13.7 Public Participation

13.7.1 Pre-Application Meeting Minutes

MEETING NOTES

JOB TITLE	BTG Part 2 Amendment – Pre-Application Meeting
PROJECT NUMBER	41102134
DATE	27 September 2019
TIME	11h40 to 13h15
VENUE	Eastern Cape Department of Economic Development, Environmental Affairs and Tourism
SUBJECT	ECm1/C/LN2/M/16-2018
CLIENT	Bay Terminals Group (Pty) Ltd
PRESENT	AS: Andries Struwig – DEDEAT DP: Deidre Penfold – CAIA JF: Jacqui Fincham – OEC/WSP ASh: Andrea Shirley - CDC
APOLOGIES	Apologies
DISTRIBUTION	As above plus:

MATTERS ARISING		ACTION
1.0	**PART 1 AMENDMENT APPLICATION**	
1.1 1.2	AS has reviewed the Part 1 Amendment application received on 10 September 2019. The supporting documentation such as the OTGC Letter are considered out of date and provide no evidence of current activity. TNPA progress is only evidenced by emails. This is not deemed to be sufficient. DEDEAT require proof of progress on agreements. DEDEAT requires proof of engagements to indicate that there is progress on the Bay Terminals Group (BTG) project; i.e. minutes, In the absence of minutes being available, please provide a written summary outlining the engagements, meetings, process to date, summary of TNPA meetings of the last 3 weeks, include CDC & BTG / Transnet meetings and resolutions. Can also include the wayleave agreement.	PRISM/WSP
2.0	**PART 2 AMENDMENT APPLICATION**	
2.1	Proposed Amendments – **Pipeline Extension:** The EA issued to BTG states that the access to the berth will either be provided by TNPA or OTGC. During the course of the last six months, there has been further clarity obtained regarding the options for access to the berth. It has been confirmed that OTGC will be the single offloading arm operator at the Port berth and will provide an operational pipeline service, in terms of the Pipelines Act, to alternative bulk liquid facilities up to the point of the OTGC Battery	

The Pavilion, 1st Floor
Cnr Portswood and Beach Road, Waterfront
Cape Town, 8001
South Africa

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www.wsp.com

	Limit. The current BTG EA therefore must be amended to include an extended pipeline route from the TNPA Port boundary to the OTGC Battery Limit. – **Tank Storage Changes:** The BTG EA must be amended to increase the storage capacity of the HFO tanks to accommodate the storage volume needed for the Carbon Black Oil (CBO) required for Orion Engineered Carbon (OEC). OEC requires a total storage capacity of 36 000m^3 and therefore the two HFO tanks should increase in capacity from 15 000m^3 each to 18 000m^3 each. This proposed increase will be balanced with a 6 000m^3 reduction in the petroleum tank storage (ULP tanks). The total volume storage of the tank farm will remain unchanged.	
2.2	Project Description AS indicated a preference from the Department to have the Part 2 amendment application include an extension of all the pipelines from the BTG facility to the OTGC Battery Limit and not only the HFO pipeline. The primary reason for this is to present the completed project and prevent the need for a future amendment application. In addition, Condition 3.1.1 can be removed from the EA if BTG commits to building the 'missing pipeline section'. JF indicated that the Risk Assessor had identified possible impacts/significant risk as a result of the LPG line running adjacent to the proposed OTGC facility. It was agreed that if this represented a technical difficulty that would delay the application, in principle the LPG line could be excluded from the current amendment and rather be deferred to a later stage when the future of LPG at the Port is better understood. JF to address with assessor and determine whether 3 or 4 lines will be included in the application. The Project scope must be updated in the amendment application.	WSP

2.3	Public Participation Procedure (PPP)
	– It was noted that the 13th of December to the 6th of January is a "shutdown" period for DEDEAT and PPP may legally not occur over this time.
	– PPP can commence once EAP receives an email from DEDEAT confirming that the application is complete and can be registered. Do not need to wait for the acknowledgement letter.
	– Adverts will be released to invite IAPs to view report and not for IAPs to register since this is an amendment process so the original process invited all potential IAPs to register. Place adverts in the Herald and the Burger newspapers (same procedure as previous application). Advertisement must indicate that it is for an application for amendment and that the draft report will be available for comments from "date" to "date".
	– Site notice to be placed on CDC electronic notice board and TNPA electronic board (confirm if this exists).
	– Notify SEZ investors and neighbours.
	– Update the existing stakeholder database generated during the BTG EIA process.
	– Anticipated numbers of Hard copies of reports:
	  – ELC members require emailed or hard copy x 1
	  – DEDEAT needs CD + hard copy x 1
	  – NMBM – hard copy x 1
	  – DWS – electronic	

3.0	**DISCUSSION**	

	1. Specialists:
	  a. Ecology – summarise section included on Ecology in the TNPA's BAR for the pipeline servitude.
	  b. AQIA – letter from LAQS; AEL application, LAQS to liaise with NMBM. CDC to request LAQS to update the cumulative AQIA (if required).
	  c. Risk Assessment
	2. The Report accompanying the Part 2 Amendment Application should be an Assessment Report (and NOT a BAR).
	3. ELC presentation to be made on Thursday 21st November at DEDEAT offices; must present the findings of the Part 2 amendment application.
	4. Oil Spill Contingency Plan – Transnet's Harbour Spill Contingency Plan is not adequate and requires review to address the increased risk of oil spills and to align the Plan to the current status of the National	

MEETING NOTES

and Dias Zone Oil Spill Contingency Plans, prior to commissioning of the proposed BTG and OTGC liquid fuel storage and handling facilities in the Coega SEZ and Port and associated bulk liquid pipelines within TNPA owned pipeline reserves in the Port of Ngqura. OTGC will be the operator and therefore it is their responsibility. It is not only the harbour spill contingency plan that is outdated / not adequate but the plan for the whole of Algoa Bay. An updated plan should clearly spell out the roles and responsibilities of the different role players. 5. CDC to place on the ELC agenda, the issue of Transnet's lacking Harbour Spill Contingency Plan and how this will be updated to ensure that OTGC, BTG, etc are covered to operate. 6. Operators should contribute towards ensuring that there are resources to manage any oil spills.	CDC

NEXT MEETING

An invitation will be issued if an additional meeting is required.

Signature of Acceptance of minutes:

29 October 2019

Andries Struwig

Eastern Cape Department of Economic Development, Environmental Affairs and Tourism

Province of the
EASTERN CAPE
ECONOMIC DEVELOPMENT, ENVIRONMENTAL AFFAIRS & TOURISM

Attendance Register

DATE: 27/09/2019

PURPOSE: Meeting: Discussion on way forward with Part 1 and Part 2 amendment to BTG EA.

NAME	ORGANISATION	E-MAIL ADDRESS	CONTACT NUMBER(S)	SIGNATURE
A. SHIRLEY	CDC	andrea.shirley@coega.co.za	0826574648	[signature]
J. Fincham	WSP	jacqui.fincham@wsp.com	0825415038	[signature]
Andrés Struwig	DEDEAT	andres.struwig@dedea.gov.za	0415088840	[signature]
DEIDRÉ PENFOLD	CAIA	deidré.penfold@caia.co.za	0834193281	[signature]

13.7.2 Interested and Affected Party Database

INTERESTED AND AFFECTED PARTY DATABASE

Prism Ref: 21928 - Coega Part 2 Amendment

Title	Name	Surname	Capacity, Categorically	Organisation/ Affiliation	Capacity	Notified of Review	Method of delivery	Date of delivery
Organs of State and Authorities								
Mr	Dayalan	Govender	Competent Authority - NEMA	EC DEDEAT	Regional Manager	Yes	Emailed	8/11/2019
Mr	Andries	Struwig	Competent Authority - NEMA	EC DEDEAT	Assistant. Director: IEM	Yes	Emailed	8/11/2019
Mr	Lyndon	Mardon	Competent Authority - NEMA	EC DEDEAT	Provincial Air Quality Officer	Yes	Emailed	8/11/2019
Mrs	Nitasha	Baijnath-Pillay	Commenting Authority	DEA: Ocean & Coast	Coastal Pollution Management Division	Yes	Emailed	8/11/2019
Mr	Reuben	Molale	Commenting Authority	DEA: Ocean & Coast	Coastal Pollution Management Division	Yes	Emailed	8/11/2019
Ms	Funanani	Ditinti	Commenting Authority	DEA: Ocean & Coast	Coastal Pollution Management Division	Yes	Emailed	8/11/2019
Mr	Wayne	Hector	Commenting Authority	Department of Environment, Forestry and Fisheries (DEFF)	Deputy Director: Strategic Infrastructure Development	Yes	Emailed	8/11/2019
Mrs	Pumeza	Skepe	Commenting Authority	Department of Environment, Forestry and Fisheries (DEFF)	Environmental Impact Management	Yes	Emailed	8/11/2019
Mrs	Andrea	Shirley	Landowner	Coega Development Corportation (CDC)	Environmental Project Manager	Yes	Emailed	8/11/2019
Mr	Graham	Taylor	Landowner	Coega Development Corportation (CDC)	Spatial Development Manager	Yes	Emailed	8/11/2019
Ms	Renee	de Klerk	Commenting Authority	Transnet Capital Projects (TCP)	Environmental Manager	Yes	Emailed	8/11/2019
Mr	Mpatisi	Pantsi	Commenting Authority	Transnet National Ports Authority (TNPA)	SHE Manager	Yes	Emailed	8/11/2019
Mr	Joram	Mkosana	Competent Authority - NEMAQA (Municipality)	Nelson Mandela Bay Metropolitan Municipality (NMBM)	Environmental Manager	Yes	Emailed	8/11/2019
Mr	Godfrey	Murrel	Competent Authority - NEMAQA (Municipality)	Nelson Mandela Bay Metropolitan Municipality (NMBM)	Environmental Manager	Yes	Emailed	8/11/2019
Ms	Rosa	Blaauw	Competent Authority - NEMAQA (Municipality)	Nelson Mandela Bay Metropolitan Municipality (NMBM)	Environmental Manager	Yes	Emailed	8/11/2019
Mr	Patrick	Nodwele	Competent Authority - NEMAQA (Municipality)	NMBM: Air Pollution & Noise Control	Air Pollution & Noise Control	Yes	Emailed	8/11/2019
Ms	Thandi	Mmachaka	Commenting Authority	Department of Human Settlements, Water and Sanitation (DHSWS)	Water Quality Management	Yes	Emailed	8/11/2019
Ms	Ncumisa	Mnotoza	Commenting Authority	Department of Human Settlements, Water and Sanitation (DHSWS)	Water Quality Management	Yes	Emailed	8/11/2019

Title	Name	Surname	Capacity, Categorically	Organisation/ Affiliation	Capacity	Notified of Review	Method of delivery	Date of delivery
Mr	Vusi	Kubheka	Commenting Authority	Department of Mineral Resources (DMR)	ASD: Mineral Regulation	Yes	Emailed	8/11/2019
Ms	Bongi	Stofile	Commenting Authority	SAMSA (South African Maritime Safety Authority)	Executive Manager: Operations	Yes	Emailed	8/11/2019
Mr	Giel	De Kock	Commenting Authority	South African National Parks (SANP)	Park Planning and Development	Yes	Emailed	8/11/2019
Mr	Russel	Smart	Commenting Authority	South African National Parks (SANP)		Yes	Emailed	8/11/2019
Dr	Ane	Oosthuizen	Commenting Authority	South African National Parks (SANP)	National Marine coordinator and Acting General Manager: Park Planning and Development	Yes	Emailed	8/11/2019
Ms	Veliswa	Baduza	Competent Authority - Heritage	South Africa Heritage Resources Agency (SAHRA)	Chief Executive Officer	Yes	Emailed	8/11/2019
	Sello	Mokhanya	Competent Authority - Heritage	Eastern Cape Provincial Heritage Resources Authority (ECPHA)	Heritage Officer	Yes	Emailed	8/11/2019
Ward Councillors								
	Sandile	Nzanzeka	Ward Councillor	Ward 23		Yes	SMS	8/11/2019
	Nomazulu	Mthi	Ward Councillor	Ward 53		Yes	SMS	8/11/2019
	Morgan	Tshaka	Ward Councillor	Ward 54		Yes	SMS	8/11/2019
	Mzuvukile	Boti	Ward Councillor	Ward 55		Yes	SMS	8/11/2019
	Mambalu	Mgcokoca	Ward Councillor	Ward 56		Yes	SMS	8/11/2019
	Becinga	Mbuqu	Ward Councillor	Ward 57		Yes	SMS	8/11/2019
	Mendiswa	Makunga	Ward Councillor	Ward 58		Yes	SMS	8/11/2019
	Mazwangwandile	Dano	Ward Councillor	Ward 59		Yes	SMS	8/11/2019
	Mvuzo	Mbelekane	Ward Councillor	60		Yes	SMS	8/11/2019
Investors in the Coega Special Economic Zone								
Mr	Jan	Beute	Zone 8	Oitanking Grinrod Calulo (Pty) Ltd	Regional Projects Manager	Yes	Emailed	8/11/2019
Ms	Nontobeko	Funde	Zone 8	Oitanking Grinrod Calulo (Pty) Ltd	Project Environmental Manager	Yes	Emailed	8/11/2019
Mr	Danie	Gerber		DSV	Branch Manager	Yes	Emailed	8/11/2019
	Brett	Williams		Digistics	DC Manager	Yes	Emailed	8/11/2019

Association								
Title	Name	Surname	Capacity, Categorically	Organisation/ Affiliation	Capacity	Notified of Review	Method of delivery	Date of delivery
	Arnold	Barnard	Zone 1: Logistics Cluster	Famous Brands	Operations Manager	Yes	Emailed	8/11/2019
	Beth	Hurr		Isuzu Motors	PDC Warehouse Manager	Yes	Emailed	8/11/2019
	Craig	Vaughan		PE Cold Storage	General Manager	Yes	Emailed	8/11/2019
	Pieter	Allers		APM Terminals		Yes	Emailed	8/11/2019
	Rudo	Stoltenkamp		Vector Logistics	Operations Manager	Yes	Emailed	8/11/2019
	Allistair	Stallenberg		ID Logistics	DC Manager	Yes	Emailed	8/11/2019
	Gerhard	Charalambous		National Ship Chandlers		Yes	Emailed	8/11/2019
	David	Brenner			General Manager	Yes	Emailed	8/11/2019
	Rhyan	Webb		Apli/Coega Fruit Terminals	General Manager	Yes	Emailed	8/11/2019
	Riaz	Ismail	Zone 2: Automotive Cluster	Zackpack/CFR	Depot Manager	Yes	Emailed	8/11/2019
	Liu	Shijie		FAW	Deputy Director	Yes	Emailed	8/11/2019
	Adrian	Vardy	Zone 3: General Industries Cluster	Dynamic Commodities	CEO	Yes	Emailed	8/11/2019
	Phillip	Nieman		Coega Dairy	CEO	Yes	Emailed	8/11/2019
	Johann	Schlebusch			Operations Manager	Yes	Emailed	8/11/2019
	Shaun	Te Brugge		Coega Concentrate	Maintenance Manager	Yes	Emailed	8/11/2019
	Vincent	Ntuli		Air Products SA (Pty) Ltd	Plant Supervisor - Coega ASU Plant	Yes	Emailed	8/11/2019
	Alta-Marie	Grebe		DCD Wind Towers	Financial Manager	Yes	Emailed	8/11/2019
	Andile	Qwase		Afrox	Plant Manager	Yes	Emailed	8/11/2019
	Martin	Foster		Himoin SA	Managing Director	Yes	Emailed	8/11/2019
	Johannes	Makgopole		Enel Green Power		Yes	Emailed	8/11/2019
	Tarryn	Shinn		Corromaster	Admin Manager	Yes	Emailed	8/11/2019
	Ashley	Van der Merwe		Ambasaam	Warehouse Manager	Yes	Emailed	8/11/2019
	Pieter	Van Heerden		Ocean Legacy Marine Engineering (OLME)	Managing Director	Yes	Emailed	8/11/2019
	Ellian	Peterson	ng and Academic uster	Discovery Health	Facilities Manager	Yes	Emailed	8/11/2019

Association								
Title	Name	Surname	Capacity, Categorically	Organisation/ Affiliation	Capacity	Notified of Review	Method of delivery	Date of delivery
	Claressita	Ramoo	Zone 4: Traini Cl	WNS	Facilities Manager	Yes	Emailed	8/11/2019
	Ashwin	Langeveldt		Bosun Bricks	HR Manager	Yes	Emailed	8/11/2019
	Jan	Du Preez		Sanitech	Branch Manager	Yes	Emailed	8/11/2019
	Jerome	Perils		Ke Nako Concrete	Managing Director	Yes	Emailed	8/11/2019
	Hannes	Smit		OSHO Cement	Site Manager	Yes	Emailed	8/11/2019
	Hassan	Khan	Zone 6& 11: Ferrous Metals Cluster	Coega Steels	Director	Yes	Emailed	8/11/2019
	Xolile	Mzimba	Zone 7: Chemicals Cluster	Cerebos	Human Resources Manager	Yes	Emailed	8/11/2019
	Vino	Yegambaram	Zone 7: Chemicals Cluster	Lension SA		Yes	Emailed	8/11/2019
	James	Classen	Zone 13: Energy Cluster	Dedisa Peaking Power	Facility Manager	Yes	Emailed	8/11/2019
	Trevor	D'Oliveira	Zone 13: Energy Cluster	Electrawinds	Director	Yes	Emailed	8/11/2019
Registered I&APs - 21803 Coega Tank Farm EIA Proces								
Dr	Paul	Martin	Public			Yes	Emailed	8/11/2019
Ms	Christelle		ECO	Habitatlink	Environmental Control Officer for the Coega SEZ and Port of Ngqura	Yes	Emailed	8/11/2019
Ms	Claire	Matern	Public	Stefanutti Stocks Coastal		Yes	Emailed	8/11/2019
Mr	Jan	Beute	Investors	Oitanking Grinrod Calulo (Pty) Ltd	Regional Projects Manager	Yes	Emailed	8/11/2019
Ms	Nontobeko	Funde	Investors	Oitanking Grinrod Calulo (Pty) Ltd	Project Environmental Manager	Yes	Emailed	8/11/2019
Ms	Roxanne	Mustard	Public	Leads 2 Business	Regional Content Researcher	Requested to be removed from list as no longer working at leads 2 business.		

13.7.3 Proof of Notification

13.7.3.1 Newspaper Advert

A copy of the Advert Proof is provided. Proof of placement of the Advert in the Star Newspaper will be included in the Final Amendment Report.

