grains, Fine sand texture, Dark Brown, No moisture, Sandy clay.			12.60	Not Weathered, Sorted grains, Fine sand texture, Red/orange, No moisture, Sandy clay.	
0.8 – 1.4		6.30	Some sign of weathering, Sorted grains, Fine sand texture, Dark Brown/Yellow, No moisture, Sandy clay.		10.60	Some sign of weathering, Sorted grains, Fine sand texture, Dark Brown/Yellow, No moisture, Sandy clay.			2.70	Not Weathered, Sorted grains, Fine sand texture, Orange, No moisture, Sandy clay.	
1.4 – 1.8		9.10	Some sign of weathering, Sorted grains, Fine sand texture, Dark Brown/Yellow, No moisture, Sandy clay.		6.00	Some sign of weathering, Sorted grains, Fine sand texture, Dark Brown/Yellow, No moisture, Sandy clay.			13.20	Not Weathered, Sorted grains, Fine sand texture, Orange, No moisture, Sandy clay	
1.8 – 2.4		29.30	No weathering, Sorted grains, Fine sand texture, Dark Brown/Orange, No moisture, Sandy clay		5.10	No weathering, Sorted grains, Fine sand texture, Dark Brown/Orange, No moisture, Sandy clay			3.20	Not Weathered, Sorted grains, Fine sand texture, Red/Orange, No moisture, Sandy clay.	
2.4 – 2.8		9.10	No weathering, Sorted grains, Fine sand texture, Light Brown/Yellow, No moisture, Sandy clay.		10.20	No weathering, Sorted grains, Fine sand texture, Light Brown/Yellow, No moisture, Sandy clay.			4.20	Not Weathered, Sorted grains, Fine sand texture, Red/Orange, No moisture, Sandy clay.	

PROJECT: 20-0530 Protea Chemicals | LOCATION: Durban | DATE COMPLETED: Sep-20

AUGER HOLE ID: SS4	AUGER HOLE ID: SS5	AUGER HOLE ID: SS6
LONGITUDE: -29.931095°	LONGITUDE: -29.930957°	LONGITUDE: -29.931354°
LATITUDE: 30.979089°	LATITUDE: 30.978762°	LATITUDE: 30.979090°
DEPTH: 3m	DEPTH: 3m	DEPTH: 3m



APPENDIX

F ENVIRONMENTAL MANAGEMENT PROGRAMME

PROTEA CHEMICALS (PTY) LTD

PROTEA CHEMICALS DECOMMISSIONING OF STORAGE TANKS

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

22 FEBRUARY 2021

DRAFT

PROTEA CHEMICALS DECOMMISSIONING OF STORAGE TANKS

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

PROTEA CHEMICALS (PTY) LTD

TYPE OF DOCUMENT (VERSION)
DRAFT

PROJECT NO.: 41103051
DATE: FEBRUARY 2021

WSP
1ST FLOOR, PHAROS HOUSE
70 BUCKINGHAM TERRACE, WESTVILLE
DURBAN, 3629
SOUTH AFRICA

T: +27 31 240 8804
F: +27 31 240 8801
WSP.COM

QUALITY MANAGEMENT

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Prepared by	Babalwa Mqokeli			
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Checked by	Carla Elliott			
Signature				
Authorised by	Carla Elliott			
Signature				
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SIGNATURES

PREPARED BY

Babalwa Mqokeli
Consultant

REVIEWED BY

Carla Elliott
Associate

PRODUCTION TEAM

CLIENT

Corporate Environmental Specialist	Tholoana Seotsanyana
Site Manager – Distribution Centre	Nilesh Rughoober

WSP

Associate	Carla Elliott
Environmental Consultant	Babalwa Mqokeli

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1 INTRODUCTION

1.1 BACKGROUND

Protea Chemicals (Pty) Ltd (Protea Chemicals) is proposing site exit of the Jacobs facility. This requires the decommissioning and removal of fifty-five (55) tanks used previously for the storage of dangerous goods (Acids, Alkaline, and Solvents). These tanks comprise both underground storage tanks (UST) and above ground storage tanks (AST).

The Environmental Impact Assessment (EIA) Regulations (Government Notice Regulation (GNR) 326 of 2017), promulgated under the National Environmental Management Act (No. 107 of 1998), as amended (NEMA), identify activities that would be subject to a Basic Assessment (BA) process. The proposed tanks storage decommissioning requires an environmental authorisation due to the applicability of activities listed in the EIA Listing Notices GNR.327 and GNR.324 (07 April 2017). In order for the proposed project to proceed it will require an Environmental Authorisation (EA) from the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (EDTEA).

This Environmental Management Programme (EMPr) has been compiled in support of Protea Chemical's EA application for the proposed decommissioning and removal of tanks previously storing dangerous goods. The EMPr has been prepared in compliance with Section 19 of NEMA and Appendix 4 of the EIA Regulations, as amended.