NOTIFICATION OF AN AMENDMENT OF THE EXISTING ENVIRONMENTAL AUTHORISATION ECm1/c/LN2/M/16-2018 FOR THE CONSTRUCTION AND OPERATION OF LIQUID FUEL AND LPG STORAGE AND HANDLING FACILITY WITHIN ZONE 7 OF THE COEGA SEZ: IN TERMS OF REGULATION 31 AND 32 OF THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REGULATIONS, 2014 (AS AMENDED

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EC DEDEAT Ref: ECm1/c/LN2/M/16-2018. Prism EMS Ref.:21928 – Coega Part 2 Amendment. Applicant: Bay Terminals Group. Location: Zone 7 of Coega Special Economic Zone formerly known as the Coega Industrial Development Zone at the following coordinates: 33° 46'24.67"S, 25° 42'16.56"E. Competent Authority: Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (EC DEDEAT). Amendments: A Part 2 Amendment of the Environmental Authorisation is required. These include: 1) Update of the Site Development Plan; 2.) Extension of Bulk Liquid Pipelines into the Port of Ngqura Property and removal of Condition 3.3.1; 3.) Reduction in the combined storage of Diesel from 80 000 m^3 to 77 000 m^3; 4.) Reduction in the combined storage of Unleaded Petrol (ULP) from 80 000 m^3 to 77 000 m^3; 5.) Increase in the combined storage of Heavy Fuel Oil (HFO) from 30 000 m^3 to 36 000 m^3; 6.) Update of the timeframes for construction within the project description in the EA as well as within Condition 3.1.2. relating to completion of all construction activities within 24 months from the start of construction; and 7.) Update of Condition 3.3.2. to clarify that TNPA will be responsible for reviewing and updating the Port Oil Spill Contingency Plan and Emergency Preparedness Plan. Prism EMS has been appointed as the independent Environmental Assessment Practitioner responsible for undertaking the amendment and associated public participation process. Review of the Amendment Report: An Amendment Report has been compiled and can be reviewed from 8 November 2019 to 9 December 2019. A copy of the report can be downloaded from: https://www.prismems.co.za/index.php/projects/pages. To obtain further information or provide written comments, contact: Monica Niehof at: Post: PO Box 1401, Wilgeheuwel, 1736, Tel: 087 985 0951, Fax: 086 601 4800, E-mail: monica@prismems.co.za/ prism@prismems.co.za by 9 December 2019

KENNISGEWING VAN 'N WYSIGING VAN DIE BESTAANDE OMGEWINGSGOEDKEURING ECm1/c/LN2/M/16-2018 VIR DIE KONSTRUKSIE EN WERKING VAN 'N VLOEIBARE BRANDSTOF EN VLOEIBARE PETROLEUMGAS (LPG) STORINGS- EN HANTERINGSFASILITEIT BINNE ZONE 7 VAN DIE COEGA IOS: KRAGTENS REGULASIE 31 EN 32 VAN DIE OMGEWINGSIMPAK EN OMVANGSBEPALING REGULASIES, 2014 (SOOS GEWYSIG)

EC DEDEAT-verwysingsnommer: ECm1/c/LN2/M/16-2018.
Prism EMS-verwysingsnommer: 21928 - Coega Part 2 Amendment.
Applikant: Bay Terminals Group.
Geldige Owerheid: Oos-Kaapse Departement van Ekonomiese Ontwikkeling, Omgewingsake en Toerisme (EC DEDEAT).
Wysigings: 'n Gedeelte 2 Wysiging van die Omgewingsgoedkeuring word vereis.
Dit sluit in:

1) Wysiging van die Terrein Ontwikkelingsplan;
2) Verlenging van Grootmaat Vloeistofpyplydings tot binne die eiendom van die Hawe van Ngqura en die verwydering van Voorwaarde 3.3.1;
3) Vermindering van die gekombineerde stoor-volume van Diesel van 80 000 m^3 na 77 000 m^3;
4) Vermindering van die gekombineerde stoor-volume van loodvrye petrol (ULP) van 80 000 m^3 na 77 000 m^3;
5) Verhoging in die gekombineerde stoor-volume van Swaar Brandstof-olie (HFO) van 30 000 m^3 na 36 000 m^3;
6) Wysiging van die tydsraamwerke vir konstruksie in die projekbeskrywing soos omvat in die Omgewingsgoedkeuring, asook in Voorwaarde 3.1.2 met betrekking tot die voltooiing van alle konstruksie aktiwiteite binne 24 maande vanaf die begin van konstruksie; en
7) Wysiging van Voorwaarde 3.3.2 in sover TNPA verantoordelik is vir die hersien en opdatering van die Olietortinggebeurlikheidsplan en Noodgeval Paraatheidsplan.

Prism EMS is as die onafhanklike omgewingse evaluasiepraktisyn aangestel wat verantwoordelik is om die wysiging en verwante openbare deelname proses te onderneem.
Inspeksie van die Wysigingsverslag: 'n Wysigingsverslag is saamgestel en sal vanaf 8 November 2019 tot en met 9 Desember 2019 ter insae lê. 'n Kopie van die verslag kan afgelaai word by: https://www.prismems.co.za/index.php/projects/pages.
Om verdere inligting te bekom of geskrewe kommentaar te lewer, kontak: Monica Niehof by Pos: Posbus 1401, Wilgeheuwel, 1736, Tel: 087 985 0951, Faks: 086 601 4800, E-pos: monica@prismems.co.za/prism@ prismems.co.za teen 9 Desember 2019.
Publikasiedatum: 8 November 2019.

17X2KENNIS-OS081119

13.7.3.2 Site Notices

A copy of the Site Notice is provided. Proof of placement of Site Notices will be included in the Final Amendment Report.

NOTIFICATION OF AN AMENDMENT OF THE EXISTING ENVIRONMENTAL AUTHORISATION ECm1/c/LN2/M/16-2018 FOR THE CONSTRUCTION AND OPERATION OF LIQUID FUEL AND LPG STORAGE AND HANDLING FACILITY WITHIN ZONE 7 OF THE COEGA SEZ: IN TERMS OF REGULATION 31 AND 32 OF THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REGULATIONS, 2014 (AS AMENDED)

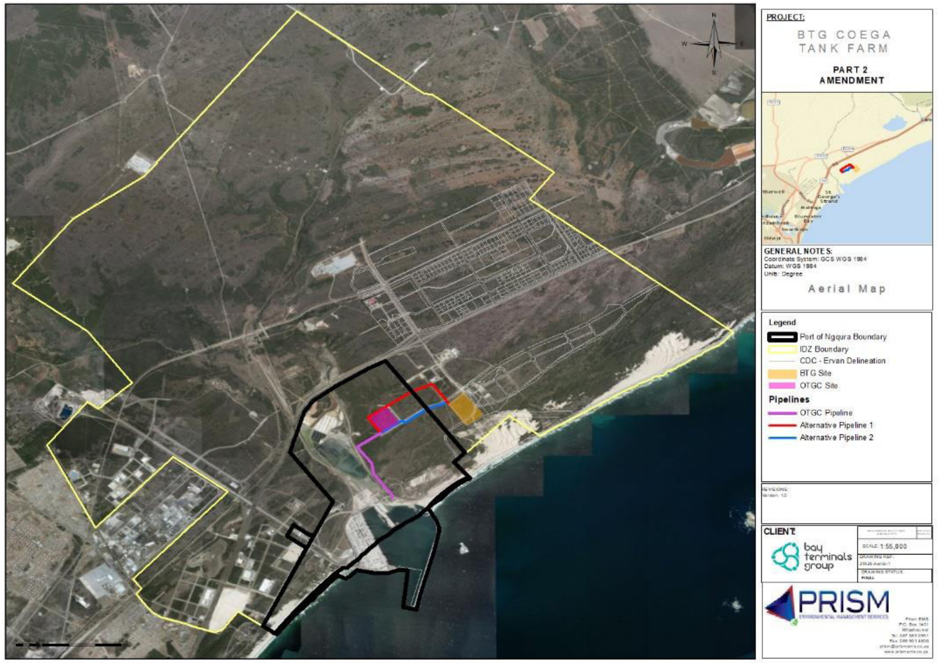

Figure 1: Locality Map

EC DEDEAT Ref: ECm1/c/LN2/M/16-2018. PRISM EMS Ref: 21928- Coega Part 2 Amendment. **Applicant:** Bay Terminals Group. **Location:** Zone 7 of Coega Special Economic Zone formerly known as the Coega Industrial Development Zone. The site occurs along the Algoa Bay coastline to the north-east of the Port of Ngqura (refer to **Figure 1**) within Nelson Mandela Bay Metropolitan Municipality, Eastern Cape Province at the following coordinates: 33° 46'24.67"S, 25° 42'16.56"E. **Competent Authority:** Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (EC DEDEAT). **Amendments:** A Part 2 Amendment of the Environmental Authorisation is required. These include: 1) Update of the Site Development Plan; 2.) Extension of Bulk Liquid Pipelines into the Port of Ngqura Property and removal of Condition 3.3.1.; 3.) Reduction in the combined storage of Diesel from 80 000 m^3 to 77 000 m^3; 4.) Reduction in the combined storage of Unleaded Petrol (ULP) from 80 000 m^3 to 77 000 m^3; 5.) Increase in the combined storage of Heavy Fuel Oil (HFO) from 30 000 m^3 to 36 000 m^3; 6.) Update of the timeframes for construction within the project description in the EA as well as within Condition 3.1.2. relating to completion of all construction activities within 24 months from the start of construction; and 7.) Update of Condition 3.3.2. to clarify that TNPA will be responsible for reviewing and updating the Port Oil Spill Contingency Plan and Emergency Preparedness Plan. **Prism EMS** has been appointed as the independent Environmental Assessment Practitioner responsible for undertaking the environmental authorisation application and associated public participation process. **Review of the Amendment Report**: An Amendment Report has been compiled and can be reviewed from **8 November 2019 to 9 December 2019.** A copy of the report can be downloaded from: https://www.prismems.co.za/index.php/projects/pages. To request information or to provide written comments, contact: **Monica Niehof** at: **Post**: PO Box 1401, Wilgeheuwel, 1736, **Tel**: 087 985 095, **Fax**: 086 601 4800, **E-mail**: monica@prismems.co.za/ prism@prismems.co.za by 9 December 2019. **Publication Date:** 7 November 2019.

PRISM ENVIRONMENTAL MANAGEMENT SERVICES

13.7.3.3 Background Information Document

A copy of the BID is provided. Proof of notification will be included in the Final Amendment Report.

BACKGROUND INFORMATION DOCUMENT

NOTIFICATION OF AN AMENDMENT OF THE EXISTING ENVIRONMENTAL AUTHORISATION ECm1/c/LN2/M/16-2018 FOR THE CONSTRUCTION AND OPERATION OF LIQUID FUEL AND LPG STORAGE AND HANDLING FACILITY WITHIN ZONE 7 OF THE COEGA SEZ: IN TERMS OF REGULATION 31 AND 32 OF THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REGULATIONS, 2014 (AS AMENDED)

Purpose of Document:

The purpose of this document is to:

- Provide all potential Interested and Affected Parties (I&APs) with information about the proposed amendments.
- Introduce, explain and initiate the Public Participation Process (PPP) that is prescribed by the relevant legislation for the amendment process.

All I&APs are requested to provide comment on:

- The environmental (bio-physical) and socio-economical environmental and/or considerations and potential impacts related to the proposed amendments.
- The proposed Public Participation Process (PPP) to be followed.
- The proposed amendment application and amendment process being followed.
- Any other suggestions and/or recommendations.

Date of Publication: 7 November 2019

Applicant: Bay Terminals Group

EAP: Prism EMS

EC DEDEAT Ref: ECm1/c/LN2/M/16-2018

Project Location:

Zone 7 of Coega Special Economic Zone (SEZ) formerly known as the Coega Industrial Development Zone. The site occurs along the Algoa Bay coastline to the north-east of the Port of Ngqura (refer to **Figure 1**). within Nelson Mandela Bay Metropolitan Municipality, Eastern Cape Province at the following coordinates: 33° 46'24.67"S, 25° 42'16.56"E.

Project Description and Amendments:

Bay Terminals Group (BTG) plans to develop a new liquid bulk facility with piping, custody metering and numerous tanks and road tanker loading at a new facility in the Coega SEZ Zone 7, near Port Elizabeth, on Erf 351 of Coega. An environmental authorisation process was undertaken in 2018 and the Environmental Authorisation (EA)(ECm1/c/LN2/M/16-2018) granted on **15 March 2019**.

Subsequently, the CDC has received funding from the Department of Trade and Industry (DTI) to develop a solution for Orion Engineered Carbons (OEC) to receive Carbon Black Oil (CBO[1]) (a type of Heavy Fuel Oil or HFO) at the Port of Ngqura. OEC currently receives via Dom Pedro facility at the Port of Port Elizabeth. However, due to the intended closure of the Dom Pedro facility at the Port of Port Elizabeth there is a requirement for a new replacement facility for OEC at the Port of Ngqura.

As part of this and subsequent to the initial BTG design process, the CDC has approached BTG regarding a possible solution for OEC. As part of the solution, BTG has entered into an agreement with the CDC to permit CDC to construct the necessary tanks and pipeline extensions from the berth to receive and store HFO within the necessary timeframes. In order to provide the necessary infrastructure for OEC, the initially planned storage capacity of the BTG facility needs to be amended to take into account the requirements of OEC.

On this basis, the proposed amendments are as follows:

- Update of the Site Development Plan;
- Extension of Bulk Liquid Pipelines into the Port of Ngqura Property and removal of Condition 3.3.1;
- Reduction in the combined storage of Diesel from 80 000 m^3 to 77 000 m^3;
- Reduction in the combined storage of Unleaded Petrol (ULP) from 80 000 m^3 to 77 000 m^3;
- Increase in the combined storage of Heavy Fuel Oil (HFO) from 30 000 m^3 to 36 000 m^3;
- Update of the timeframes for construction within the project description in the EA as well as within Condition 3.1.2. relating to completion of all construction activities within 24 months from the start of construction; and
- Update of Condition 3.3.2. to clarify that TNPA will be responsible for reviewing and updating the Port Oil Spill Contingency Plan and Emergency Preparedness Plan.

[1] *Please note that the chemical composition of CBO falls within the broad definition of HFO.*

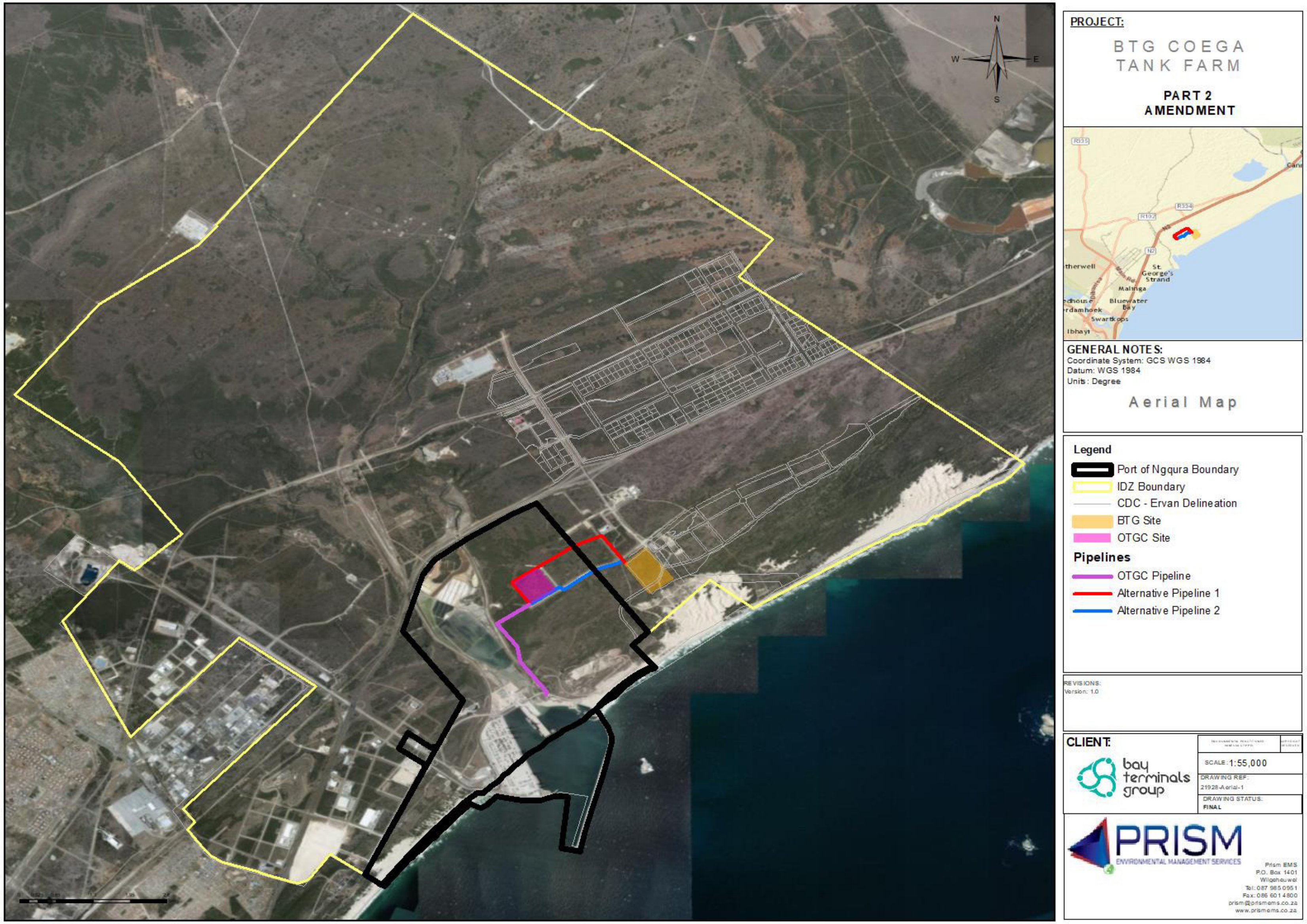

Figure 1: Aerial Locality Map

Environmental Assessment Practitioner: Prism EMS is a multi-disciplinary Environmental Management consulting firm which has a vision encompassing a holistic understanding of integrated environmental management in combination with sustainability. The company prides itself on excellent service and value-added solutions to a range of clients. The team involved with the Amendment process is as follows:

Table 1: Project Team

Project Director	Unit Manager/Quality Control	Principal EAP
De Wet Botha M.A. Env. Man. PHED. 15 years' experience	Vanessa Stippel Pr.Sci.Nat. MSc. Ecol, Env, & Cons 8 years' experience	Monica Niehof BSc. Hons. Env. Man. 12 years' experience.

Legal Requirements:

Chapter 5 of the new Environmental Impact Assessment (EIA) Regulations (GN 982 of 4 December 2014) provides the process that must be followed in respect to amendment of an environmental authorisation. The Regulations provide for two types of amendments that may be undertaken. The type of amendment is dependent on the type of changes. The two types of amendments are as follows:

- Part 1 Amendments where there is no change of scope or a change of ownership occurs; and
- Part 2: Amendments where a change in scope occurs.

As part of this, Section 31 of Part 2 (as amended) notes the following:

"An environmental authorisation may be amended by following the process prescribed in this Part if the amendment will result in a change to the scope of a valid environmental authorisation where such change will result in an increased level or change in the nature of impact where such level or change in the nature of impact was not-

(a) assessed and included in the initial application for environmental authorisation; or

(b) taken into consideration in the initial environmental authorisation.

and the change does not, on its own, constitute a listed or specified activity".

<u>The Amendments in question do not constitute a new listed activity but do change the scope of the existing authorisation and as such a Part 2 Amendment is required.</u>

Be an Integral Part of the Environmental Impact Assessment Process:

Public involvement is an essential part of the Part 2 Amendment process. Parties wishing to review and comment on the Amendment Report can obtain a copy from **https://www.prismems.co.za/index.php/projects/pages**. A 30-day public review period from **8 November 2019 to 9 December 2019** is provided. Comments to be provided in writing to Prism EMS, using the attached Comment Sheet by **9 December 2019.**

Amendment and Public Participation Processes

A Part 2 Amendment will be undertaken, and the amendment process prescribed by Part 2 of the EIA Regulations, 2014 will be followed. Section 32 of the 2014 EIA Regulations (as amended) note the following in respect to Part 2 Amendments:

The Applicant must within 90 days of receipt by the competent authority of the application made in terms of regulation 31, submit to the competent authority,

(a.) a report, reflecting-

(i) an assessment of all impacts related to the proposed change;

(ii) advantages and disadvantages associated with the proposed change; and

(iii) measures to ensure avoidance, management and mitigation of impacts

(iv) associated with such proposed change; and

(v) any changes to the EMPr;

which report-

(aa) had been subjected to a public participation process, which had been agreed to by the competent authority, and which was appropriate to bring the proposed change to the attention of potential and registered interested and affected parties, including organs of state, which have jurisdiction in respect of any aspect of the relevant activity, and the competent authority, and

(bb) reflects the incorporation of comments received, including any comments of the competent authority.

The Amendment Report will be available for review from 8 November 2019 to 9 December 2019. A copy of the report can be downloaded from: https://www.prismems.co.za/index.php/projects/pages.

NOTIFICATION OF AN AMENDMENT OF THE EXISTING ENVIRONMENTAL AUTHORISATION ECm1/c/LN2/M/16-2018 FOR THE CONSTRUCTION AND OPERATION OF LIQUID FUEL AND LPG STORAGE AND HANDLING FACILITY WITHIN ZONE 7 OF THE COEGA IDZ: IN TERMS OF REGULATION 31 AND 32 OF THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REGULATIONS, 2014 (AS AMENDED)

I&AP Comment Form

Prism EMS Ref No: 21928 – Coega Part 2 Amendment

Name:			Surname		
Title			Initials		
Organisation / interest:			Capacity (e.g. Chairperson):		
Postal / Residential Address:					
	Area:		Code:		
Contact Details:	Tel:	( )	Mobile:	( )	
	Email				
Preferred Method of Communication	Email		Fax		Post
Date of Comment					

What is your main area of interest with regard to the proposed amendment?
Please note any comments you may have on the proposed amendments and/or Amendment Report*
Please indicate any I&APs you feel we should notify in regard to this amendment process

Name:		Surname:	
Tel/Mobile:		Email:	

Please, fax, mail, or e-mail the completed registration form to Prism EMS: **Attention:** Monica Niehof ▪ **Tel:** (087) 985 0951 ▪ **Fax:** (086) 601 4800 ▪ **Email:** monica@prismems.co.za/prism@prismems.co.za ▪ **Post:** PO Box 1401, Wilgeheuwel, 1736

Thank you for your participation.

**Please note you are not restricted to use this template to provide written comments on the Amendment process. All written comments will be accepted and taken into account.*

13.7.3.4 Proof of Written Communication

Proof of notification will be included in the Final Amendment Report.

13.7.4 Comments and Responses Report

The Comments and Responses Report will be updated with any comments received.

13.7.5 Comments Received

Any comments received during the notification and review period will be included in the Final Amendment Report.

13.8 Specialist Studies

13.8.1 Risk Assessment

PROJECT DONE ON BEHALF OF
PRISM ENVIRONMENTAL MANAGEMENT SERVICES CC

QUANTITATIVE RISK ASSESSMENT OF THE PROPOSED BAY TERMINAL GROUP TANK FARM AT COEGA, EASTERN CAPE

Author: M P Oberholzer

Date of Issue: 1st of November 2019
Report No.: R/18/PRI-0 Rev 3

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DOCUMENT CHANGE HISTORY			
PAGE/LINE	**CHANGE**	**DATE**	**REV**
Document	Initial release	20 Sept 2018	0
Document	Updated with client comments	27 Sep 2018	1
Document	Updated with CBO phase change	16 Oct 2019	2
Document	Updated with client comments	1 Nov 2019	3

RISCOM (PTY) LTD

RISCOM (PTY) LTD is a consulting company that specialises in process safety. Further to this, RISCOM* is an approved inspection authority (AIA) for conducting Major Hazard Installation (MHI) risk assessments in accordance with the OHS Act 85 of 1993 and its Major Hazard Installation regulations (July 2001). In order to maintain the status of approved inspection authority, RISCOM is accredited by the South African National Accreditation System (SANAS) in accordance with the IEC/ISO 17020:2012 standard.

The accreditation consists of a number of elements, including technical competence and third-party independence.

The independence of RISCOM is demonstrated by the following:

- RISCOM does not sell or repair equipment that can be used in the process industry;
- RISCOM does not have any shareholding in processing companies nor companies performing risk assessment functions;
- RISCOM does not design equipment or processes.

Mike Oberholzer is a professional engineer, holds a Bachelor of Science in Chemical Engineering and is an approved signatory for MHI risk assessments, thereby meeting the competency requirements of SANAS for assessment of the risks of hazardous components, including fires, explosions and toxic releases.

Opinions and interpretations expressed herein this report are outside the scope of SANAS accreditation.

M P Oberholzer Pr. Eng. BSc (Chem. Eng.) MIChemE MSAIChE

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QUANTITATIVE RISK ASSESSMENT OF THE PROPOSED BAY TERMINAL GROUP TANK FARM AT COEGA, EASTERN CAPE

EXECUTIVE SUMMARY

1 INTRODUCTION

The Bay Terminal Group (hereinafter referred to as BTG), is proposing the establishment of a bulk liquid storage and handling facility at the Port of Ngqura in Zone 7 of the Coega Special Economic zone (SE Special), situated near Port Elizabeth, within the Nelson Mandela Bay Municipality (NMBM), of the Eastern Cape Province. Bulk liquids, such as petrol, diesel, jet fuel, fuel oil, and liquefied petroleum gas (LPG), would be transported via ship to the berth in the Port of Ngqura and would be piped to the proposed facility.

Since off-site incidents may result due to hazards of some of the chemical components to be stored on, produced at or delivered to site, RISCOM (PTY) LTD was commissioned to conduct a quantitative risk assessment (QRA) to determine whether the impacts onto surrounding properties and communities as part of an environmental impact assessment (EIA).

At this stage of the project the detailed engineering designs are not yet available and there is not enough information to complete a formal Major Hazard Installation (MHI) risk assessment. Furthermore, the project will be developed in phases. As the earlier phases would be developed in advance of subsequence phases, the MHI risk assessment must be reviewed and for each subsequent phase, prior to construction.

The purpose of this report is to convey the essential details, which include a short description of hazards, the receiving environment and current relevant design as well as risks and consequences of a major incident.

1.1 Terms of Reference

The main aim of the investigation was to quantify the risks to employees, neighbours and the public with regard to the proposed BTG facility in the Coega SEZ.

This risk assessment was conducted in accordance with the MHI regulations and can be used as notification for the facility. The scope of the risk assessment included:

1. Development of accidental spill and fire scenarios for the facility;
2. Using generic failure rate data (for tanks, pumps, valves, flanges, pipework, gantry, couplings and so forth), determination of the probability of each accident scenario;
3. For each incident developed in Step 2, determination of consequences (such as thermal radiation, domino effects, toxic-cloud formation and so forth);
4. For scenarios with off-site consequences (greater than 1% fatality off-site), calculation of maximum individual risk (MIR), taking into account all generic failure rates, initiating events (such as ignition), meteorological conditions and lethality.

1.2 Purpose and Main Activities

The main activity at the proposed BTG facility in the Coega SEZ is the storage of and distribution of petrol, diesel, HFO, jet fuel and LPG.

1.3 Main Hazards Due to Substance and Process

The main hazards that would occur with a loss of containment of hazardous components at the proposed BTG facility in the Coega SEZ include exposure to:

- Thermal radiation from fires;
- Overpressure from explosions.

2 ENVIRONMENT

The Coega SEZ is situated approximately 15 km from Port Elizabeth, within the Nelson Mandela Metropolitan Municipality of the Eastern Cape. The proposed BTG terminal would be constructed on a portion of land in Zone 7 of the IDZ, which is owned by Transnet National Ports Authority (TNPA) and has been designated for the storage of bulk liquids, as shown in Figure 2-1.Entrance into the SEZ is restricted with permissible access to workers, contractors and persons having direct business within the area. The general public would be beyond the site boundary of the SEZ.

There are currently little developments in Zone 7 at the Coega SEZ, but it is expected that as time progresses the area would become occupied by light and heavy industries. The closest residential area is Motherwell, approximately 7 km to the west of the proposed BTG facility.

Figure 2-1: Location of the proposed BTG facility in Coega

The proposed BTG facility is to be built in an unoccupied area within the Coega SEZ with no surrounding neighbours. However, this will change in future with new developments.

The pipeline to the BTG facility will tie-in at the OTGC tank farm which is located in the Port of Ngqura and crosses into the Coega SEZ boundary, running north to south approximately 450 m east to the BTG facility.

Entrance into the Port of Ngqura and SEZ is restricted with permissible access to workers, contractors and persons having direct business within the area. The general public would be beyond the site boundary of the Port of Ngqura and the SEZ

3 PROCESS DESCRIPTION

3.1 Site

The BTG facility in the Coega SEZ will consist of storage vessels, gantries, offices, workshops, and infrastructure.

Subsequently to the initial design process, the Coega Development Corporation (CDC) has approached BTG regarding possible solutions for Orion Engineered Carbons (OEC). OEC currently receives carbon black oil (CBO) via Dom Pedro facility at the Port of Port Elizabeth. However, due to the intended closure of the Dom Pedro facility at the Port of Port Elizabeth there is a deadline by which the new replacement facility for OEC must be commissioned at the Port of Ngqura. As part of the solution, BTG has entered into an agreement with the CDC to permit CDC to construct the necessary tanks and pipeline from the berth to receive and store CBO within the necessary timeframes.

In addition, the initially planned storage capacity of the BTG facility needs to be amended to take into account the requirements of OEC (36 000m3 of CBO storage required). These changes include an increase in capacity of the two HFO tanks from 15 000m3 ^{each} to 18 000m3 each. In addition, there will be a reduction in the petroleum tank storage (ULP and Diesel tanks) of 6 000m3. As such, the total volume storage of the tank farm will remain unchanged.

The BTG Project be implemented in two separate phases. Phase 1 will include all the infrastructure required by OEC and Phase 2 will be the remainder of the BTG facility, which could be further broken down into additional phases to accommodate future growth, as shown in Figure 3-1.

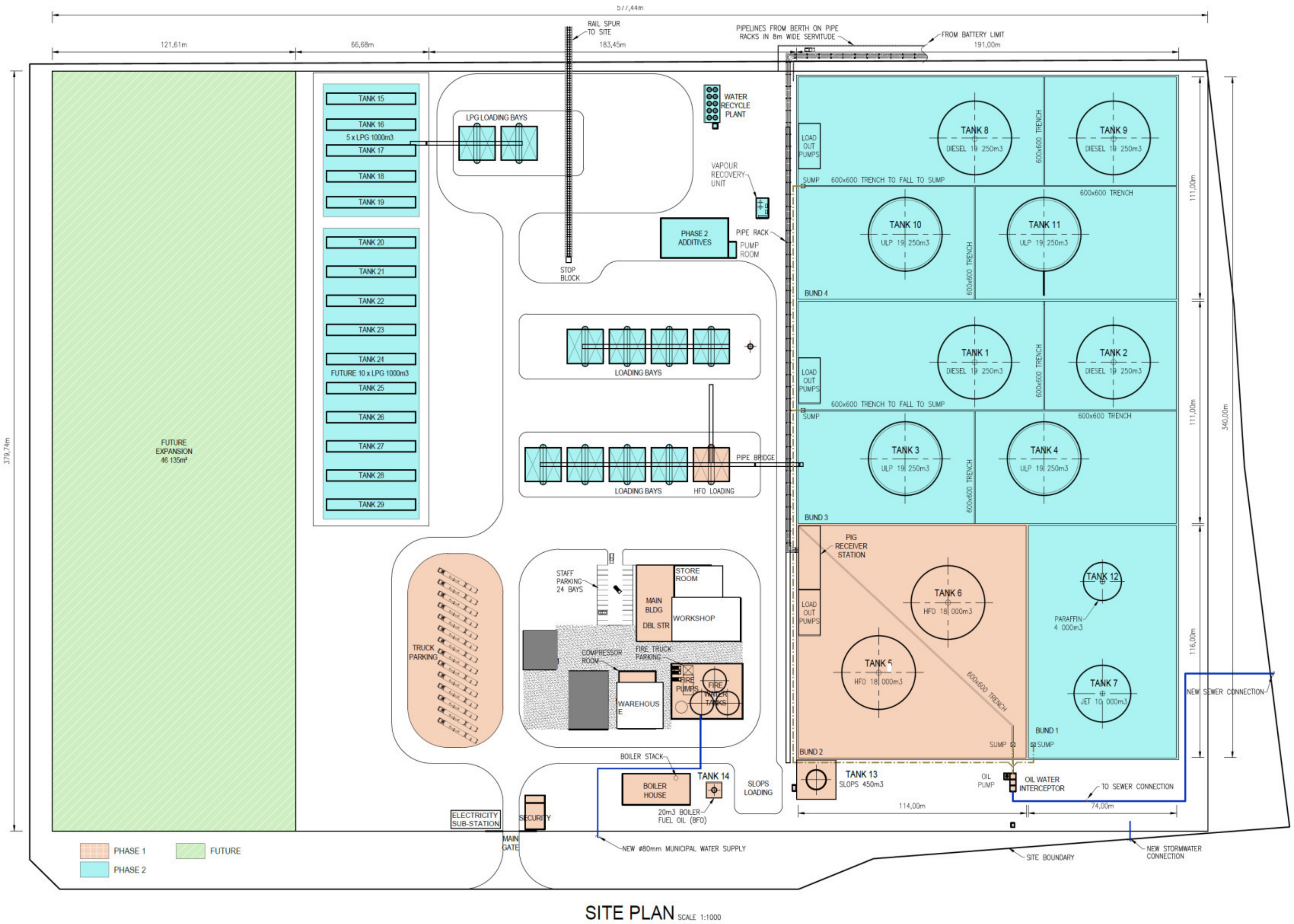

Figure 3-1: Site layout

3.2 Process Description

Phase 1 of the project will consist of:

- HFO pipeline from the tank farm to the battery limit of OTGC facility, but not excluding a separate rack in the OTGC section to the berth;
- 2 x HFO 18 000 m^3 tanks (Tank 5 and 6) (total capacity 36 000 m^3);
- Outflow Heaters;
- Pig Receiver Station;
- Boiler;
- 2 x Loading bays for road tankers;
- Fire protection and suppression system;
- Oil Spill Management System;
- Booster station;
- Admin buildings and toilets.

HFO will be delivered 30 000 m^3 parcels from the ship (approximately 3-4 times per year) and will be transported to the BTG facility via a 400 mm pipeline at a flow rate of 500-900 m^3/h. The pipeline manifold pressure would be 6-8 bar(g) at 60ºC.

Figure 3-2 illustrates the flow process of the BTG facility where ULP (petrol, diesel, HFO), Jet A-1 and LPG will be imported from ships and transported to site via pipelines and stored in product specific bulk tanks.

Products from the bulk tanks will be loaded into road tankers at the specific gantries and transported to the end user.

Additive tanks have been provided for ULP, which will be added to the fuel at the gantry.

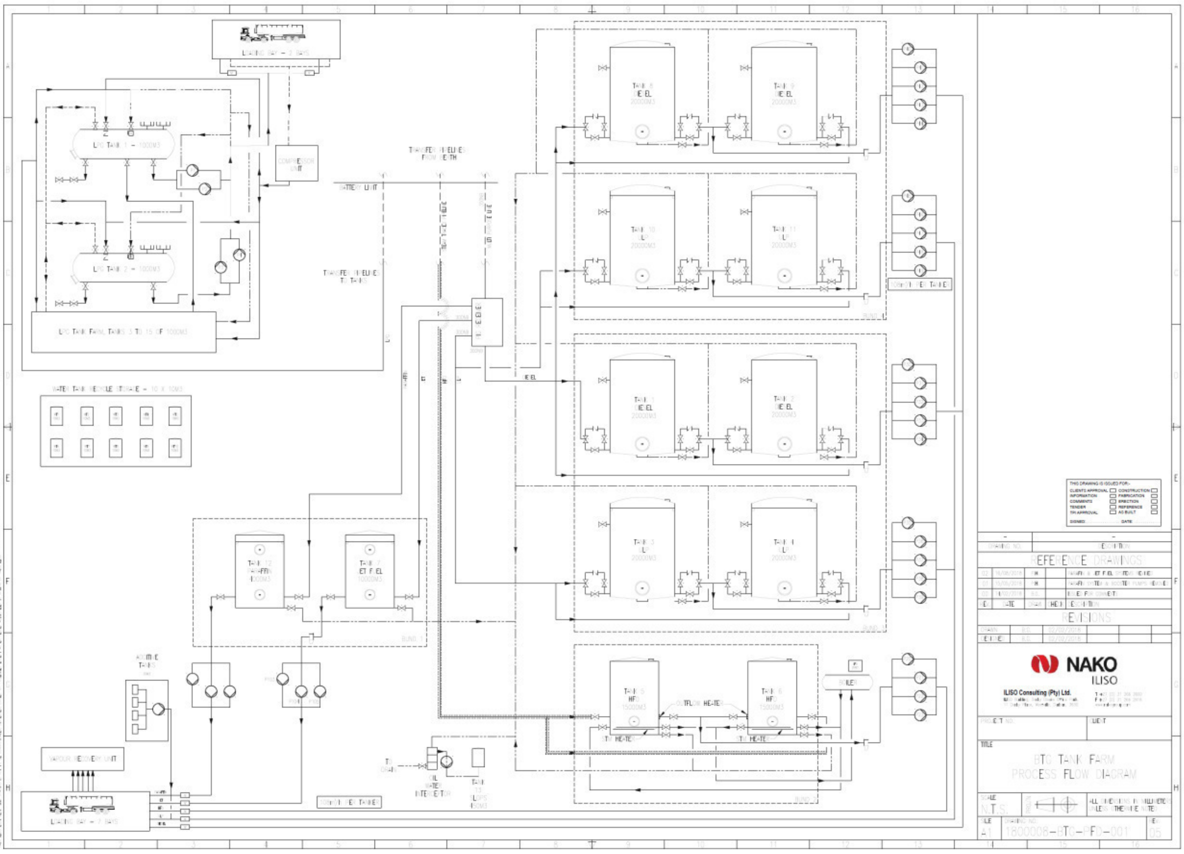

Figure 3-2: Process flow diagram

3.3 Summary of Bulk Materials to be Stored on Site

A summary of bulk materials that can give hazardous effects that are to be stored on site is given in Table 3-4 and Table 3-5, for the respective phases.