1.2 SCOPE OF THE EMPR

The EMPr is applicable to the decommissioning phase of the storage tanks as per the project description (**Section 3**). This EMPr is the primary document for managing potential environmental risks and opportunities during the project. It provides the framework for identifying environmental aspects and impacts, and environmental controls and processes to be implemented by the project proponent and contractors in carrying out their respective responsibilities. The EMPr serves as a live document and should be revised and updated to reflect any new information that should arise. The objectives of the EMPr are to:

- Provide effective, site-specific and implementable procedures and mitigation measures to control and monitor environmental impacts of the decommissioning phases, such that the related activities do not adversely impact the environment in the surrounding area.
- Comply with all applicable national laws, regulations, standards and guidelines for the protection of the environment.
- Train employees and contractors with regard to environmental obligations.
- Ensure that during the life of the project, Protea Chemicals ensures mitigation for negative impacts associated with the decommissioning work.

1.3 DETAILS OF ENVIRONMENTAL ASSESSMENT PRACTITIONER

WSP Environmental (Pty.) Ltd, Africa (WSP) has been appointed in the role of independent Environmental Assessment Practitioner (EAP) to undertake the BA processes for the proposed project as well as to develop this Environmental Management Programme (EMPr). **Table 1-1**outlines the details of the EAP and their expertise.

Table 1-1: Details of Environmental Assessment Practitioner

DETAILS

Name of Consultant	WSP Environmental (Pty) Ltd

Contact Person	Carla Elliott
Address	1st Floor, Pharos House 70 Buckingham Terrace Westville, Durban 3629
Telephone	031 240 8874
Fax	031 240 8801
Email	Carla.elliott@wsp.com
EAP Expertise	Carla has 15 years post graduate experience in the field of economic development, project management and environmental services. Carla has been a project manager of various strategic and integrated development projects. Her areas of expertise include: environmental strategic and framework planning and environmental management authorisation processes both within the infrastructural and industrial sectors. She has undertaken various projects in the South Durban Basin, including the decommissioning project at the Port of PE.

1.4 ENVIRONMENTAL MANAGEMENT PROGRAMME STRUCTURE

Table 1-2 cross references the sections within the EMPr with the legislated requirements as per Appendix 4 of GNR 326 of 2017, as amended.

Table 1-2: Legislation Requirements as detailed in Appendix 4 of GNR 326

APPENDIX 4	LEGISLATED REQUIREMENTS AS PER THE NEMA GNR 326	RELEVANT REPORT SECTION
(a)	details of-	
	(i) the EAP who prepared the EMPr; and	Section 1.3
	(ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Section 1.3 and Appendix B of BAR
(b)	a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 3
(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;	Section 3 / Figure 3-2

(d)	A description of the impact management outcomes, 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-	Section 5
	(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;	
(f)	a description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraphs (d) will be achieved, and must, where applicable, include actions to -	Section 5
	(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);	Section 4.5
(h)	the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 4.5 / Section 5
(i)	an indication of the persons who will be responsible for the implementation of the impact management actions;	Section 4 / Section 5
(j)	the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Section 5
(k)	the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Section 4 / Section 5
(l)	a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations	Section 4 / Section 5
(m)	an environmental awareness plan describing the manner in which-	Section 4.2
	(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	N/A

1.5 APPLICABLE DOCUMENTATION

The following documents are to be read in conjunction with the EMPr:

- Basic Assessment Report (BAR) for the Proposed Decommissioning of Storage Tanks;
- Environmental Authorisation issued by the KZN DEDTEA in terms of the NEMA (once issued); and
- Protea Chemicals Standard Operating Procedures

2 LEGAL FRAMEWORK

The national environmental legislation applicable to the proposed project includes, but is not limited, to the following:

- The Constitution of the Republic of South Africa (No. 108 of 1996);
- National Environmental Management Act (No. 107 of 1998);
- National Environmental Management, Waste Act (No 59 of 2008);
- National Environmental Management, Air Quality Act (No 39 of 2004);
- National Water Act, (No 36 of 1998);
- Occupational Health and Safety Act, (No 85 of 1993);
- National Heritage Resource Act (No. 25 of 1999); and
- Hazardous Substances Act (No. 15 of 1973).

3 PROJECT DESCRIPTION

Protea Chemicals is situated at the corner of Quality Street and Balfour Street in Jacobs, Durban, KwaZulu - Natal. The site is surrounded by commercial and light industrial land-use in the Jacobs area (**Figure 3-1**). Tanks at the Jacobs site were installed and operated pre-2014, and operation of the tanks ceased in July 2020.

Site exit at the Jacobs facility requires the decommissioning and removal of fifty-five (55) tanks storing dangerous goods. This comprises thirty-three (33) tanks of a combined capacity of 422, 500 litres storing Acids and Alkaline (also referred to as BTPs[1]) and twenty-two (22) tanks of a combined capacity of 226, 00 litres storing Solvents. Solvents have been stored in nineteen (19) underground storage tanks (UST) and three (3) above ground storage tanks (AST). Acids and Alkalines have been stored in 33 ASTs. An overview of the site layout is presented in **Figure 3-2.**

There is no plan to demolish subsurface structures / insitu systems etc. The future buyer would need to determine any other environmental requirements should future use of the site required decommissioning of support infrastructure.