Table 3-4: Summary of hazardous components to be stored on site (Phase 1)

No.	Product	Tank Diameter (m)	Tank Height (m)	Nominal Capacity (m3)	Maximum Capacity (m3)	Tank Type
5	HFO	36.8	17.5	18 000	17 009	A, V, FR, IH
6	HFO	36.8	17.5	18 000	17009	A, V, FR, IH

Table 3-5: Summary of hazardous components to be stored on site (Subsequence Phases)

No.	Product	Tank **Diameter (m)**	Tank **Height (m)**	Working Capacity **(m3)**	Tank Type
1	Diesel	36.8	20	19 250	A, V, FR
2	Diesel	36.8	20	19 250	A, V, FR
3	ULP	36.8	20	19 250	A, V, IFR
4	ULP	36.8	20	19 250	A, V, IFR
7	JET-A1	28.3	18	10 000	A, V, IFR
8	Diesel	36.8	20	19 250	A, V, FR
9	Diesel	36.8	20	19 250	A, V, FR
10	ULP	36.8	20	19 250	A, V, FR
11	ULP	36.8	20	19 250	A, V, FR
12	Paraffin	19	16	4000	A, V, FR
13	Slops	8	10	450	A, V, FR
14	BFO	2.5	8	20	A, V, IFR
LPG1	LPG	5.5	44.6	1 000	P, H
LPG2	LPG	5.5	44.6	1 000	P, H
LPG3	LPG	5.5	44.6	1 000	P, H
LPG4	LPG	5.5	44.6	1 000	P, H
LPG5	LPG	5.5	44.6	1 000	P, H
LPG6	LPG	5.5	44.6	1 000	P, H
LPG7	LPG	5.5	44.6	1 000	P, H
LPG8	LPG	5.5	44.6	1 000	P, H
LPG8	LPG	5.5	44.6	1 000	P, H
LPG10	LPG	5.5	44.6	1 000	P, H
LPG11	LPG	5.5	44.6	1 000	P, H
LPG12	LPG	5.5	44.6	1 000	P, H
LPG13	LPG	5.5	44.6	1 000	P, H
LPG14	LPG	5.5	44.6	1 000	P, H
LPG14	LPG	5.5	44.6	1 000	P, H

NOTE:
Tank Type

A	Atmospheric tank
P	Pressurised tank
V	Vertical tank
H	Horizontal tank
FR	Fixed roof
IRF	Internal floating roof
IH	Internal heating

4 METHODOLOGY

The first step in any risk assessment is to identify all hazards. The merit of including a hazard for further investigation is then determined by how significant it is, normally by using a cut-off or threshold value.

Once a hazard has been identified, it is necessary to assess it in terms of the risk it presents to the employees and the neighbouring community. In principle, both probability and consequence should be considered, but there are occasions where, if either the probability or the consequence can be shown to be sufficiently low or sufficiently high, decisions can be made based on just one factor.

During the hazard identification component of the report, the following considerations are taken into account:

- Chemical identities;
- Location of on-site installations that use, produce, process, transport or store hazardous components;
- Type and design of containers, vessels or pipelines;
- Quantity of material that could be involved in an airborne release;
- Nature of the hazard most likely to accompany hazardous materials spills or releases, e.g. airborne toxic vapours or mists, fires or explosions, large quantities to be stored and certain handling conditions of processed components.

The evaluation methodology assumes that the facility will perform as designed in the absence of unintended events such as component and material failures of equipment, human errors, external events and process unknowns.

Due to the absence of South African legislation regarding determination methodology for quantitative risk assessment (QRA), the methodology of this assessment is based on the legal requirements of the Netherlands, outlined in CPR 18E (Purple Book; 1999) and RIVM (2009). The evaluation of the acceptability of the risks is done in accordance with the UK Health and Safety Executive (HSE) ALARP criteria that clearly cover land use, based on determined risks.

The QRA process is summarised with the following steps:

1. Identification of components that are flammable, toxic, reactive or corrosive and that have potential to result in a major incident from fires, explosions or toxic releases;
2. Development of accidental loss of containment (LOC) scenarios for equipment containing hazardous components (including release rate, location and orientation of release);
3. For each incident developed in Step 2, determination of consequences (such as thermal radiation, domino effects, toxic-cloud formation and so forth);
4. For scenarios with off-site consequences (greater than 1% fatality off-site), calculation of maximum individual risk (MIR), taking into account all generic failure rates, initiating events (such as ignition), meteorological conditions and lethality.

Scenarios included in this QRA have impacts external to the establishment. The 1% fatality from acute affects (thermal radiation, blast overpressure and toxic exposure) is determined as the endpoint (RIVM 2009). Thus, a scenario producing a fatality of less than 1% at the establishment boundary under worst-case meteorological conditions would be excluded from the QRA.

5 CONCLUSIONS

Risk calculations are not precise. Accuracy of predictions is determined by the quality of base data and expert judgements.

This risk assessment included the consequences of fires and explosions at the BTG facility in the Coega SEZ. A number of well-known sources of incident data were consulted and applied to determine the likelihood of an incident to occur.

This risk assessment was performed with the assumption that the site would be maintained to an acceptable level and that all statutory regulations would be applied. It was also assumed that the detailed engineering designs would be done by competent people and would be correctly specified for the intended duty. For example, it was assumed that tank wall thicknesses have been correctly calculated, that vents have been sized for emergency conditions, that instrumentation and electrical components comply with the specified electrical area classification, that material of construction is compatible with the products, etc.

It is the responsibility of the owners and their contractors to ensure that all engineering designs would have been completed by competent persons and that all pieces of equipment would have been installed correctly. All designs should be in full compliance with (but not limited to) the Occupational Health and Safety Act 85 of 1993 and its regulations, the National Buildings Regulations and the Buildings Standards Act 107 of 1977 as well as local bylaws.

A number of incident scenarios were simulated, taking into account the prevailing meteorological conditions, and described in the report.

5.1 Notifiable Substances

The General Machinery Regulation 8 and its Schedule A on notifiable substances requires any employer who has a substance equal to or exceeding the quantity listed in the regulation to notify the divisional director. A site is classified as a Major Hazard Installation if it contains one or more notifiable substances or if the off-site risk is sufficiently high. The latter can only be determined from a quantitative risk assessment.

As more than 25 t of LPG would be stored in a single vessel, the LPG storage would be classified as a notifiable substance and automatically the facility would be classified as a Major Hazard Installation.

5.2 Transportation Pipelines

Four product pipelines would be provided to transport the products from the common import line to the terminal. The four pipelines would include:

- Dedicated HFO/CBO pipeline
- Dedicated LPG pipeline
- Two multi product (MPP) pipelines

The tie-in point will be located approximately 2.5 km from the terminal and travel above ground, with potential below ground section for the road crossing. Two alternative pipeline routings were reviewed, one to the north of the OTGC facility and the other along the road servitude.

A loss of containment of the lines containing liquids would result in the formation of a flammable pools, which if ignited would form pool fires. The consequences from these pool fire would be localised and could impact direct facilities bordering the pipeline servitude.

A loss of containment from a pressurised LPG pipeline could result in large jet fires. Again, under such circumstances, the impacts would be localised affecting companies bordering the pipeline.

Impacts from major incidents resulting from a loss of containment of transportation pipelines would remain with the Coega SEZ and would not extend into residential areas. Providing there is adequate protection from vehicle impacts, both routes would have similar risks and would be acceptable to the general public outside of the Coega SEZ

5.3 LPG Storage and Road Loading Gantry

LPG to be transported from the ship would initially be stored in five large storage vessels with the addition of ten more vessels at a later stage. The LPG would be loaded into road tankers at a dedicated bay and transported to customers.

The current designs of the LPG gas storage are conceptual, but would be in accordance to the SANS 10087 standard.

The effects of a major incident, including flash fires and vapour cloud explosions, from a loss of containment of LPG could extend some distance, but would remain within the Coega SEZ

The risks from the proposed BTG facility, at the end of Phase 2, could extend beyond the site boundary, but would not extend beyond the Coega SEZ facility and would not impact onto the general public

5.4 Atmospheric Tank Storage and Liquid Fuel Road Gantry

Liquid fuels transported from the ship would be stored in eight atmospheric tanks with the potential of four more tanks at a later stage. The fuels would be loaded into road tankers that will be transported offsite to end users.

The current designs are conceptual. They state that the vessels would be compliant to the applicable petroleum storage standard of SANS 10089 with the low flash point ULP tanks of having internal floating roofs.

Phase 1 of the project, consisting of the construction of the CGO/HFO storage tanks and associated pipeline and infrastructure, would have a minimal risk footprint, due to the high flash point of the CBO/HFO

The risks after completion of all phases of the project, could extend a short distance beyond the site boundary, but would not extend beyond the Coega SEZ.

5.5 Impacts onto Neighbouring Properties, Residential Areas and MHIs

Large LPG jet fires, flash fires, vapour cloud explosions and boiling liquid expanding vapour explosions (BLEVEs) could extend to the beyond the proposed BTG facility, but would not extend beyond the Coega SEZ. Thus, the risks to the public, outside the Coega SEZ from such releases will be considered acceptable.

None of the neighbouring companies have identified themselves to BTG as being classified as a Major Hazard Installation.

5.6 Major Hazard Installation

It should be noted that Section 2 of the MHI regulations applies only if the risk posed by the installation poses a risk to both employees and the public. The definition of an employee under the OHS Act No. 85 of 1993 is that an employee receives remuneration and works under supervision. As all personnel entering the Coega ISE, do so at the access point and have business within the secured boundaries of the complex, such personnel would be considered employees under that definition.

The risk of $1x10^{-6}$ fatalities per person per year isopleth for modelled releases on site does not extend beyond the Coega SEZ. As the general public is located beyond the complex boundary, the proposed operations would not pose a risk to both employees and the public. However, due to the inventory capacities of the LPG to be stored on-site. LPG would-be classified as notifiable substance and will automatically classify the proposed bulk liquid storage facility as a Major Hazard Installation

This study is not intended to replace the Major Hazard Installation risk assessment which should be completed prior to construction of the BGT facility

6 RECOMMENDATIONS

As a result of the risk assessment study conducted for the proposed BTG facility (including the pipeline routing alternatives) in the Coega IDZ, a number of events were found to have risks beyond the BTG site boundary.

While the design presented is conceptual, RISCOM did not find any fatal flaws that would prevent the project proceeding to the detailed engineering phase of the project.

RISCOM would support the project with the following conditions:

- Compliance with all statutory requirements, i.e. National Building Regulations & Building Standards Act 103 of 1977, Pressure Equipment Regulations (PER);
- Compliance with applicable SANS codes, i.e. SANS 10087, SANS 10089, SANS 10108, SANS 347 etc.;
- Incorporation of a rational fire design, with approval from local authority;
- Demonstration that preventative measures are in place to prevent the above ground pipelines from being damaged from road vehicles;
- Demonstration that above ground pipelines are protected from vegetation fires below or near the pipelines and cannot be damaged or exceed the design ratings of the pipelines, under such circumstances;
- Demonstration that the pipelines will not exceed the design pressure when not in use, due to thermal expansion, or pressure surges (liquid hammer);
- LPG vessels to be mounded, or detailed justification provided for non-mounding vessels, with adequate mitigation provided to prevent a major incident;
- Incorporation of applicable guidelines or equivalent international recognised codes of good design and practice into the designs;
- Completion of a recognised process hazard analysis (such as a HAZOP study, FMEA, etc.) on the proposed facility prior to construction to ensure design and operational hazards have been identified and adequate mitigation put in place;
- Full compliance with IEC 61508 and IEC 61511 (Safety Instrument Systems) standards or equivalent to ensure that adequate protective instrumentation is included in the design and would remain valid for the full life cycle of the tank farm:
  - Including demonstration from the designer that sufficient and reliable instrumentation would be specified and installed at the facility;
- Preparation and issue of a safety document detailing safety and design features reducing the impacts from fires, explosions and flammable atmospheres to the MHI assessment body at the time of the MHI assessment:
  - Including compliance to statutory laws, applicable codes and standards and world's best practice;
  - Including the listing of statutory and non-statutory inspections, giving frequency of inspections;
  - Including the auditing of the built facility against the safety document;
  - Noting that codes such as IEC 61511 can be used to achieve these requirements;
- Demonstration by BTG or their contractor for the final designs would reduce the risks posed by the installation to internationally acceptable guidelines;
- Signature of all facility designs by a professional engineer registered in South Africa in accordance with the Professional Engineers Act, who takes responsibility for suitable designs;

- Completion of an emergency preparedness and response document for on-site and off-site scenarios prior to initiating the MHI risk assessment (with input from local authorities);
- Permission not being granted for increases to the product list or product inventories without redoing part of or the full EIA;
- Final acceptance of the facility risks with an MHI risk assessment that must be completed in accordance to the MHI regulations:
    - Basing such a risk assessment on the final design and including engineering mitigation.

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QUANTITATIVE RISK ASSESSMENT OF THE PROPOSED BAY TERMINAL GROUP TANK FARM AT COEGA, EASTERN CAPE

1 INTRODUCTION

The Bay Terminal Group (hereinafter referred to as BTG), is proposing the establishment of a bulk liquid storage and handling facility at the Port of Ngqura in Zone 7 of the Coega Special Economic zone (SE Special), situated near Port Elizabeth, within the Nelson Mandela Bay Municipality (NMBM), of the Eastern Cape Province. Bulk liquids, such as petrol, diesel, jet fuel, fuel oil, and liquefied petroleum gas (LPG), would be transported via ship to the berth in the Port of Ngqura and would be piped to the proposed facility.

Since off-site incidents may result due to hazards of some of the chemical components to be stored on, produced at or delivered to site, RISCOM (PTY) LTD was commissioned to conduct a quantitative risk assessment (QRA) to determine whether the impacts onto surrounding properties and communities as part of an environmental impact assessment (EIA).

At this stage of the project the detailed engineering designs are not yet available and there is not enough information to complete a formal Major Hazard Installation (MHI) risk assessment. Furthermore, the project will be developed in phases. As the earlier phases would be developed in advance of subsequence phases, the MHI risk assessment must be reviewed and for each subsequent phase, prior to construction.

The purpose of this report is to convey the essential details, which include a short description of hazards, the receiving environment and current relevant design as well as risks and consequences of a major incident.

1.1 Legislation

Legislation discussed in this subsection is limited to the health and safety of employees and the public.

Risk assessments are conducted when required to do so by law or by companies wishing to determine the risks of the facility for other reasons, such as insurance. In South Africa, risk assessments are carried out under the legislation of two separate acts, each with different requirements. These are discussed in the subsections that follow.

1.1.1 National Environmental Management Act (No. 107 of 1998) (NEMA) and its Regulations

The National Environmental Management Act (NEMA) contains South Africa’s principal environmental legislation. It has as its primary objective to make provision for cooperative governance by establishing principles for decision making on matters affecting the environment, on the formation of institutions that will promote cooperative governance and on establishing procedures for coordinating environmental functions exercised by organs of state as well as to provide for matters connected therewith (Government Gazette 1998).

Section 30 of the NEMA act deals with the control of emergency incidents where an "*incident*" is defined as an "*unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed*".

The act defines "*pollution*" as *"any change in the environment caused by:*

(i) Substances;
(ii) Radioactive or other waves; or
(iii) Noise, odours, dust or heat…

Emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or wellbeing or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future... "

"*Serious*" is not fully defined but would be accepted as having long lasting effects that could pose a risk to the environment or to the health of the public that is not immediately reversible.

This is similar to the definition of a MHI as defined in the Occupational Health and Safety Act (OHS Act) 85 of 1993 and its MHI regulations.

Section 28 of NEMA makes provision for anyone who causes pollution or degradation of the environment being made responsible for the prevention of the occurrence, continuation or reoccurrence of related impacts and for the costs of repair of the environment. In terms of the provisions under Section 28 that are stated as:

" Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped… "

1.1.2 The Occupational Health and Safety Act No. 85 of 1993

The Occupation Health and Safety Act 85 (1993) is primarily intended for the health and safety of the employees, whereas its MHI regulations is intended for the health and safety of the public.

The OHS Act shall not apply in respect of:

" *a)* *A mine, a mining area or any works as defined in the Minerals Act, 1991 (Act No. 50 of 1991), except in so far as that Act provides otherwise;*

b) *Any load line ship (including a ship holding a load line exemption certificate), fishing boat, sealing boat and whaling boat as defined in Section 2 (1) of the Merchant Shipping Act, 1951 (Act No. 57 of 1951), or any floating crane, whether or not such ship, boat or crane is in or out of the water within any harbour in the Republic or within the territorial waters thereof, (date of commencement of paragraph (b) to be proclaimed.), or in respect of any person present on or in any such mine, mining area, works, ship, boat or crane.* *"*

1.1.2.1 Major Hazard Installation Regulations

The MHI regulations (July 2001) published under Section 43 of the OHS Act require employers, self-employed persons and users who have on their premises, either permanently or temporarily, a major hazard installation or a quantity of a substance which may pose a risk (our emphasis) that could affect the health and safety of employees and the public to conduct a risk assessment in accordance with the legislation.

In accordance with legislation, the risk assessment must be done prior to construction of the facility by an approved inspection authority (AIA; see Appendix A), registered with the Department of Labour and accredited by the South African National Accreditation Systems (SANAS).

Similar to Section 30 of NEMA as it relates to the health and safety of the public, the MHI regulations are applicable to the health and safety of employees and the public in relation to the operation of a facility and specifically in relation to sudden or accidental major incidents involving substances that could pose a risk to the health and safety of employees and the public.

It is important to note that the MHI regulations are applicable to the risks posed and not merely the consequences. This implies that both the consequence and likelihood of an event need to be evaluated, with the classification of an installation being determined on the risk posed to the employees and the public.

The definition of an employee under the OHS Act is a person that receives remuneration and works under supervision. As all personnel entering the complex do so at an access point and have business in the complex; such persons would be considered employees under the definition. This includes employees at the proposed BTG facility and other facilities located in the complex as well as contractors. The public would include persons located beyond the complex boundary.

The notification of the MHI is described in the regulations as an advertisement placement and specifies the timing of responses from the advertisement. It should be noted that the regulation does not require public participation.

The regulations, summarised in Appendix B, essentially consists of six parts, namely:

1. The duties for notification of a MHI (existing or proposed), including:
   a. Fixed;
   b. Temporary installations;
2. The minimum requirements for a quantitative risk assessment (QRA);
3. The requirements for an on-site emergency plan;
4. The reporting steps for risk and emergency occurrences;
5. The general duties required of suppliers;
6. The general duties required of local government.

As this is not an MHI risk assessment, the application of the above legislation is not mandatory but the legislation is described to give a background to this report.