3.1 PROPOSED DECOMMISSIONING ACTIVITIES

3.1.1 TANK REMOVAL AND WASTE MANAGEMENT

The chemical inventory (Safety Data Sheets) for the site suggests that most are hazardous - residual chemicals are therefore required to be managed accordingly. All tanks were therefore pressure cleaned and emptied of any residual liquid and cleaned where required. Potentially contaminated wash water was collected by Oricol Environmental Services in sealed receptacles for disposal at an appropriate licenced facility.

Atomic Demolishers have provided a scope of work for demolition, including both removal of tanks for scrapping by Atomic[2] and relocation of tanks. This will entail:

- Compilation and submission of a Health and Safety Plan by the Contractor
- Site establishment
- Mobilisation of plant and equipment including a ZX330 excavator with hammer attachment
- Mechanical demolition of concrete surface to expose underground tanks
- Rigging of underground tanks and placing onto ground elevation for processing.
- Controlled demolition of overhead and surface mounted tanks /vessels by use of a Hyundai 50ton with a mechanical shear attachment
- Demolition of infrastructure to tanks such us platforms, columns and beams
- Demolition of any walls in the way or requested to be demolished between tank farm and bund areas
- Processing of tanks to be demolished as per inventory listing inclusive of stainless tanks
- Cut and process material into manageable size for removal
- Rigging of JoJo tanks and setting aside for reuse
- Loading of material into designated trucks and skips
- Cartage of steel material from site

[1] The terms acid and base describe chemical characteristics of many substances that we use daily. Acidic things taste sour. Basic or alkaline things taste soapy. Strong acids are corrosive and strong bases are caustic; both can cause severe skin damage that feels like a burn (https://www2.nau.edu/lrm22/lessons/acids_and_bases/acids_and_bases.html).

[2] All material will become the property of Atomic – this is presumably linked to recover cost of demolition via scrap return.

- Stockpiling of rubble into designated stockpiles for filling by others
- Basic cleaning of site
- De-establishment

3.1.2 TANK REUSE

Six (6) ASTs are planned to be retained and reused at other Protea Chemical Facilities as planned:

- Three (3) tanks (previously storing caustic and white spirits) to be used at the Wadeville site in Gauteng
- Three (3) tanks (previously storing caustic) to be used at the Mobeni site in Durban
- Rig and transport 3 x tanks to Mobeni Site including offloading
- Rig and Transport 3 x Tanks to Wadeville site including offloading

3.1.3 TANK SCRAPPING AND DISPOSAL

Atomic shall handle the removal of tanks on site that shall be sent for scrap metal. End of life for all USTs (i.e. Solvents) includes:

- The disposal of Protea Chemical Tanks in poor condition
- The return of ten (10) tanks (white liquor, caustic, diesel etc.) to Engen (leased)[3]

[3] Engen tanks will be removed as per Engen Protocols with a team allocated for tank removal. Engen shall only start the project plan after a "Record of Decision" has been received from the Department.

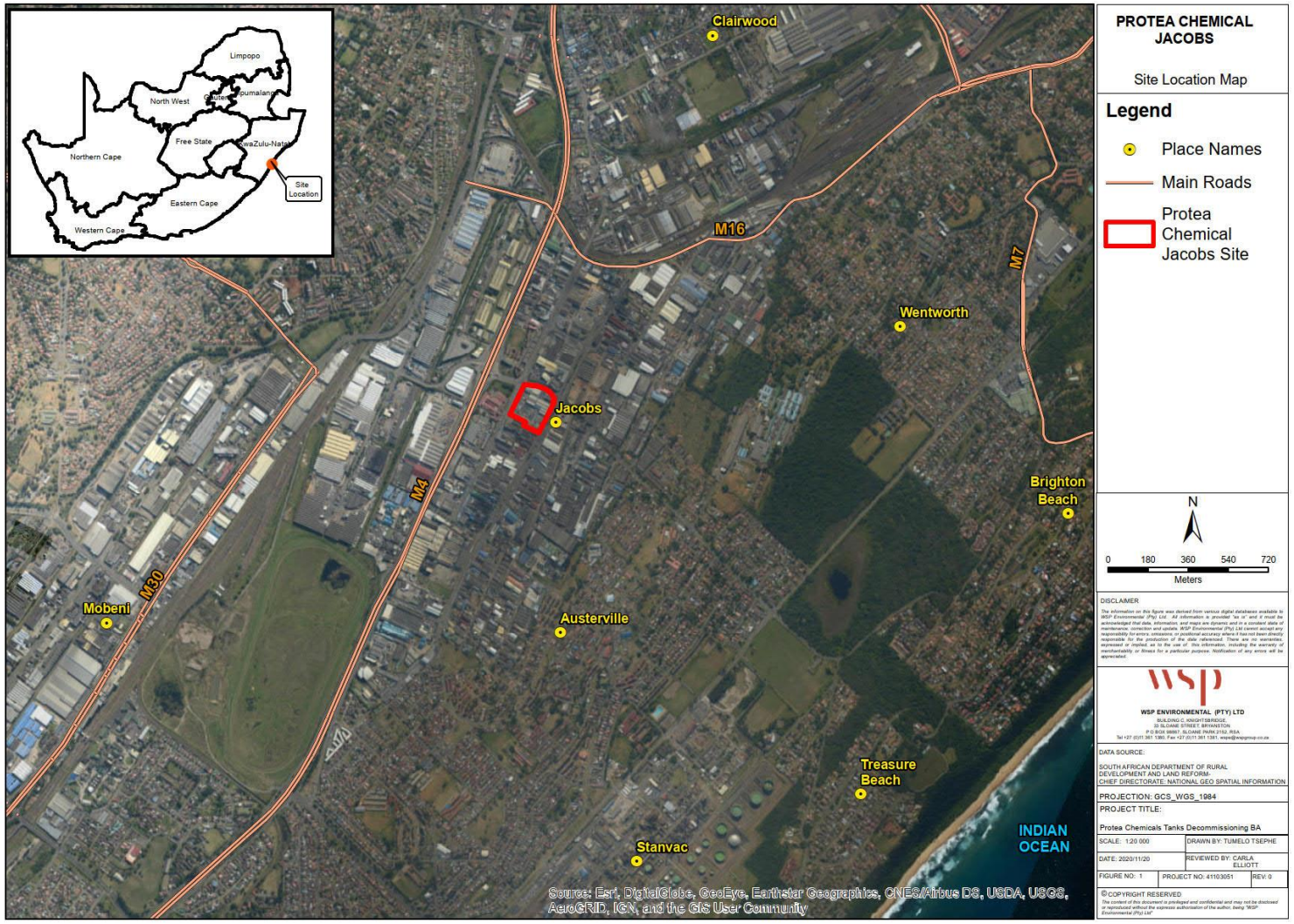

Figure 3-1: Locality setting of the Protea Chemicals Jacobs site (WSP, 2020)

Figure 3-2: Protea Chemicals Jacobs Facility Site Layout (WSP, 2020)

4 ENVIRONMENTAL MANAGEMENT PROGRAMME GOVERNANCE

4.1 ROLES AND RESPONSIBILITIES

Table 4-1 provides a high level outline of the various roles and responsibilities of Protea Chemicals representatives and the Contractor(s).

Table 4-1: Roles and Responsibilities

DESIGNATION	ROLES AND RESPONSIBILITY
Protea Chemicals Site Manager & Corporate Environmental Specialist	– Prepare EMPr amendments / updates if required. – Authorise environmental method statements. – Environmental awareness training. – Stakeholder engagement. – Maintain environmental incidents and stakeholder complaints register. – Environmental incident management. – Effect designated Management and Mitigation Actions detailed in the EMPr.
Protea Chemicals Project Manager	– Reviewing the reports compiled by the Environmental Manager. – Inclusion of EMPr in tender documentations / contractor appointment documentation. – Communicating directly with the Contractors. – Issuing non-conformance notification to Contractors that do not comply with the requirements of the EMPr and associated requirements or documents (including EA, other permits and licenses).
Independent Environmental Control Officer (ECO)	– Undertake compliance audits against the EMPr and conditions of the EA. – Prepare audit reports (and submit reports to the relevant authority as required). – Provide support and advice to the project team, contractor and all subcontractors in the implementation of environmental management procedures and corrective actions. – Assess the efficacy of the EMPr and identify possible areas of improvement or amendment required within the EMPr. – Facilitate the amendment of the EMPr in conjunction with the Environmental Manager (as required).
Contractors, Staff and Service Providers	– Prepare Method Statements as per the EMPr. – Regular on-site auditing to assess performance against the requirements of this EMPr. – Completion of the appropriate training requirements as specified in the training program (**Table 3-2**). – Implementation and maintenance of environmental management controls as set out in the project's environmental management documentation.