1.2 Terms of Reference

The main aim of the investigation was to quantify the risks to employees, neighbours and the public with regard to the proposed BTG facility in the Coega SEZ.

This risk assessment was conducted in accordance with the MHI regulations and can be used as notification for the facility. The scope of the risk assessment included:

1. Development of accidental spill and fire scenarios for the facility;
2. Using generic failure rate data (for tanks, pumps, valves, flanges, pipework, gantry, couplings and so forth), determination of the probability of each accident scenario;
3. For each incident developed in Step 2, determination of consequences (such as thermal radiation, domino effects, toxic-cloud formation and so forth);
4. For scenarios with off-site consequences (greater than 1% fatality off-site), calculation of maximum individual risk (MIR), taking into account all generic failure rates, initiating events (such as ignition), meteorological conditions and lethality.

1.3 Purpose and Main Activities

The main activity at the proposed BTG facility in the Coega SEZ is the storage of and distribution of petrol, diesel, HFO, jet fuel and LPG.

1.4 Main Hazards Due to Substance and Process

The main hazards that would occur with a loss of containment of hazardous components at the proposed BTG facility in the Coega SEZ include exposure to:

- Thermal radiation from fires;
- Overpressure from explosions.

1.5 Approach to the Study

As mentioned in the previous subsection, the MHI regulations give instructions to the owner regarding the requirements of the risk assessment but stops short on giving the methodologies and criteria that must be used for such studies.

As an AIA, RISCOM uses the methodologies and criteria described in the internationally recognised CPR 18E (1999) (Purple Book) and RIVM (2009). This is a requirement of accreditation and implies that similar results should be obtained by independent risk assessors compliant to the aforementioned documents. Furthermore, CPR 18E (1999) (Purple Book) and RIVM (2009) are legal requirements for conducting quantitative risk assessments (QRAs) in the Netherlands and form the basis of the commercially available software.

The evaluation and acceptability of the risks is extended to the Health and Safety Executive (HSE) of the (UK) ALARP criteria, which explains clearly and covers land use based on the determined risks in the Section 5.

1.6 Assumptions and Limitations

The risk assessment was based on the conceptual designs of the pipeline routing and tank farm layout. Furthermore, EIAs are intended to suggest mitigation which may alter the design and layout of the project. It is thus understood that detail designs would be required to complete the project for construction.

RISCOM used the information provided and made engineering assumptions as described in the document. The accuracy of the document would be limited to the available documents presented in the Amendment Report.

The risk assessment excludes the following:

- Road and rail transportation outside of the facility;
- Natural events such as earthquakes and floods;
- Ecological risk assessment;
- An emergency plan.

1.7 Software

Physical consequences were calculated with TNO's EFFECTS v.9.0.23 and the data derived was entered into TNO's RISKCURVES v. 9.0.26 All calculations were performed by Mr M P Oberholzer.

2 ENVIRONMENT

2.1 General Background

The Coega SEZ is situated approximately 15 km from Port Elizabeth, within the Nelson Mandela Metropolitan Municipality of the Eastern Cape. The proposed BTG terminal would be constructed on a portion of land in Zone 7 of the IDZ, which is owned by Transnet National Ports Authority (TNPA) and has been designated for the storage of bulk liquids, as shown in Figure 2-1.Entrance into the SEZ is restricted with permissible access to workers, contractors and persons having direct business within the area. The general public would be beyond the site boundary of the SEZ.

There are currently little developments in Zone 7 at the Coega SEZ, but it is expected that as time progresses the area would become occupied by light and heavy industries. The closest residential area is Motherwell, approximately 7 km to the west of the proposed BTG facility.

Figure 2-1: Location of the proposed BTG facility in Coega

The proposed BTG facility is to be built in an unoccupied area within the Coega SEZ with no surrounding neighbours. However, this will change in future with new developments.

The pipeline to the BTG facility will tie-in at the OTGC tank farm which is located in the Port of Ngqura and crosses into the Coega SEZ boundary, running north to south approximately 450 m east to the BTG facility.

Entrance into the Port of Ngqura and SEZ is restricted with permissible access to workers, contractors and persons having direct business within the area. The general public would be beyond the site boundary of the Port of Ngqura and the SEZ

2.2 Meteorology

Meteorological mechanisms govern dispersion, transformation and eventual removal of hazardous vapours from the atmosphere. The extent to which hazardous vapours will accumulate or disperse in the atmosphere is dependent on the degree of thermal and mechanical turbulence within the earth's boundary layer.

Dispersion comprises of vertical and horizontal components of motion. The stability and the depth of the atmosphere from the surface (known as the mixing layer) define the vertical component. The horizontal dispersion of hazardous vapours in the atmospheric boundary layer is primarily a function of wind field. Wind speed determines both the distance of downwind transport and the rate of dilution as a result of stretching of the plume, and generation of mechanical turbulence is a function of the wind speed in combination with surface roughness. Wind direction and variability in wind direction both determine the general path hazardous vapours will follow and the extent of crosswind spreading.

Concentration levels of hazardous vapours therefore fluctuate in response to changes in atmospheric stability, to concurrent variations in the mixing layer depth and to shifts in the wind field.

For this report, the meteorological conditions at Ngqura (Coega), as measured by the South African Weather Services, were used as the basis of hourly wind speed and direction determinations. Due to an incomplete weather set at Coega with no hourly readings after August 2015, the weather set comprised of four years from 1 January 2011 to 31 December 2014.

The long-term weather conditions at Port Elizabeth, as measured by the South African Weather Services, from 1981 to 2010 were used as the basis of, temperature, precipitation and atmospheric humidity and stability.

2.2.1 Surface Winds

Hourly averages of wind speed and direction recorded at Ngqura (Coega) were obtained from the South African Weather Services for the period from the 1st of January 2011 to the 31st of December 2014.

Ngqura (Coega) does not experience calm conditions, with the yearly average being 1.5%
The wind roses in Figure 2-2 depict seasonal variances of measured wind speeds. In summer months, wind blows predominantly from the south with the south-south easterly winds having a frequency over 10%. The southerly wings could be medium to high wind speeds with the lower frequency northerly wind consisting of predominantly low speed

During the winter months, the wind is predominantly from the north western quadrant with high frequency medium to high wind speeds.

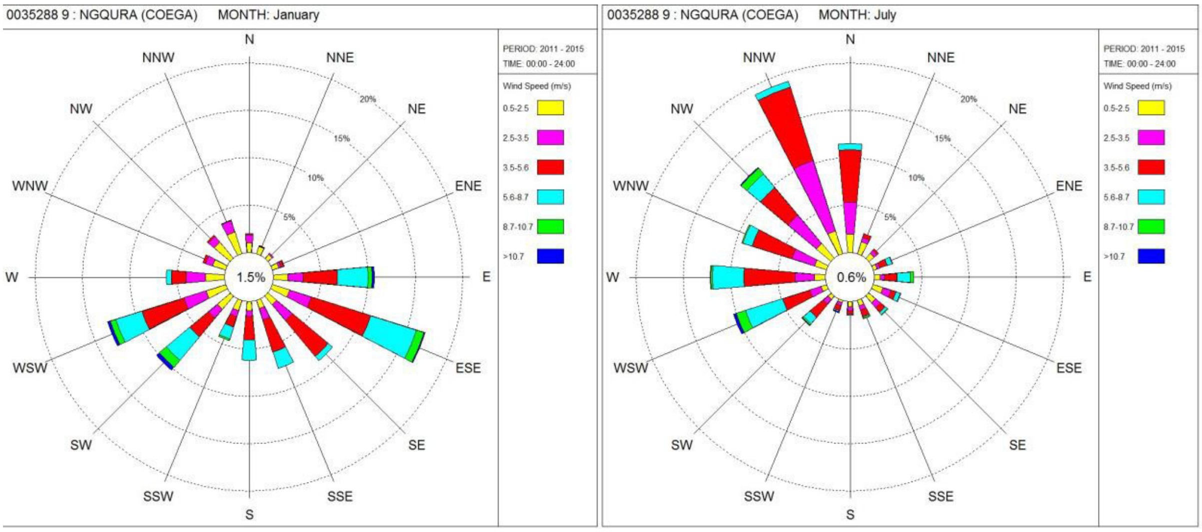


Figure 2-2: Seasonal wind speed as a function of wind direction at Ngqura (Coega) the period from 2011 to 2015

2.2.2 Precipitation and Relative Humidity

The long-term rainfall and relative humidity recorded at Port Elizabeth was obtained from the South African Weather Services for the period from 1981 to 2010, as given in Table 2-1.

In Port Elizabeth there is an average annual rainfall of 581 mm occurring throughout the year with no distinct winter or summer rainfall patterns.

The average relative humidity typically ranges from 61 % during the day to 82 % during the night time. There is no marked seasonal variance between the relative humidity ranges.

Table 2-1: Long-term rainfall at Port Elizabeth

Month	Average Maximum Relative Humidity (%)	Average Minimum Relative Humidity (%)	Average Monthly Precipitation (mm)
January	82	63	39
February	84	64	38
March	84	64	51
April	83	63	45
May	81	56	47
June	78	52	54
July	79	52	40
August	82	58	67
September	82	63	45
October	83	65	57
November	83	65	53
December	82	63	45
Year	**82**	**61**	**581**

2.2.3 Temperature

The long-term temperatures recorded at Port Elizabeth was obtained from the South African Weather Services for the period for the period from 1981 to 2010, as given in Table 2-2.

The surrounding region has a temperate climate with the average daily maximum between 20°C and 25°C. Temperatures rarely extend below freezing, with the mean minimum average daily temperature of 13°C.

The diurnal temperature average was calculated to be 18°C, and liquid pool calculations were calculated with a temperature of 18°C.

Table 2-2: Long-term temperatures measured at Port Elizabeth

Month	Temperature (°C)			
	Highest Recorded	Average Daily Mean	Average Daily Maximum	Average Daily Minimum
January	37.3	21.6	25.6	17.6
February	37.6	21.9	25.9	17.9
March	39.6	20.6	24.7	16.4
April	40.1	18.7	23.4	14.0
May	36.9	16.8	22.1	11.4
June	32.4	14.5	20.5	8.6
July	33.1	14.2	20.2	8.2
August	34.4	14.8	20.0	9.6
September	39.0	15.7	20.3	11.0
October	39.1	17.1	21.2	13.1
November	38.2	18.7	22.7	14.6
December	36.0	20.3	24.3	16.2
Year	**40.1**	**17.9**	**22.6**	**13.2**

2.2.4 Atmospheric Stability

Atmospheric stability is frequently categorised into one of six stability classes. These are briefly described in Table 2-3. Atmospheric stability, in combination with wind speed, is important in determining the extent of a particular hazardous vapour release.

A very stable atmospheric condition, typically at night, would have low wind speeds and produce the greatest endpoint for a dense gas. Conversely, a buoyant gas would have the greatest endpoint distance at high wind speeds.

Table 2-3: Classification scheme for atmospheric stability

Stability Class	Stability Classification	Description
A	Very unstable	Calm wind, clear skies, hot conditions during the day
B	Moderately unstable	Clear skies during the day
C	Unstable	Moderate wind, slightly overcast conditions during the day
D	Neutral	Strong winds or cloudy days and nights
E	Stable	Moderate wind, slightly overcast conditions at night
F	Very stable	Low winds, clear skies, cold conditions at night

The atmospheric stability for Ngqura (Coega), as a function of the wind class, was calculated from hourly weather values supplied by the South African Weather Services from the 1st of January 2011 to the 31st of December 2014, as given in Figure 2-3.

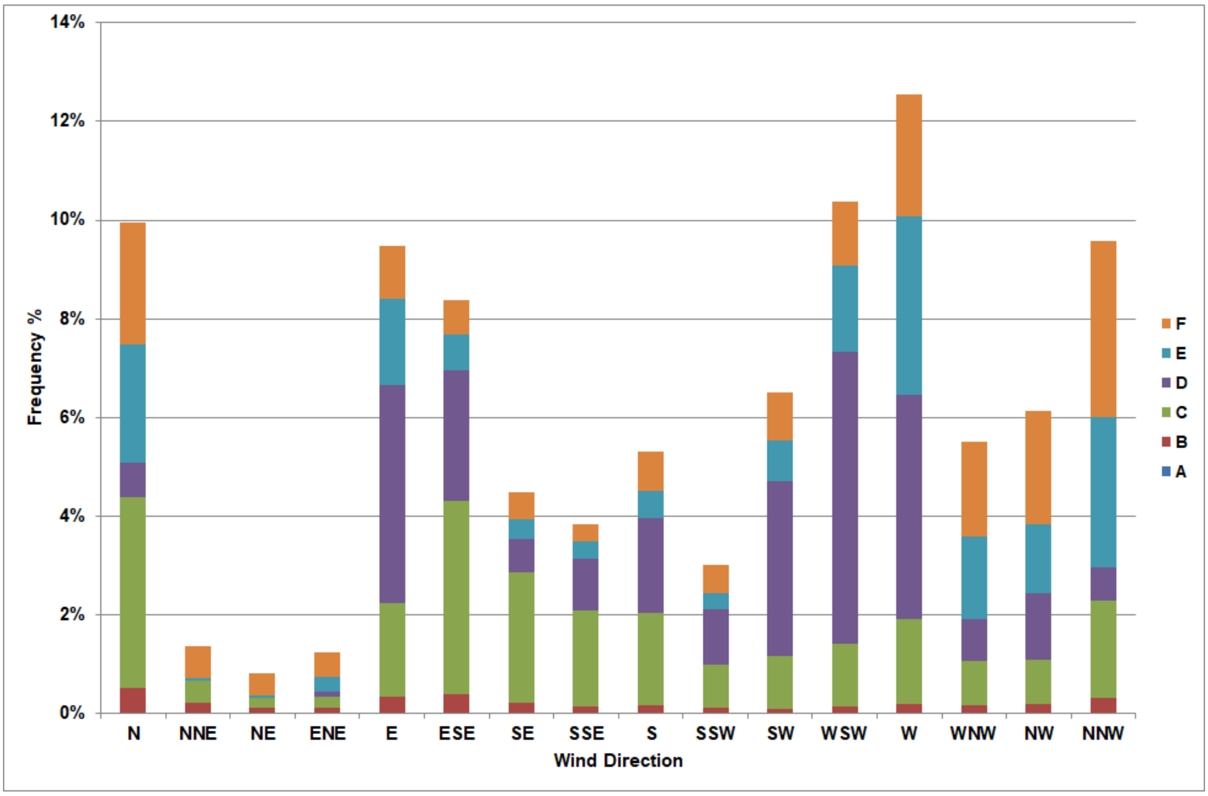


Figure 2-3: Atmospheric stability as a function of wind direction

Calculations for this risk assessment are based on six representative weather classes covering stability conditions of stable, neutral and unstable as well as low and high wind speeds. In terms of Pasquill classes, representative conditions are given in Table 2-4.

Table 2-4: Representative weather classes

Stability Class	Wind (m/s)
B	3
D	1.5
D	5
D	9
E	5
F	1.5

As wind velocities are vector quantities (having speed and direction) and blow preferentially in certain directions, it is mathematically incorrect to give an average wind speed over 360° of wind direction; the result would be incorrect risk calculations.

It would also be incorrect to base risk calculations on one wind category, such as 1.5/F for example. In order to obtain representative risk calculations, hourly weather data for wind speed and direction was analysed over a four-year period and categorised into the six wind classes for day and night conditions and 16 wind directions. The risk was then determined using contributions from each wind class in various wind directions.

The allocation of observations into the six weather classes is summarised in Table 2-5 with the representative weather classes given in Figure 2-4.

Table 2-5: Allocation of observations into six weather classes

<table>
<tr><th>Wind Speed</th><th>A</th><th>B</th><th>B/C</th><th>C</th><th>C/D</th><th>D</th><th>E</th><th>F</th></tr>
<tr><td>< 2.5 m/s</td><td colspan="3" rowspan="3">B 3 m/s</td><td colspan="3">D 1.5 m/s</td><td colspan="2">F 1.5 m/s</td></tr>
<tr><td>2.5 - 6 m/s</td><td colspan="3">D 5 m/s</td><td colspan="2" rowspan="2">E 5 m/s</td></tr>
<tr><td>> 6 m/s</td><td colspan="3">D 9 m/s</td></tr>
</table>

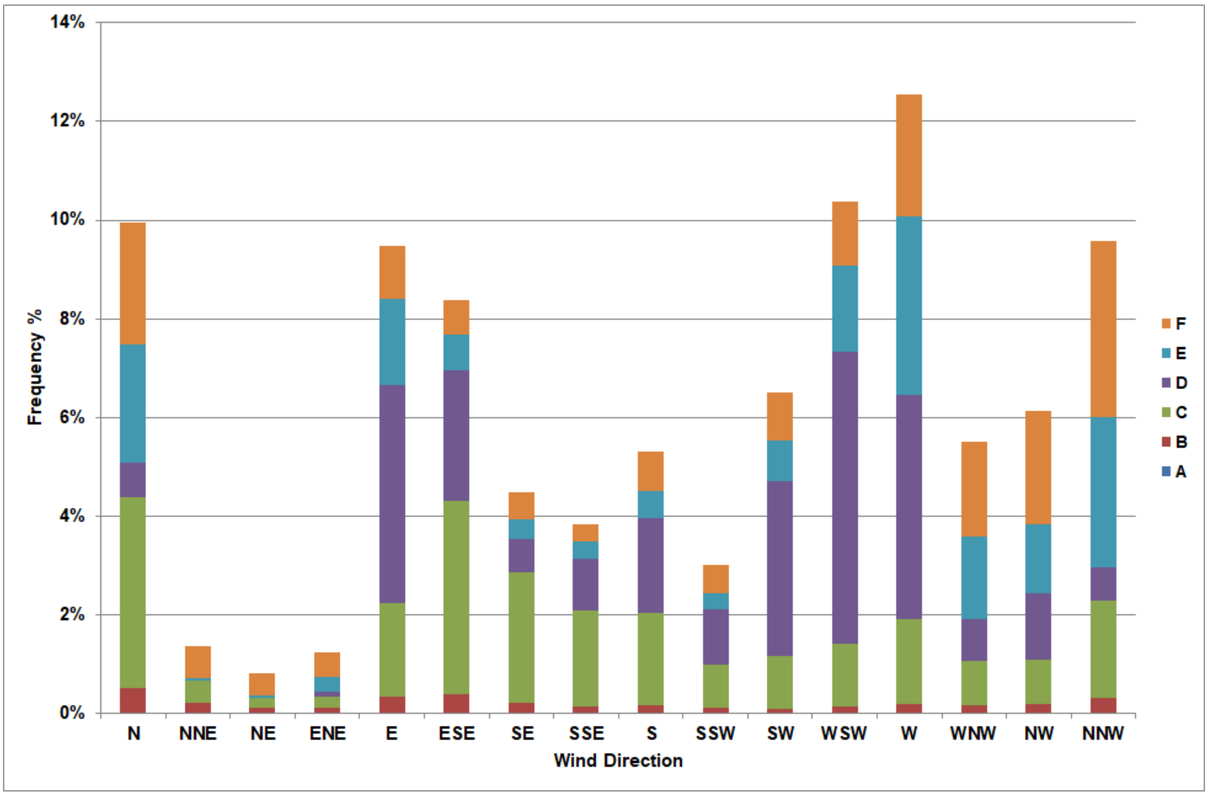


Figure 2-4: Representative weather classes for Ngqura (Coega)

2.2.5 Default Meteorological Values

Default meteorological values used in simulations, based on local conditions, are given in Table 2-6.