4.2 ENVIRONMENTAL AWARENESS PLAN

Protea Chemicals has the responsibility to ensure that all persons involved in the project are aware of, and are familiar with, the environmental requirements of the project. All project personnel, including contractors and sub-contractors are required to receive training of a type and level of detail that is appropriate for the environmental aspects of their work. As a minimum, all personnel are required to complete the training requirements stipulated in **Table 4-2.**

Table 4-2: Training and Induction Requirements

AWARENESS INITIATIVE	PURPOSE	FREQUENCY
Site Induction	The purpose of the induction is to ensure that, as a minimum, all on-site personnel understand the EMPr in terms of: — Key issues relating to the project. — Relevant conditions of the EA. — Waste management and minimisation. — Minimising potential impacts to air, noise and water quality. — Erosion and sediment control. — Surface and groundwater contamination. — Spill control measures. — Environmental Emergency Plan. — Incident reporting procedures. — Best pollution prevention practices. — Roles and responsibility relating to environmental management.	Decommissioning Phase: prior to commencement of work by staff and / or contractors.
Toolbox Talks	Toolbox talks are intended to deliver specific training in an aspect of work or control including: — Personal Protective Equipment (PPE) requirements. — Waste handling procedures. — Spill management procedures. — Ad hoc training and awareness as required to promote compliance with the EMPr.	Decommissioning Phase: As required

The Decommissioning Contractor must make allowance for all decommissioning site staff, including all subcontractors that will be working at the site, to attend environmental awareness training sessions prior to commencement of any work on site. Attendance records must be completed after each training session for the above and retained on site within the Environmental File.

4.3 INCIDENT MANAGEMENT AND MITIGATION

Table 4-3 itemises the requirements for incident management and mitigation.

Table 4-3: Incident Management and Mitigation

ASPECT	REQUIREMENT

Reporting of Environmental Incidents	– Any environmental incident should be reported immediately to the Protea Chemicals Site Manager. – Immediate correspondence should be taken with the relevant staff members to determine mitigation and close-out requirements. – All significant incidents are to be reported to the relevant Authority as per the legal requirements.
Contents of Environmental incident records	Environmental incident reporting and recording should include the following information and be retained in the Environmental File: – Time, date and nature of the incident. – Response and investigation undertaken. – Actions taken and by whom.
Continual Improvement	– Corrective and preventative action requests should be forwarded to the responsible person so that corrective action can be taken. Open non-conformances should only be closed on verification by the Project Manager that the corrective action has been implemented effectively in order to meet the EMPr requirements. – The cause of all incidents should be investigated to determine root cause and to ensure that corrective action is able to be implemented to ensure that there is no repeat of the incident. – A summary and review of incidents recorded during the decommissioning activities should be included within a report by the Protea Chemicals Site Manager (and retained in the Environmental File). – If required following an incident, a review of the efficacy of the EMPr should be undertaken by the Protea Chemicals Environmental Manager in order to identify possible areas of improvement or updating or amendment required within the EMPr.

4.4 STAKEHOLDER AND COMMUNITY ENQUIRIES AND COMPLAINTS

Enquiries or complaints should be able to be received from adjacent land-users and / or the community (i.e. stakeholders) through the following channels:

– Contact: **Protea Chemicals Site Manager (Nilesh Rughoobeer)**
– Telephone number: **+27 827768832**

Community enquiries or complaints that are environmental in nature must be brought to the attention of the above Protea Chemicals representative who should ensure corrective action and close-out. As a minimum the following information should be recorded:

– Time, date and nature of enquiry or complaint.
– The means by which the enquiry or complaints was made.
– Personal details of the person / party lodging the enquiry or complaint (subject to privacy considerations).
– Actions taken to investigate and close-out the complaint as well as complainant feedback.

All complaints received will be investigated and a response (even if pending further investigation) will be given to the complainant within 7 days.

Any actions that cannot be managed immediately should be assigned to the appropriate personnel and become an outstanding action. The action remains outstanding until it is closed off by the Project Manager.

4.5 ENVIRONMENTAL PERFORMANCE MONITORING

4.5.1 INTERNAL MONITORING

The Protea Chemicals Site Manager is required to monitor the performance of the contractor against the conditions of the EA and the EMPr. The frequency and scope of the internal monitoring is at the discretion of the Protea Chemicals Environmental Manager unless indicated otherwise within the EA.

4.5.2 EXTERNAL MONITORING

External environmental audits of the EMPr must be undertaken by an independent environmental consultant / Environmental Control Officer (ECO) upon commencement of the decommissioning activities. The EA will determine the frequency of external audits, however weekly audits (including pre- and post-decommissioning) are recommended.

In order to facilitate communication between the ECO, Project Manager / Environmental Manager and Contractor, it is important that a suitable chain of command is structured that will ensure that the ECO's recommendations have the full backing of the Protea Chemicals project team before being conveyed to the Contractor.

4.6 DOCUMENT CONTROL (ENVIRONMENTAL FILE)

The Site Manager (supported by the Protea Chemicals Corporate Environmental Specialist) is responsible for ensuring that up to date documentation is kept on-site; this should include, as a minimum, the following:

- Copy of the EA
- Up to date copy of the EMPr;
- Approved Contractor Method Statements;
- Emergency Response Plan
- Spill Contingency Plan
- Copies of other Contractor environmental information such as Waste Safe Disposal Certificates
- Environmental monitoring and inspection reports (internal and external);
- Environmental Incident Reports;
- Records of stakeholder and community complaints and follow-up actions taken; and
- Induction and training records.

4.7 ENVIRONMENTAL METHOD STATEMENTS

Method Statements are written suggestions by the contractor to the ECO in response to the requirements of this EMPr, or as requested by the ECO. The contractor shall be required to prepare Method Statements for several specific decommissioning activities and/or environmental management aspects.

The contractor shall not commence the activity for which a Method Statement is required until the ECO has approved the relevant Method Statement.

Method Statements must be submitted and accepted or rejected timeously as suggested below:

Failure to submit a Method Statement may result in suspension of the activity concerned until such time as a Method Statement has been submitted and approved.

The Method Statements shall cover relevant details with regard to:

- Proposed decommissioning works;

- Delineation of laydown areas / active work areas;
- Materials and equipment to be utilised;
- Procedures for transporting materials to/from site (entry/exit points and turning areas would be indicated on the site plan);
- Method and location of storage of material (this would be required to be indicated on a site plan);
- Emergency Response Plan;
- Spill Contingency Plan;
- Recommendations outlined within this report;
- Management of materials (movement, storage, preparation/handling);
- Waste management;
- Erosion control/s;
- Equipment maintenance; and,
- Roles and responsibilities of the Contractor's key personnel concerning environmental management.

This Method Statement will be used in conjunction with the EMPr during project activities and included in Contractor tender documents.

4.8 EMPR REVISIONS

It is proposed that revisions may only be made by the independent ECO. In the case of amendments that materially change the project impacts, the amendments are to be submitted to the EDTEA for approval.

5 PROPOSED MITIGATION AND MANAGEMENT MEASURES

5.1 PLANNING, DESIGN AND PRE-DECOMMISSIONG PHASE

POTENTIAL ISSUES / IMPACTS	MANAGEMENT ACTIONS	RESPONSIBLE PERSON	TIMEFRAME
Impact Management Objective: – To implement measures to minimise impacts on the environment from the initiation of decommissioning activities through planning, careful site access route selection and the identification and demarcation of no-go areas, working areas and site camp facilities.			
Impact on the environment during decommissioning.	– A suitably qualified and external ECO must be appointed before any activities commence on site. – The appointed ECO must undertake a pre-decommissioning inspection, manage and verify compliance with the EA and EMPr. – Disturbance and decommissioning activities are restricted to the development layout footprint. – Any no-go area must be identified before the decommissioning commences, and must be designated as no-go areas (cordoned off), and clearly communicated to contractors. – A site layout plan, which indicates site access points; storage locations; temporary waste storage areas; and other significant development infrastructure, must be developed (by the contractor), approved (by Protea Chemicals Environmental Manager) and complied with. – Locate firefighting measures onsite, such as fire extinguishers, and make personnel aware of fire prevention and firefighting measures.	Protea Chemicals Project Manager & Contractor	Planning and Pre-decommissioning phase

5.2 DECOMMISSIONING PHASE

5.2.1 AIR EMISSIONS

POTENTIAL ISSUES / IMPACTS	MANAGEMENT ACTIONS	RESPONSIBLE PERSON	TIMEFRAME
Impact Management Objective: – To minimise potential fugitive emissions release associated with construction activities, materials transport etc.			
Decommissioning activities will result in localised dust emissions which could result in a nuisance factor to sensitive receptors if unabated.	– Ensure that the equipment, machinery and vehicles are adequately maintained so as to reduce emissions. – No burning of waste, such as plastic bags, cement bags and litter is permitted. – Dust must be monitored and the ground wetted if a nuisance factor is identified (e.g. within Complaints Register). – Avoid dust-generating activities during windy periods. – Cover and/or maintain appropriate freeboard on trucks hauling any loose material that could produce dust when travelling. – Implement effective and environmentally-friendly dust control measures during excavation activities.	Site Manager/Protea Chemicals Project Manager & Contractor	Decommissioning phase

5.2.2 NOISE

POTENTIAL ISSUES / IMPACTS	MANAGEMENT ACTIONS	RESPONSIBLE PERSON	TIMEFRAME
Impact Management Objective: – To minimise environmental noise levels at the site and at potential off-site receptors.			

The decommissioning activities will involve the use of construction machinery resulting in noise sources at the site.	– Maintain vehicles and machinery in good working order. – Equipment fitted with noise reduction facilities will be used, if deemed necessary, and undergo regular maintenance to ensure optimum efficiency during operation. – Equipment with a lower noise output should be selected where practical (e.g. electronic powered equipment typically has lower noise levels than equivalent diesel equipment). – Maintain a Complaints Register to report any excessive noise incidents (and kept within Environmental File). – Investigate all complaints or observations of excessive noise and assess possibilities for mitigation. – Non-tonal reverse alarms for site based equipment should be used where practical. – Avoid noisy activities at night-time and outside of normal weekend working hours where possible. – Employees / contractors are to be provided with appropriate PPE when undertaking work in noisy environments.	Site Manager & Contractor	Decommissioning phase

5.2.3 SOIL EROSION/INSTABILITY

POTENTIAL ISSUES / IMPACTS	MANAGEMENT ACTIONS	RESPONSIBLE PERSON	TIMEFRAME
Impact Management Objective: – To prevent soil erosion instability.			