Table 2-6: Default meteorological values used in simulations, based on local conditions

Parameter	Default Value (Day)	Default Value (Night)
Ambient temperature (°C)	23	13
Substrate or bund temperature (°C)	18	18
Water temperature (°C)	18	18
Air pressure (bar)	1.013	1.013
Humidity (%)	61	82
Fraction of a 24-hour period	0.5	0.5
Mixing height	[1]	[1]

1 The default values for the mixing height, which are included in the model, are: 1500 m for Weather Category B3; 300 m for Weather Category D1.5; 500 m for Weather Category D5 and Weather Category D9; 230 m for Weather Category E5; and, 50 m for Weather Category F1.5.

3 PROCESS DESCRIPTION

3.1 Site

The BTG facility in the Coega SEZ will consist of storage vessels, gantries, offices, workshops, and infrastructure.

Subsequently to the initial design process, the Coega Development Corporation (CDC) has approached BTG regarding possible solutions for Orion Engineered Carbons (OEC). OEC currently receives carbon black oil (CBO) via Dom Pedro facility at the Port of Port Elizabeth. However, due to the intended closure of the Dom Pedro facility at the Port of Port Elizabeth there is a deadline by which the new replacement facility for OEC must be commissioned at the Port of Ngqura. As part of the solution, BTG has entered into an agreement with the CDC to permit CDC to construct the necessary tanks and pipeline from the berth to receive and store CBO within the necessary timeframes.

In addition, the initially planned storage capacity of the BTG facility needs to be amended to take into account the requirements of OEC (36 000m^3 of CBO storage required). These changes include an increase in capacity of the two HFO tanks from 15 000m^3 each to 18 000m^3 each. In addition, there will be a reduction in the petroleum tank storage (ULP and Diesel tanks) of 6 000m^3. As such, the total volume storage of the tank farm will remain unchanged.

The BTG Project be implemented in two separate phases. Phase 1 will include all the infrastructure required by OEC and Phase 2 will be the remainder of the BTG facility, which could be further broken down into additional phases to accommodate future growth, as shown in Figure 3-1.

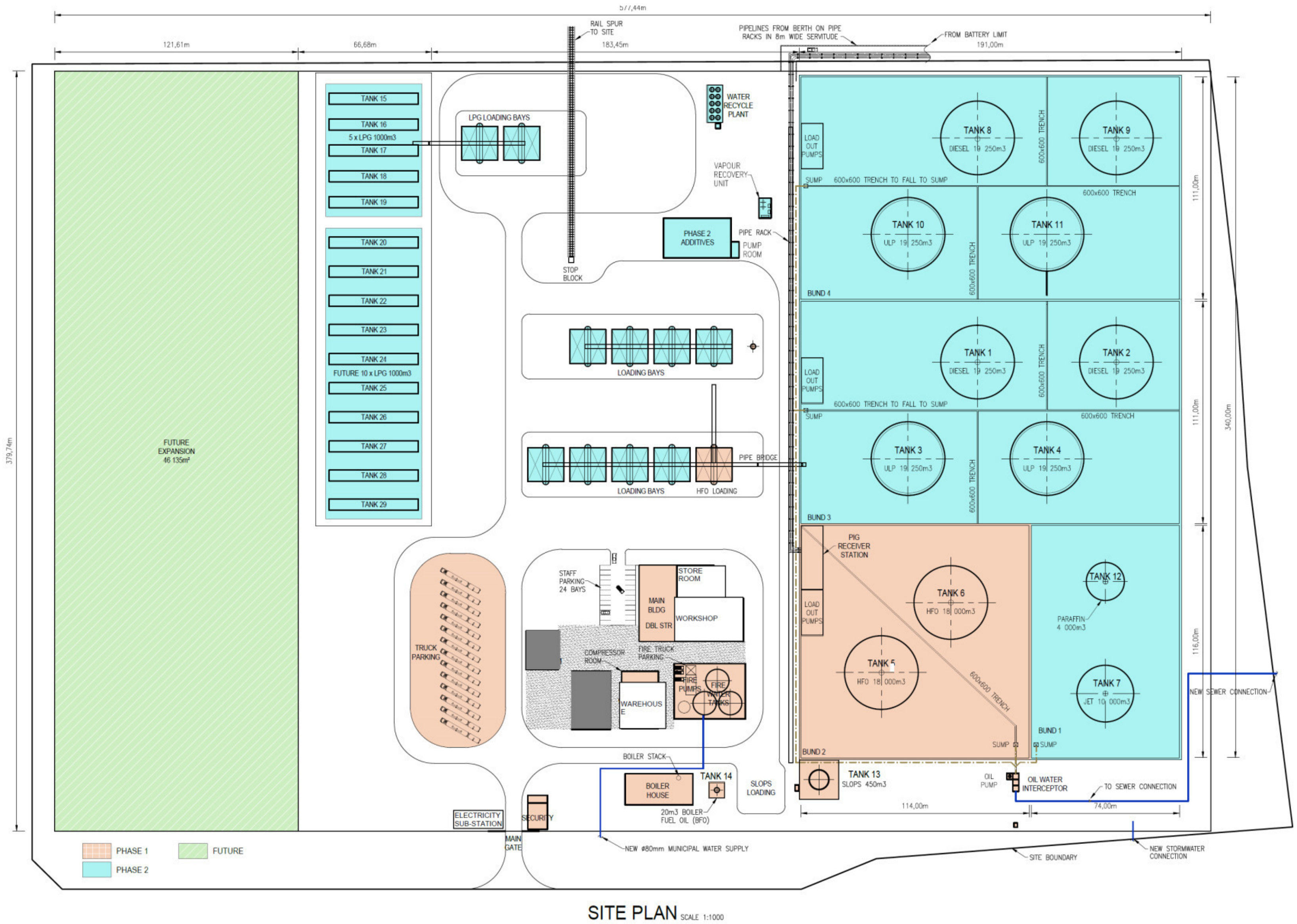


Figure 3-1: Site layout

3.2 Process Description

Phase 1 of the project will consist of:

- HFO[1] pipeline from the tank farm to the battery limit of OTGC facility, but not excluding a separate rack in the OTGC section to the berth;
- 2 x HFO 18 000 m^3 tanks (Tank 5 and 6) (total capacity 36 000 m^3);
- Outflow Heaters;
- Pig Receiver Station;
- Boiler;
- 2 x Loading bays for road tankers;
- Fire protection and suppression system;
- Oil Spill Management System;
- Booster station;
- Admin buildings and toilets.

HFO will be delivered 30 000 m^3 parcels from the ship (approximately 3-4 times per year) and will be transported to the BTG facility via a 400 mm pipeline at a flow rate of 500-900 m^3/h. The pipeline manifold pressure would be 6-8 bar(g) at 60ºC.

Figure 3-2 illustrates the flow process of the BTG facility where ULP (petrol, diesel, HFO), Jet A-1 and LPG will be imported from ships and transported to site via pipelines and stored in product specific bulk tanks.

Products from the bulk tanks will be loaded into road tankers at the specific gantries and transported to the end user.

Additive tanks have been provided for ULP, which will be added to the fuel at the gantry.

1. Note CBO and HFO are interchangeable with both oils having very similar physical properties and require to be kept at 60ºC for storage and transportation

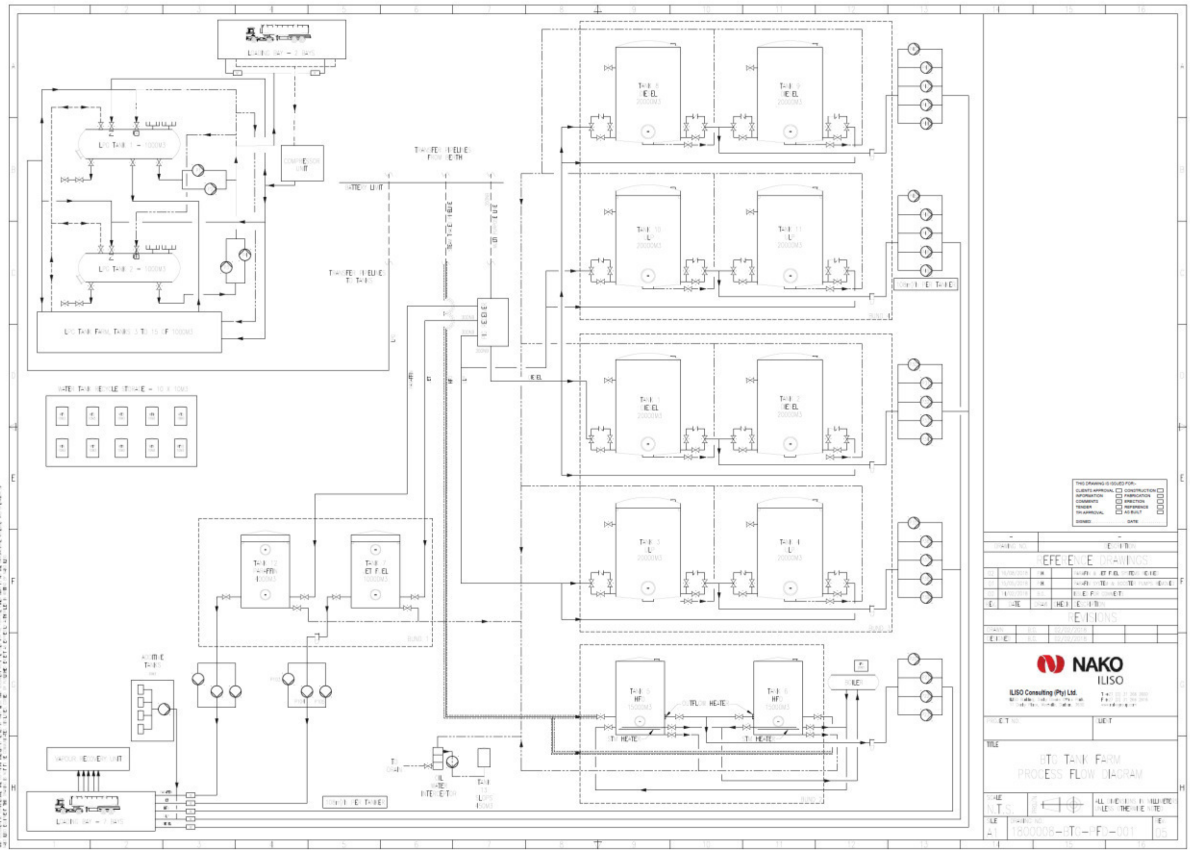


Figure 3-2: Process flow diagram

More details regarding specific areas of the terminal are given below

3.3 Fuel Receipts

Ship offloading will be done at the berth via ship-to-shore offloading booms mounted on the berth structure. This is a separate area to the site operations and the necessary communication systems will be put in place to manage this. Insulating flanges will be utilized at the loading arms, to prevent against electrical arcing due to possible differences in potential between the ship's piping and terminal pipework to avoid static discharges and associated fire hazard.

A pigging station will be provided for pipelines with shared products. An outflow heater will be considered for HFO pumping.

Each parcel of fuel will be transferred via a pipeline to the BTG facility, using the ship's on-board pumps. Should the head loss of the HFO pipeline found to be excessive during the detailed design stage, booster pumps will be included to provide sufficient pressure to fill the HFO tanks. The actual rate of delivery depends on the capacity of the respective ship's pumps, but the berth will have a total transfer capacity of 1600 m^3/h for liquids, limited by the nominal bore of the transfer pipeline (up to 300NB). LPG transfer capacity is 600 m^3/h.

The maximum proposed transfer parcel is 50 000 m^3 to be discharged in 36 hours (32 hours pumping and 4 hours setup and dismantling). The ship's pumps should have sufficient head rating (+-12 bar) to transfer the product to the bulk fuel tanks, with the exception of the HFO tanks, which may require booster pumps. Each respective petroleum product will be pumped from the ship directly to their respective tanks at the storage facility.

For safety reasons, a specified feed rate per pipeline must not be exceeded and for this reason, the unloading process will be controlled with valves and flowmeters.

The necessary Environmental Management Systems [EMS] will be provided for drip containments, spill control, Fire safety, and transfer control communications to site. All piping, hoses and valves must be fire safe, cast steel, and carbon steel to recognized codes.

BTG will only construct their portion of piping from the OTGC battery limit point to their site [2800 m], with the exception of the HFO line which will potentially not tie into the OTGC facility but rather run from the BTG facility to the berth. The port side work up to the OTGC tie-in will be by others.

The conveyance of ULP [petrol]; Jet-A1; paraffin; HFO; diesel and LPG from the Liquid Bulk Berth to its dedicated storage tanks will be carried out via a respective above-ground max. 300 NB pipeline which will meet the requirements of ASME B31.8, in SA-106 Grade B steel.

The pipelines will cover a distance of approximately 5328 m starting from the Liquid Bulk Berth header and ending at the inlet header at the tank farm. The pipelines will traverse up a grade of nearly 50m. The pipelines will be designed for a maximum pressure of 16 bar and have a maximum flowrate of 1 600 m^3/h. (HFO flowrate will be around 1000 m^3/h

A total of 4 pipelines will be provided – 2 lines will be dedicated to LPG and HFO, and the other lines will be a multipurpose pipeline [MPP] transfer line shared amongst the other [white oil] products. The pipelines will be mostly above ground, except at road crossings where it will be in a culvert/ pipe duct or buried. The piping will run on concrete & steel pipe supports and will be trace heated and insulated in the case of HFO, as shown in Figure 3-3.
Due to the phasing of the project, the HFO pipeline may be located on a separate pipe rack
There will be provision for flow-meters and bypasses, in addition to pressure transmitters with alarms and pump shutdowns.

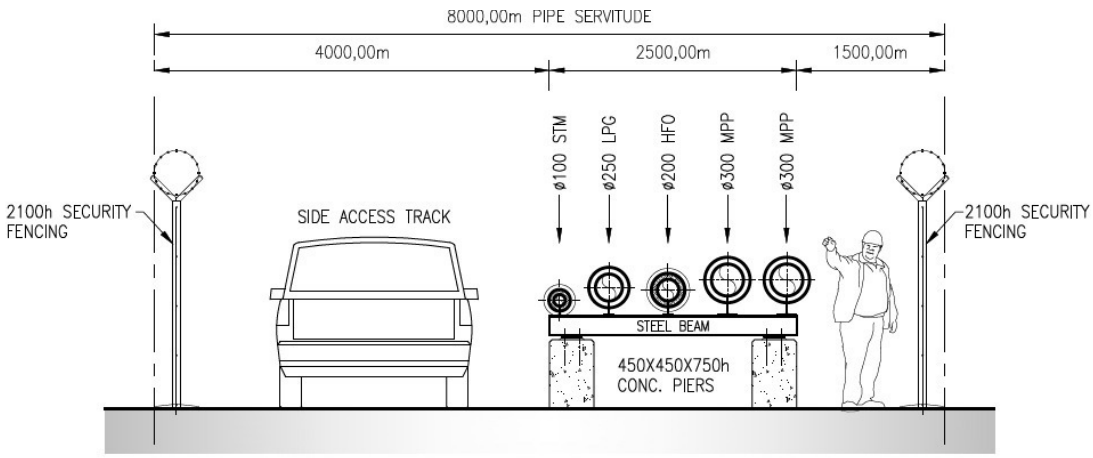


Figure 3-3: Typical cross-sectional piping servitude

The pipeline information regarding the pipeline size, products and maximum flowrate is given in Table 3-1.

Table 3-1: List of pipelines and products

Line No.	Products	Size	Maximum Flow Rate (m^3/h)
Line 1	MPP; ULP; Diesel, JET, Paraffin	300NB	1 600
Line 2	MPP; ULP; Diesel, JET, Paraffin	300NB	1 600
Line 3	HFO	400NB	1 000
Line 4	LPG	300NB	600

The routing of the pipelines will be in an already proclaimed reserve approved by DEDEAT within one of three Environmental Authorisations (EA):

- TNPA EA for landside infrastructure;
- OTGC EA for a bulk liquid terminal and associated pipelines; and
- CDC EA for bulk infrastructure.

CDC have allocated a portion of the bulk infrastructure servitude to BTG for the pipelines from the TNPA Port boundary to the site. TNPA have provided CDC with a Wayleave Agreement to construct the HFO line within the landside fuel reserve to the berth and OTGC have agreed to a tie-in of the remaining 3 lines at the OTGC battery limit. All the pipeline routings are located within a servitude with defined safety distances, security and access control, as well as a service vehicle side road. A proposed servitude of approx. 8 m wide is required for the pipe rack: (4 m for the pipelines, and 4 m for the adjacent service road). BTG will be responsible for the construction of the pipelines from the OTGC tie-in limit to the BTG facility, a distance of 2.8 km. The pipeline routing is shown in Figure 3-4 with two possible alternatives provided. The first of these is in red (Alternative 1) and follows the existing services road whilst the second (Alternative 2, in blue), follows the existing approved road reserve. As mentioned above, BTG will only be responsible for constructing the pipeline from their facility to the OTGC tie-in (point D).

The HFO must be kept at a temperature of around 60°C for transfer and this requires a steam tracing / condensate return system as well as pipe lagging to maintain the temperature.

Provision will be made for pipeline pigging in the 2 common lines following a product change. (ULP, Jet-A1 and diesel) There will be pig launching and receiving stations at the Liquid Bulk Berth and at the BTG facility in the pipeline as required. The pig will be operated by compressed air linked to the launchers (a portable air compressor will be needed at the Liquid Bulk Berth).

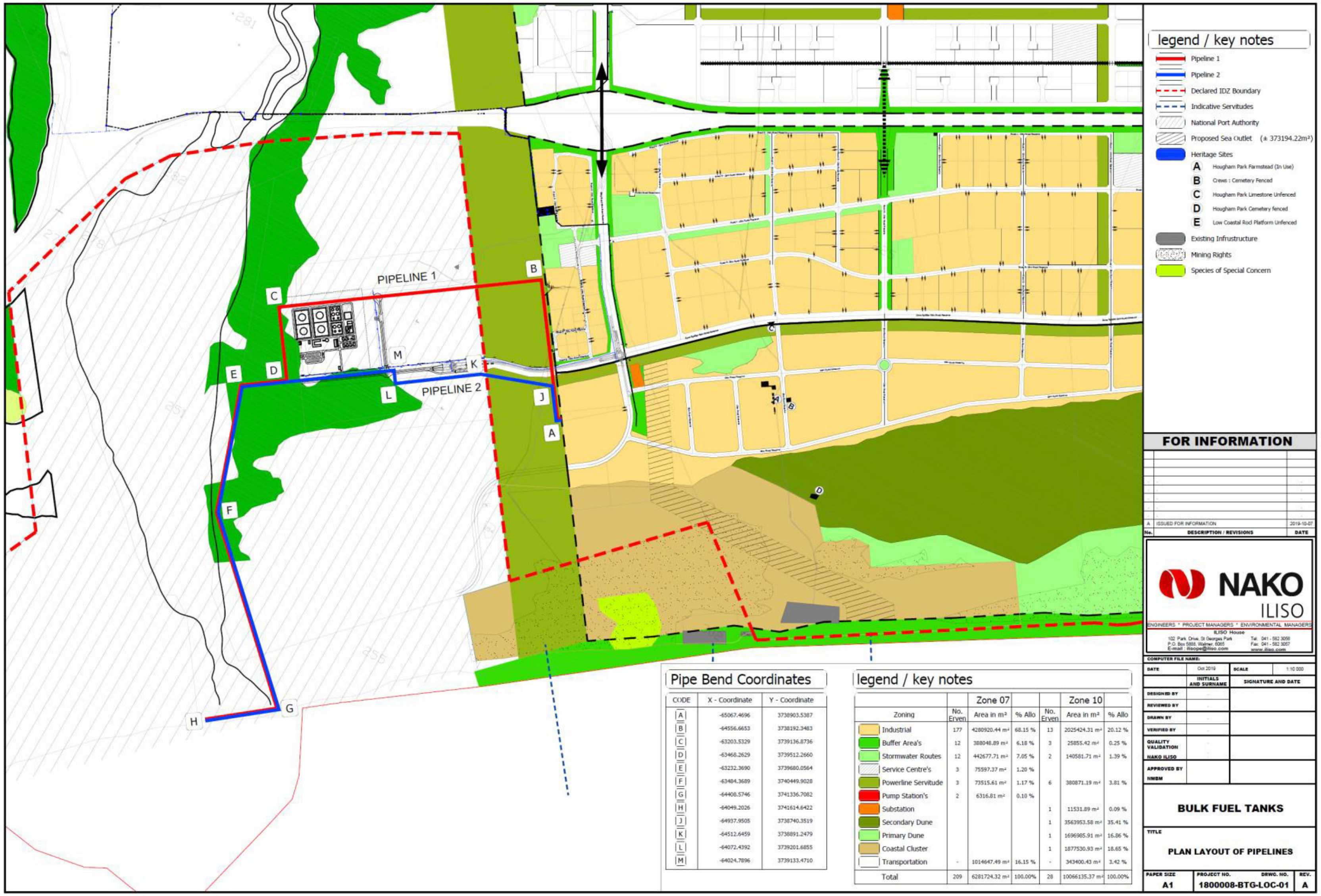


Figure 3-4: Pipeline routing alternatives from the OTGC tie-in to the BTG tank farm

3.4 Atmospheric Liquids

3.4.1 Bulk Liquid Storage

The bulk atmospheric liquid fuel tank farm will be designed in accordance to the requirements of SANS 10089-1, storing ULP, diesel, paraffin, Jet A-1 and HFO fuels, with a working tank capacity of 194 000 m^3. The detail and capacities of the individual tanks are listed in Table 3-4 and Table 3-5, for the respective phases.

The bulk liquid tanks will be classified as vertical tanks, which would be constructed according to the American Petroleum Institute (API) 650 standard, which pertains to the construction of atmospheric steel tanks. The bulk liquid tanks would be designed to store product at atmospheric pressure and temperature with the exception of the tanks containing HFO, which must be heated before it is pumped, The HFO tanks will be equipped with an internal heating coil to maintain the HFO at a temperature of 40 to 50°C. The coil will remain submerged during normal operation, and as such, the coil and nozzle will be situated below the fuel outflow line. During pumping the HFO is further heated to 60°C by means of an external shell and tube heat exchanger. The coil and heat exchanger will be heated using medium pressure steam from the boiler.

Each tank will have a spiral stairway leading to a roof platform, all with handrailing. Where practical, groups of tanks will be connected via walkways.

The storage tanks containing non-volatile products, such as diesel, paraffin and HFO, would be fitted with fixed roofs. However, the storage tanks containing ULP and Jet-A1 would consist of internal floating roofs in order to reduce vapour loss. An internal floating roof (IFR) system entails a roof that floats on the surface of the product within the tanks, together with a seal around the rim. The floating roof fluctuates according to the level of the stored product, which reduces the potential of a gaseous zone occurring above the product. In addition, the internal floating-roof system controls the amount of vapour released into the atmosphere and displays 95% efficiency in terms of vapour loss. The diesel and paraffin storage tanks would be installed with free venting roofs. These efficiencies are in line with internationally accepted standards as well as the latest technology in the industry for tank farm installations of this nature.

An automatic tank gauging system will be installed to cover each product tank, additive tanks and the fire water tank. The gauging system will consist of tank instrumentation, a communications interface unit and a link to the control system operator interface.
Alarms will be provided for the following situations:

- Low level
- High level
- High level
- Maximum working level
- High Level
- Minimum working level
- Low level; and
- Low level

The first three alarms will be hardwired to the control system as well. Low levels are interlocked with the product pumps to prevent them running dry.

The tanks will have an overfill protection system, whereby the radar type gauge that monitors the tank level, will trigger an alarm and also activate the fail close remotely operated shut off valves on the tank inlet and outlet valves.

Walls around the tanks, called bunds, are intended to retain any accidental spillages. The bunding in the proposed tank farm has been designed to comply with requirements of the SANS 10089-1 specifications with a view to minimize any risk associated with product spills into the environment.

The drainage from the bund areas would be valved in order to assist in retaining the storm water, which would only be released once the quality has been reviewed and deemed to be within the relevant specifications.

The tanks are designated and grouped by product class and viscosities (refer to the plot plan layout-Figure 3-1) within the bunded areas.

The bunds were designed to contain 110% of the nominal capacity of the largest tank contained within the bund. To achieve this, bund walls will be 1.7 m high. The bunded containment areas shall be connected to the oily water sewer system and will be provided with isolation valves which will remain closed during normal operation. Spillages will either be cleaned out by specialist contactors or sent to the oily water sewer and then to the oil-water separator. Details of tank grouping and bunds are listed in Table 3-2.

Table 3-2: Tank grouping and bund details

Bund No.	Products	Class	No. of Tanks	Tank Capacity (m^3)	Gross Bund Area (m^2)	Bund Height (m)
Bund 1	Jet	II	1	10 000	8 584	1.7
	Paraffin	II	1	4000		
Bund 2	HFO	III	2	18 000 each	13 224	1.7
Bund 3	ULP	I	4	19 250 each	20 868	1.7
Bund 4	Diesel	II	4	18 500 each	20 868	1.7

3.4.2 Liquid Fuel Pump Bay

The Load-Out Pump Stations transfer the fuel from the storage tanks via pipe racks to the loading bays. These are located adjacent to the tank bunded areas as follows:

Jet: 2 off 2000 ℓ/m pumps (1 operating, 1 standby)
HFO: 3 off 2000 ℓ/m pumps (2 operating, 1 standby)
ULP: 4 off 2000 ℓ/m pumps (3 operating, 1 standby)
Diesel: 4 off 2000 ℓ/m pumps (3 operating, 1 standby)
Paraffin 2 off 2000 ℓ/m pumps (1 operating, 1 standby)

3.4.3 Liquid Fuel Road Gantry

The road-tanker loading gantry would be located within the tank farm site adjacent to the tanks.

The facility will have gantries serving the loading bays. Additives are added by injection into loading lines from dosing pumps at controlled rates at the loading facility. Tankers will be loaded from the relevant tanks, via a calibrated and temperature-compensating measuring system, using pumps located in the pump bays adjacent to the bunded areas. Road tankers are filled from above (top loading) using articulated loading arms. The system allows for gas returns to the vapour recovery plant. Filling rates will be up to 108 m^3/h and tankers will have a turnaround time of less than 30 minutes. The loading bays will consist of concrete islands with packages unit steelwork gantries consisting of a covered roof, and multiple counterbalanced loading arms.

The number of loading bays per product are listed in Table 3-3.

Table 3-3: Number of loading bays per product

Product	No. of Bays
Diesel	6
ULP	6
JET/ Paraffin	4
HFO	2

The road tanker loading area is paved and provided with drainage channels leading to the oily water sewer system, in case of spillages

3.4.4 Vapour Recovery Unit (VRU)

A vapour recovery system will be in place to recover vapours displaced during filling activities at the storage tanks as well as at the road tanker filling facilities. The VRU processes surplus vapours providing both an ecological and economic aspect of recovering products, with an average 1.5 ℓ/m^3 of hydrocarbon vapours.

The vapour recovery system will most probably be a membrane technology system, or a carbon technology system. The liquified hydrocarbons are then pumped to the Slops Tank.

3.5 LPG Storage

API Standard 2510 - Design and Construction of LP Gas Installation at Marine and Pipeline Terminals, Natural Gas Processing Plants, Refineries, Petrochemical Plants and Tank Farms.

LPG is a class 0 substance and is stored as a liquid under pressure. Design of the LPG tanks shall be according to ASME VIII Div. 1 or PD5500 and comply to the Pressure Equipment Regulations (PER) of the Occupational Health and Safety Act, 1993 (Act No.85 of 1993).

LPG Tanks shall be above-ground and supported by leg plinths, and be located in an un-bunded area with porous ground (concrete) sloping away from the tanks. (Mounded and buried tanks are alternate options that limit risk and allow safety distances and fire protection to be reduced).

Corrosion protection shall be applied to the tanks and underground pipework. All tanks, associated pipework and equipment shall be earthed and bonded. Electrical equipment to be suitably rated as per hazardous location (SANS 10089:3).

Safety distances to site boundaries (30 m), driveways (5 m), loading gantry (15 m), buildings (30 m), adjacent tanks etc. shall comply with the regulations of SANS 10087:3 for 1 000 m^3 tanks. The use of firewalls or mounding can reduce the safety distances required. A maximum of six LPG tanks can be stored in one group, with each group having a required safety distance between them.

Emergency systems shall be used for the shutdown of all electrical equipment and activation of deluge sprinklers. Gas monitors to be integrated into the safety system to ensure valve closures during power failures. For an un-stenched product, it is required that a gas detection and alarm system as per SANS 61779-6 be installed.

LPG tanks shall have fire-safe valves with a safety valve located at the liquid outlet port. Each tank will have pressure relief valves suited for tank capacity of 1 000 m^3 with vent pipes. Vapour spaces of tanks to be inter-connected for distribution of pressure changes during filling or off-loading of product. Excess flow valves and non-return valves shall be incorporated at the product outlet and inlet ports respectively. Telemetric' s to be used to remotely monitor liquid levels.

Pipelines to and from LPG tanks shall be SCH40 pipe with class 300 fittings and flanges. In-line strainers, drain valves and pressure gauges to be incorporated at suitable locations for maintenance purposes. Line pressure relief valves to be installed, particularly between any two valves/points of isolation where a build-up of pressure can occur.

All site procedures (off-loading, loading, inspection and maintenance) shall comply with SANS 10089:3 and PER (SANS 347).

3.5.1 LPG Road Gantry

LPG loading shall have a dedicated 4 bays for loading gantry. The use of break-away couplings to be used at the end of the liquid delivery line at the loading gantry. Flexible offloading hoses (suitably rated) shall be used to connect to road tankers if required. A vapour recovery system to be included at the loading gantry to alleviate pressure differences while loading product. The vapour recovery shall extract vapour from the road tankers and re-liquefy through a compressor to pump back to the tanks.

3.6 Fire Fighting

Key fire protection features include adequate tank spacing; overfill protection; bunded areas for spill control; fixed fire protection systems and water and foam supply. Fire systems will be designed to SANS 10089-1, API 650, NFPA and the relevant referenced codes there-in. This shall apply to main fire water storage, pumping and reticulation, tank shell cooling, with fire water, foam pouring for bund and tank top and vapor spaces, Bund foam pourers, and foam canons to be mounted at selected points per the Fire plans.

Three fire water pumps (two duty pumps and one standby pump) and two foam pumps (one duty pump and one standby pump) will be provided. Duty pumps will be electrical driven and standby pump diesel driven to cater for electrical failures.

3.6.1 Fire Water Storage

An approximately 3 400 m^3 water tank will be provided which will be capable of supplying 680 m^3/h of cooling water and foam for the largest tanks (20 000 m^3) for 4 hours. The main fire water supply piping system will be buried pipe in HDPE up to the bunds and points of service and above ground piping will be steel. The system will be designed with a ring main and interconnecting piping.

3.6.2 Sprinkler System

Fixed water spray or deluge systems will be installed on all storage tanks and LPG vessels for shell cooling at the minimum of 4.1 $\ell/min/m^2$ shell surface for 1 hour per SANS 10089-1. On the storage tanks sprinklers will be provided on two circumferential locations on the roof, as well as circumferentially around the shell of the tank, below the wind girder.

3.6.3 Foam System

Fixed foam equipment, including adequate supply of foam concentrates will be provided at all storage tanks. The amount of foam concentrate provided will be adequate to extinguish a fire on the largest storage tank. The foam system will be designed in accordance with SANS 10089-1 and the foam concentrate mixed into water at 3 to 6% shall expand at a ratio up to 8:1. Foam to fixed roof tanks shall be applied at 6.5 $\ell/min/m^2$ fire area, with a foam stock of 1 hour.

All Tanks will be fitted with foam top pouring systems and all bunds will be fitted with fixed bund foam pourers.

3.6.4 LPG Fire Protection

LPG fire protection shall consist of a deluge system capable of delivering 10 $\ell/min/m^2$ for at least 60 min. In addition, fire hydrants and hose reels shall be located in a safe and accessible area within the tank area. Water supply for use by the fire brigade to be within 100 m of the tank area, and sufficient portable fire-fighting equipment to be kept on site. The LPG loading bay shall have equivalent fire protection.

3.7 Summary of Bulk Materials to be Stored on Site

A summary of bulk materials that can give hazardous effects that are to be stored on site is given in Table 3-4 and Table 3-5, for the respective phases.

Table 3-4: Summary of hazardous components to be stored on site (Phase 1)

No.	Product	Tank Diameter (m)	Tank Height (m)	Nominal Capacity (m^3)	Maximum Capacity (m^3)	Tank Type
5	HFO	36.8	17.5	18 000	17 009	A, V, FR, IH
6	HFO	36.8	17.5	18 000	17009	A, V, FR, IH

Table 3-5: Summary of hazardous components to be stored on site (Subsequence Phases)

No.	Product	Tank Diameter (m)	Tank Height (m)	Working Capacity (m^3)	Tank Type
1	Diesel	36.8	20	19 250	A, V, FR
2	Diesel	36.8	20	19 250	A, V, FR
3	ULP	36.8	20	19 250	A, V, IFR
4	ULP	36.8	20	19 250	A, V, IFR
7	JET-A1	28.3	18	10 000	A, V, IFR
8	Diesel	36.8	20	19 250	A, V, FR
9	Diesel	36.8	20	19 250	A, V, FR
10	ULP	36.8	20	19 250	A, V, FR
11	ULP	36.8	20	19 250	A, V, FR
12	Paraffin	19	16	4000	A, V, FR
13	Slops	8	10	450	A, V, FR
14	BFO	2.5	8	20	A, V, IFR
LPG1	LPG	5.5	44.6	1 000	P, H
LPG2	LPG	5.5	44.6	1 000	P, H
LPG3	LPG	5.5	44.6	1 000	P, H
LPG4	LPG	5.5	44.6	1 000	P, H
LPG5	LPG	5.5	44.6	1 000	P, H
LPG6	LPG	5.5	44.6	1 000	P, H
LPG7	LPG	5.5	44.6	1 000	P, H
LPG8	LPG	5.5	44.6	1 000	P, H
LPG8	LPG	5.5	44.6	1 000	P, H
LPG10	LPG	5.5	44.6	1 000	P, H
LPG11	LPG	5.5	44.6	1 000	P, H
LPG12	LPG	5.5	44.6	1 000	P, H
LPG13	LPG	5.5	44.6	1 000	P, H
LPG14	LPG	5.5	44.6	1 000	P, H
LPG14	LPG	5.5	44.6	1 000	P, H

NOTE:

1. Tank Type

A	Atmospheric tank
P	Pressurised tank
V	Vertical tank
H	Horizontal tank
FR	Fixed roof
IRF	Internal floating roof
IH	Internal heating

4 METHODOLOGY

4.1 Hazard Identification

The first step in any risk assessment is to identify all hazards. The merit of including a hazard for further investigation is then determined by how significant it is, normally by using a cut-off or threshold value.

Once a hazard has been identified, it is necessary to assess it in terms of the risk it presents to the employees and the neighbouring community. In principle, both probability and consequence should be considered but there are occasions where, if either the probability or the consequence can be shown to be sufficiently low or sufficiently high, decisions can be made based on just one factor.

During the hazard identification component of the report, the following considerations are taken into account:

- Chemical identities;
- Location of on-site installations that use, produce, process, transport or store hazardous components;
- Type and design of containers, vessels or pipelines;
- Quantity of material that could be involved in an airborne release;
- Nature of the hazard most likely to accompany hazardous materials spills or releases, e.g. airborne toxic vapours or mists, fires or explosions, large quantities to be stored and certain handling conditions of processed components.

The evaluation methodology assumes that the facility will perform as designed in absence of unintended events, such as component and material failures of equipment, human errors, external events and process unknowns.

4.1.1 Notifiable Substances

The General Machinery Regulation 8 and its Schedule A on notifiable substances requires any employer who has a substance equal to or exceeding the quantity listed in the regulation to notify the divisional director. A site is classified as a Major Hazard Installation if it contains one or more notifiable substances or if the off-site risk is sufficiently high. The latter can only be determined from a quantitative risk assessment.

As more than 25 t of LPG would be stored in a single vessel, the LPG storage would be classified as a notifiable substance and automatically the facility would be classified as a Major Hazard Installation.

4.1.2 Substance Hazards

All components on site were assessed for potential hazards according to the criteria discussed in this section.

4.1.2.1 Chemical Properties

A short description of bulk hazardous components to be stored on, produced at or delivered to site is given in the following subsections. The material safety data sheets (MSDSs) of the respective materials are attached in Appendix F.

- **LPG/Propane**

LPG primarily consists of propane with minor impurities such as butane. Propane is a colourless gas at room temperature with an odour of commercial natural gas. It has a low boiling point of -41.9°C and is often compressed and transported and sold as a liquid, primarily as a fuel.

Propane is a severe fire and explosion hazard with an invisible vapour that spreads easily and can be set on fire by many sources such as pilot lights, welding equipment, electrical motors, switches, etc. It is heavier than air and can travel along ground for some distance to an ignition source.

Propane is not compatible with strong oxidants and can react with these, resulting in fires and explosions.

Propane is not considered a carcinogenic material. The toxicology and the physical and chemical properties of propane suggest that overexposure is unlikely to aggravate existing medical conditions.