The natural soil on the site is likely to be poorly consolidated material that may have a generally collapsible fabric as well as rapid lateral and vertical variability in clay content and moisture conditions. These materials are also likely to be sensitive to changes in moisture content. Therefore any excavations are likely to have a variable stability depending on moisture conditions. As such excavations should be considered to be unstable and allowances should be made for safe excavation practices to be followed.	– Backfilling of excavations should be done using compacted lifts of materials of similar or greater strength to the in situ soil profile. This is to ensure that the filled void does not settle excessively after filling. – All disturbed areas susceptible to erosion must be suitably covered and/or stabilised via the implementation of effective erosion control measures.	Site Manager & Contractor	Decommissioning phase

5.2.4 HAZARDOUS SUBSTANCES AND CONTAMINATION

POTENTIAL ISSUES / IMPACTS	MANAGEMENT ACTIONS	RESPONSIBLE PERSON	TIMEFRAME
Impact Management Objective: – To manage any potentially contaminated seepage and stormwater from the site. – To prevent occupational health and safety incidents. – To ensure that soil and groundwater resources are adequately protected.			

The storage and handling of hazardous substances (such as diesel and oil) has the potential to result in accidental spillage of small quantities of hazardous substances.	<u>Above ground Storage / Handling of Hazardous Substances</u> — Storage of hazardous materials should be undertaken within impermeable bunded, ventilated and covered storage areas, capable of containing 110% of total volume. — All storage containers are to be labelled, sealed and stored in accordance with Material safety Data Sheets (MSDS) / Safety Data Sheets (SDS) requirements. — Use drip trays on vehicles and machinery that are prone to oil leaks. — Machinery must be regularly checked to ensure hydrocarbon leaks (including fuel and hydraulic fluids) are not occurring. — No repair work must be undertaken on machinery onsite or campsite area. — Contaminated soil must be removed as soon as possible and managed appropriately as hazardous waste. — Utilise the existing Storm water Management Plan (SWMP) to control the flow of stormwater and limit the potential of dirty water from mixing with clean water sources. — All stormwater generated by the medium to high risk contamination 'dirty' areas must not be allowed to discharge into the surrounding environment. — Ensure the integrity of the hardstanding surface on the site is maintained to prevent any potential seepage of contaminated surface water to groundwater sources. — Personnel involved in the handling of hazardous waste must be provided with the necessary PPE as stipulated in the MSDS/SDS. <u>Spill and Incident Management</u> — Spill and response equipment must be accessible on-site. — Suitable spill containment must be provided for transfer points outside of bunded areas. — Spillages / leaks are to be contained immediately; deploy oil containment berms if the spill migrates to other areas. — Cover the spill with absorbent material. — Dispose of the clean-up material in line with MSDS/SDS requirements of spilled material.	Contractor	Decommissioning phase

Potential leakage of residual hazardous substances during the removal of tanks on site leading to localised contamination to surrounding soils.	– Ensure all tanks are emptied or cleaned prior to tanks removals, and the residual chemicals are managed accordingly (i.e. disposed as hazardous waste at licensed facility). – Ensure safe disposal certificates are available on request. – Residual chemicals to be managed in accordance with the relevant MSDS/SDS. – Validation analysis of the surrounding soils within the cavity must be undertaken following uplift of tanks, and prior to backfilling of excavation cavities to prove absence of contamination. – If encountered, material should be managed appropriately (i.e. as hazardous waste).	Site Manager & Contractor	Decommissioning phase

5.2.5 WASTE GENERATION

POTENTIAL ISSUES / IMPACTS	MANAGEMENT ACTIONS	RESPONSIBLE PERSON	TIMEFRAME
Impact Management Objective: – To ensure waste generation is minimised (i.e. avoided, reduced, re-used and recycled) and / or disposed of responsibly. – To ensure no direct or indirect environmental impacts as a result of waste management, handling or disposal. – To ensure the safety of personnel involved in the handling of hazardous waste types.			

Generation, handling and management of hazardous waste streams has the potential to lead to soil and groundwater pollution (including offsite).	– Hazardous waste storage (including used oils and material containing oils, solvents, empty chemical containers etc.) should be undertaken within impermeable bunded and ventilated storage areas, capable of containing 110% of total volume. All storage containers are to be labelled, sealed and stored in accordance with MSDS / SDS requirements. – MSDS or SDS for all hazardous wastes must be available on site. – Personnel involved in the handling of hazardous waste must be provided with the necessary PPE as stipulated in the MSDS / SDS. – Retain records of appropriate safety disposal certificates associated with hazardous waste removal, transportation and disposal. Waste manifests must also be retained. – Waste should be stored within waste skips within a designated area with consideration to stormwater management. – Bins/skips must be emptied regularly and collected by a licensed contractor for disposal at an appropriate, licensed facility.	Site Manager & Contractor	Decommissioning phase

Improper segregation of waste will result in lost opportunity for reuse and recycling resulting in increased pressure on local landfills.	– Waste should be stored in separate, labelled and secure skips / containers depending on management options – opportunities should be determined, in consultation with waste service providers, for re-use, recycle, or disposal options. – The contractor is required to implement systems at the construction site for the segregation of recyclable materials in order to divert waste from landfill. – Recover, recycle and reuse waste where possible. – Any recyclable material which is considered hazardous is to be collected and transferred by a permitted/trained waste contractor in accordance with the SANS 10228 for transport to the approved recycling/recovery facility. – Contaminated scrap metal can be taken to a hazardous waste landfill or to a dealer who is licensed to handle and clean the hazardous scrap metal before recycling. – Return excess construction materials which are suitable for re-use. – Train and inform all onsite personnel regarding general waste minimisation, management and disposal. – Working areas are to be cleared of litter on a daily basis. No litter / waste is to be burnt on-site.		

5.2.6 HERITAGE

POTENTIAL ISSUES / IMPACTS	MANAGEMENT ACTIONS	RESPONSIBLE PERSON	TIMEFRAME
Impact Management Objective: – To ensure the identification and protection of any heritage or archaeological resources.			

The project site has been fully transformed from its natural state and consists of hard standing surface. Due to the brownfield nature of the Protea Chemicals site, it is unlikely that intact heritage resources will be found on the site other than building older than 60 years.	– Approval from SAHRA (AMAFA) should be obtained prior to any alteration or decommissioning of heritage buildings and features of heritage importance. – For any chance heritage finds, all work must cease in the area affected and the Contractor must immediately inform the Project Manager. – The provincial heritage agency, AMAFA must be informed. – A heritage specialist must be called to site to assess the significance of the find. – Permits must be obtained from AMAFA if heritage resources are to be removed, destroyed or altered. – Under no circumstances may heritage material be destroyed or removed from site unless under direction of a heritage specialist. – Only once the heritage specialist gives the go-ahead can work in the area of the find re-commence.	Project Manager & Contractor	Decommissioning phase

5.2.7 TRAFFIC

POTENTIAL ISSUES / IMPACTS	MANAGEMENT ACTIONS	RESPONSIBLE PERSON	TIMEFRAME
<u>Impact Management Objective:</u> – To prevent congestion from occurring particularly during peak times; and safety risks to pedestrians.			
Increased vehicular traffic is likely to be associated with the transport of equipment and waste removal. The	– Validation of contractor documentation and qualifications.	Site Manager	Prior to appointment of Contractors

increase in traffic may contribute to safety risks to pedestrians in the absence of adequate controls.	— All Contractor drivers are required to hold valid licenses and be able to demonstrate technical training for respective class of vehicle. — The movement of vehicles into and out of the site must be managed such as ensuring that abnormal loads are moved outside of peak traffic hours. — Ensure that there is sufficient parking and loading space for vehicles to limit congestion around the site. — Effective signage and traffic control measures must be implemented along the access route to ensure that public and staff safety is managed adequately. — Ensure compliance with applicable road regulations and any permit issued in terms of the National Road Traffic Regulations (2000).	Project Manager	Decommissioning phase

5.2.8 SOCIO-ECONOMIC

POTENTIAL ISSUES / IMPACTS	MANAGEMENT ACTIONS	RESPONSIBLE PERSON	TIMEFRAME
Impact Management Objective: — Promote employment and indirect benefits to local businesses.			
A limited number of temporary semi-skilled and skilled opportunities will be generated during the decommissioning period. The majority of employment opportunities will be through existing contractors.	— As far as possible, contractors and labour must be sourced locally from within the local communities.	Project Manager (in conjunction with Human Resources) & Contractor	Prior to appointment of Contractors

5.3 REHABILITATION

POTENTIAL ISSUES / IMPACTS	MANAGEMENT ACTIONS	RESPONSIBLE PERSON	TIMEFRAME

Impact Management Objective: – To reinstate site surfaces.			
Decommissioning activities will result in the removal and demolition of underground and overhead tanks which will result in the disturbance of hard surface and alteration of the site structures.	– Ensure that any damaged hardstanding surfaces are returned to their original form following completion of decommissioning activities.	Site Manager & Contractor	Post Decommissioning

6 CONCLUSION

In terms of NEMA, everyone (i.e. all persons engaging in any component of this project) is required to take reasonable measures to ensure that they do not pollute the environment. The reasonable measures include informing and educating employees about the environmental risks associated with their work and training them to operate in an environmentally responsible manner.

The principal Contractor and Protea Chemicals also recognise that, in terms of NEMA, the cost to repair any environmental damage will be borne by the person responsible for the damage. If the above-mentioned environmental management actions are adopted, it is anticipated that all negative environmental impacts will be mitigated. An appointed ECO will need to monitor the site throughout decommissioning to ensure that the required environmental controls are in place and working effectively.