Overexposure to propane may cause dizziness and drowsiness. Effects of a single (acute) overexposure may result in asphyxiation due to lack of oxygen that could be fatal. Self-contained breathing apparatus may be required by rescue workers. Moderate concentrations may cause headache, drowsiness, dizziness, excitation, excess salivation, vomiting and unconsciousness. Vapour contact with the skin will not cause any harm. However, contact with liquid may cause frostbite due to the low temperature of the liquid propane.

- **Diesel**

Diesel is a hydrocarbon mixture with variable composition with a boiling-point range of between 252 and 371°C. It is a pale-yellow liquid with a petroleum odour. Due to the flash point of diesel between 38 and 65°C, this material is not considered highly flammable but will readily ignite under suitable conditions.

Diesel is stable under normal conditions. It will react with strong oxidising agents and nitrate compounds. This reaction may cause fires and explosions.

Diesel is not considered a toxic material. Contact with vapours may result in slight irritation to nose, eyes and skin. Vapours may cause headache; dizziness; loss of consciousness or suffocation; lung irritation with coughing; gagging; dyspnoea; substernal distress and rapidly developing pulmonary oedema.

If swallowed, diesel may cause nausea or vomiting, swelling of the abdomen, headache, CNS depression, coma and death.

The long-term effects of diesel exposure have not been determined. However, this may affect the lungs and may cause the skin to dry out and become cracked.

Diesel floats on water and can result in environmental hazards with large spills into waterways. It is harmful to aquatic life in high concentrations.

- **Petrol (Gasoline)**

Petrol is a hydrocarbon mixture with variable composition with a boiling-point range of between 20 and 215°C. It is a pale-yellow liquid with strong petroleum odour. Due to the flash point of petrol at minus 40°C, this material is considered highly flammable and will readily ignite under suitable conditions. The vapours of petrol are heavier than air and may travel some distance to an ignition source.

Petrol may contain up to 5% volume of benzene, a known animal carcinogen. It may also contain ethers and alcohols as oxygenates to a maximum concentration of 2%. Petrol may also contain small quantities of multifunctional additives to enhance performance.

Petrol is stable under normal conditions. It will react with strong oxidising agents and nitrate compounds, which may cause fires and explosions.

Although petrol is of a low to moderate oral toxicity to adults, ingestion of small quantities may prove dangerous or fatal to small children.

Contact with vapours may result in slight irritation to nose, eyes and skin. Vapours may cause headache, dizziness, loss of consciousness or suffocation; lung irritation with coughing, gagging, dyspnoea, substernal distress and rapidly developing pulmonary oedema.

If swallowed, petrol may cause nausea or vomiting, swelling of the abdomen, headache, CNS depression, coma and death.

The long-term effects of petrol exposure have not been determined. However, it may affect lungs and may cause the skin to dry out and become cracked.

Petrol floats on water and can result in environmental hazards with large spills into waterways. It is harmful to aquatic life in high concentrations.

- **Additives**

The petrol and diesel additives have a flash point > 55ºC and are not considered flammable but could sustain combustion once ignited. In some instances, the products may decompose over 100 °C and in sometimes are stored below ground. Due to the high flash points of the additives, the materials do not easily form vapour clouds, thus limiting any toxic effects.

- **Paraffin/Jet-A1**

Paraffin and Jet-A1 is chemically the same component, with Jet-A1 having a tighter specification regarding impurities, such as water and particles.

Paraffin is a clear colourless to light amber liquid with a petroleum odour that consists of a distillate fraction refined from crude petroleum. Thus, the composition and physical properties may vary. The flash point of the paraffin is approximately 38°C and thus is considered flammable but has a low toxicity to humans.

Paraffin is relatively stable under normal storage conditions. However, saturated aliphatic hydrocarbons, contained in paraffin, may be incompatible with strong oxidizing agents like nitric acid.

Paraffin can be absorbed into the body by inhalation of its vapour, through the skin and by ingestion.

Short-term exposure to paraffin could irritate the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis.

Repeated or prolonged contact of paraffin with skin may cause dermatitis. The liquid defeats the skin.

Paraffin may cause an environmental problem, particularly in water, if spilt.

- **Heavy Fuel Oil (HFO)**

Fuel oils are divided into six categories. The fuel oils No. 5 and 6 are loosely called Heavy Fuel Oil or Heavy Furnace Oils. HFO is a mixture of petroleum thus forming a product of varying compositions with carbon chain length of between 12 and 70. HFO is a thick, syrupy, black liquid with a tar-like odour. It is a "leftover" or residual product of crude oil after the more valuable hydrocarbons have been removed.

The chemical composition of HFO is highly variable due to the fact that HFO is often mixed or blended with cleaner fuels. Blending streams can include carbon numbers from C20 to greater than C50. HFOs are blended to achieve certain viscosity and flow characteristics for a given use. As a result of the wide compositional spectrum, HFO is defined by processing, physical and final use characteristics. HFO is characterized by a maximum density of 1010 kg/m^3 at 15°C, and a maximum viscosity of 700 mm^2/s (cSt) at 50°C according to ISO 8217. HFO is classified as a Class III chemical based on its flash point being above 60.5°C. Oil for Carbon Black (CBO), typically, has a two to three-member aromatic ring system that have stable bonds and has a high density with a lower heating value. CBO falls within the broad definition of HFO as it has a closed-cup flash point of over 100°C. Figure 4-1below provides the definition from SANS 10089-1:2008 that defines Class III Chemicals.

SANS 10089-1:2008
Edition 4.3

– **class IIIA**: liquids that have a closed-cup flash point of 60,5 °C or above, but below 93 °C

– **class IIIB**: liquids that have a closed-cup flash point of 93 °C or above

Figure 4-1: Definition of Class III Chemicals according to SANS 10089-1:2008

HFO is not considered flammable but can sustain combustion with ignition. HFO is not considered acutely toxic.

HFO is stable under normal conditions but may react with strong acids or oxidizing agents with a fire and explosion hazard.

4.1.2.2 Corrosive Liquids

Corrosive liquids considered under this subsection are those components that have a low or high pH and that may cause burns if they come into contact with people or may attack and cause failure of equipment.

No bulk materials to be stored on, produced at or delivered to site are considered extremely corrosive.

4.1.2.3 Reactive Components

Reactive components are components that when mixed or exposed to one another react in a way that may cause a fire, explosion or release a toxic component.

All components to be stored on, produced at or delivered to site are considered thermally stable in atmospheric conditions. The reaction with air is covered under the subsection dealing with ignition probabilities.

4.1.2.4 Flammable and Combustible Components

Flammable and combustible components are those that can ignite and give a number of hazardous effects, depending on the nature of the component and conditions. These effects may include pool fires, jet fires and flash fires as well as explosions and fireballs.

The flammable and combustible components to be stored on, produced at or delivered to site are listed in Table 4-1. These components have been analysed for fire and explosion risks.

Table 4-1: Flammable and combustible components to be stored on, produced at or delivered to site

Component	Flashpoint (°C)	Boiling Point (°C)
ULP	-40	87
Jet A1 / paraffin	> 37	> 150
Diesel	> 55	290
Additives	> 55	100-200

4.1.2.5 Toxic and Asphyxiant Components

Toxic or asphyxiant components of interest to this study are those that could produce dispersing vapour clouds upon release into the atmosphere. These could subsequently cause harm through inhalation or absorption through the skin. Typically, the hazard posed by toxic or asphyxiant components will depend on both concentration of the material in the air and the exposure duration.

No bulk components to be stored on, produced at or delivered to site are considered acutely toxic or asphyxiant.

4.1.3 Physical Properties

For this study, components were modelled as a pure component, as given in Table 4-2. The physical properties used in the simulations were based on the DIPPR[1] data base and included in the software

Table 4-2: Representative components

Component	Modelled as
ULP	n-Heptane
Paraffin	n-Nonane
Diesel/ Additives	n-Dodecane
LPG	Propane

1 Design Institute for Physical Properties

4.2 Historical Major Incidents at Refineries and Storage Facilities

Some historical incidents at refineries should be reviewed in an attempt to identify the root causes of such incidents and to prevent occurrences at the proposed BTG facility in the Coega SEZ.

4.2.1 Durban (2007)

On the evening of the 19th of the November 2007 a bolt of lightning struck gasoline storage tanks at the Engen refinery in Durban, South Africa.

The fire did not result in fatalities but resulted in extensive damage to storage tanks and part of the refinery. A tank-top fire, as shown in Figure 4-2, did not cause the complete failure of the tank, which would have resulted in the fire spreading into the bunded area with possible knock-on effects.

Figure 4-2: Tank-top fire at the Engen refinery caused by lightning

4.2.2 Buncefield (2005)

In the early hours of Sunday, on the 11th of December 2005, a number of explosions occurred at the Buncefield storage depot in Hemel Hempstead, the United Kingdom.

At least one of the initial explosions was of massive proportions, and there was a large fire that engulfed most of the site. Over 40 people were injured; fortunately, there were no fatalities. Significant damage occurred to both commercial and residential properties in the vicinity and a large area around the site was evacuated on emergency service advice. The fire burned for several days, destroying most of the site and emitted large clouds of black smoke into the atmosphere.

The damage caused by the Buncefield incident, as shown in Figure 4-3 extended further than expected. This has put into question traditional safety distances for petroleum storage terminals.

The cause of the explosions and fires was attributed to an overfilling of a petrol tank followed by an ignition. The full mechanism of the incident including the source of ignition is not fully understood although the HSE (UK) has published an investigation.

Lessons learnt and proposed mitigation to prevent a recurrence of a similar tank farm fire have been prepared and published by the HSE (UK).

Figure 4-3: Damages incurred due to the Buncefield incident

4.3 Physical and Consequence Modelling

In order to establish which impacts follow an accident, it is first necessary to estimate the physical process of the spill (i.e. rate and size), spreading of the spill, evaporation from the spill, subsequent atmospheric dispersion of the airborne cloud and, in the case of ignition, the burning rate and resulting thermal radiation from a fire and the overpressures from an explosion.

The second step is then to estimate the consequences of a release on humans, fauna, flora and structures in terms of the significance and extent of the impact in the event of a release. The consequences could be due to toxic or asphyxiant vapours, thermal radiation or explosion overpressures. They may be described in various formats.

The simplest methodology would show a comparison of predicted concentrations, thermal radiation or overpressures to short-term guideline values.

In a different but more realistic fashion, the consequences may be determined by using a dose-response analysis. Dose-response analysis aims to relate the intensity of the phenomenon that constitutes a hazard to the degree of injury or damage that it can cause. Probit analysis is possibly the method mostly used to estimate probability of death, hospitalisation or structural damage. The probit is a lognormal distribution and represents a measure of the percentage of the vulnerable resource that sustains injury or damage. The probability of injury or death (i.e. the risk level) is in turn estimated from this probit (risk characterisation).

Consequence modelling gives an indication of the extent of the impact for selected events and is used primarily for emergency planning. A consequence that would not cause irreversible injuries would be considered insignificant, and no further analysis would be required. The effects from major incidents are summarised in the following subsections.

4.3.1 Fires

Combustible and flammable components within their flammable limits may ignite and burn if exposed to an ignition source of sufficient energy. On process plants releases with ignition normally occur as a result of a leakage or spillage. Depending on the physical properties of the component and the operating parameters, combustion may take on a number of forms, such as pool fires, jet fires, flash fires and so forth.

4.3.1.1 Thermal Radiation

The effect of thermal radiation is very dependent on the type of fire and duration of exposure. Certain codes, such as the American Petroleum Institute API 520 and API 2000 codes, suggest values for the maximum heat absorbed by vessels to facilitate adequate relief designs in order to prevent failure of the vessel. Other codes, such as API 510 and the British Standards BS 5980 code, give guidelines for the maximum thermal radiation intensity and act as a guide to equipment layout, as shown in Table 4-3.

The effect of thermal radiation on human health has been widely studied, relating injuries to the time and intensity of exposure.

Table 4-3: Thermal radiation guidelines (BS 5980 of 1990)

Thermal Radiation Intensity (kW/m^2)	Limit
1.5	Will cause no discomfort for long exposure
2.1	Sufficient to cause pain if unable to reach cover within 40 seconds
4.5	Sufficient to cause pain if unable to reach cover within 20 seconds
12.5	Minimum energy required for piloted ignition of wood and melting of plastic tubing
25	Minimum energy required to ignite wood at indefinitely long exposures
37.5	Sufficient to cause serious damage to process equipment

For pool fires, jet fires and flash fires CPR 18E (Purple Book; 1999) suggests the following thermal radiation levels be reported:

- 4 kW/m^2, the level that glass can withstand, preventing the fire entering a building, and that should be used for emergency planning;
- 10 kW/m^2, the level that represents the 1% fatality for 20 seconds of unprotected exposure and at which plastic and wood may start to burn, transferring the fire to other areas;
- 35 kW/m^2, the level at which spontaneous ignition of hair and clothing occurs, with an assumed 100% fatality, and at which initial damage to steel may occur.

4.3.1.2 Bund and Pool Fires

Pool fires, either tank or bund fires, consist of large volumes of a flammable liquid component burning in an open space at atmospheric pressure.

The flammable component will be consumed at the burning rate, depending on factors including prevailing winds. During combustion heat will be released in the form of thermal radiation. Temperatures close to the flame centre will be high but will reduce rapidly to tolerable temperatures over a relatively short distance. Any building or persons close to the fire or within the intolerable zone will experience burn damage with severity depending on the distance from the fire and time exposed to the heat of the fire.

In the event of a pool fire, the flames will tilt according to the wind speed and direction. The flame length and tilt angle affect the distance of thermal radiation generated.

4.3.1.3 Tank-top fires

A tank-top fire occurs within a tank, and thus the pool fire is limited to the area of the tank. A tank-top fire could escalate to a bund fire should the tank fail, releasing a flammable or combustible component into the bund.

4.3.1.4 Jet Fires

Jet fires occur when a flammable component is released with a high exit velocity ignites.

In process industries this may be due to design (such as flares) or due to accidental releases. Ejection of a flammable component from a vessel, pipe or pipe flange may give rise to a jet fire and in some instances the jet flame could have substantial ‘reach’.

Depending on wind speed, the flame may tilt and impinge on other pipelines, equipment or structures. The thermal radiation from these fires may cause injury to people or damage equipment some distance away from the source of the flame.

4.3.1.5 Flash Fires

A loss of containment of a flammable component may mix with air, forming a flammable mixture. The flammable cloud would be defined by the lower flammable limit (LFL) and the upper flammable limit (UFL). The extent of the flammable cloud would depend on the quantity of the released and mixed component, physical properties of the released component, wind speed and weather stability. An ignition within a flammable cloud can result in an explosion if the front is propagated by pressure. If the front is propagated by heat, then the fire moves across the flammable cloud at the flame velocity and is called a flash fire. Flash fires are characterised by low overpressure, and injuries are caused by thermal radiation. The effects of overpressure due to an exploding cloud are covered in the subsection dealing with vapour cloud explosions (VCEs).

A flash fire would extend to the lower flammable limit; however, due to the formation of pockets, it could extend beyond this limit to the point defined as the ½ LFL. It is assumed that people within the flash fire would experience lethal injuries while people outside of the flash fire would remain unharmed. Twice the distance to the LFL is used for emergency planning to evacuate people to a safe distance in the event of a release.

4.3.2 Explosions

The concentration of a flammable component would decrease from the point of release to below the lower explosive limits (LEL), at which concentration the component can no longer ignite. The sudden detonation of an explosive mass would cause overpressures that could result in injury or damage to property.

Such an explosion may give rise to any of the following effects:

- Blast damage;
- Thermal damage;
- Missile damage;
- Ground tremors;
- Crater formation;
- Personal injury.

Obviously, the nature of these effects depends on the pressure waves and the proximity to the actual explosion. Of concern in this investigation are the ‘far distance effects’, such as limited structural damage and the breakage of windows, rather than crater formations.

Table 4-4 and Table 4-5 give a more detailed summary of the damage produced by an explosion due to various overpressures.

CPR 18E (Purple Book; 1999) suggests the following overpressures be determined:

- 0.03 bar overpressure, corresponding to the critical overpressure causing windows to break;
- 0.1 bar overpressure, corresponding to 10% of the houses being severely damaged and a probability of death indoors equal to 0.025:
  - No lethal effects are expected below 0.1 bar overpressure on unprotected people in the open;
- 0.3 bar overpressure, corresponding to structures being severely damaged and 100% fatality for unprotected people in the open;
- 0.7 bar overpressure, corresponding to an almost entire destruction of buildings.

Table 4-4: Summary of consequences of blast overpressure (Clancey 1972)

Pressure (Gauge)		Damage
Psi	kPa	
0.02	0.138	Annoying noise (137 dB), if of low frequency (10 – 15 Hz)
0.03	0.207	Occasional breaking of large glass windows already under strain
0.04	0.276	Loud noise (143 dB); sonic boom glass failure
0.1	0.69	Breakage of small under strain windows
0.15	1.035	Typical pressure for glass failure
0.3	2.07	'Safe distance' (probability 0.95; no serious damage beyond this value); missile limit; some damage to house ceilings; 10% window glass broken
0.4	2.76	Limited minor structural damage
0.5–1.0	3.45–6.9	Large and small windows usually shattered; occasional damage to window frames
0.7	4.83	Minor damage to house structures
1.0	6.9	Partial demolition of houses, made uninhabitable
1.0–2.0	6.9–13.8	Corrugated asbestos shattered; corrugated steel or aluminium panels, fastenings fail, followed by buckling; wood panels (standard housing) fastenings fail, panels blown in
1.3	8.97	Steel frame of clad building slightly distorted
2.0	13.8	Partial collapse of walls and roofs of houses
2.0–3.0	13.8–20.7	Concrete or cinderblock walls (not reinforced) shattered
2.3	15.87	Lower limit of serious structural damage
2.5	17.25	50% destruction of brickwork of house
3.0	20.7	Heavy machines (1.4 t) in industrial building suffered little damage; steel frame building distorted and pulled away from foundations
3.0–4.0	20.7–27.6	Frameless, self-framing steel panel building demolished
4.0	27.6	Cladding of light industrial buildings demolished
5.0	34.5	Wooden utilities poles (telegraph, etc.) snapped; tall hydraulic press (18 t) in building slightly damaged
5.0–7.0	34.5–48.3	Nearly complete destruction of houses
7.0	48.3	Loaded train wagons overturned
7.0–8.0	48.3–55.2	Brick panels (20 – 30 cm) not reinforced fail by shearing or flexure
9.0	62.1	Loaded train boxcars completely demolished
10.0	69.0	Probable total destruction buildings; heavy (3 t) machine tools moved and badly damaged; very heavy (12 000 lb. / 5443 kg) machine tools survived
300	2070	Limit of crater lip

Table 4-5: Damage caused by overpressure effects of an explosion (Stephens 1970)

Equipment	Overpressure (psi)																								
	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	12	14	16	18	20
Control house steel roof	A	C	V				N																		
Control house concrete roof	A	E	P	D			N																		
Cooling tower	B			F			O																		
Tank: cone roof		D				K							U												
Instrument cubicle			A			LM						T													
Fire heater				G	I					T															
Reactor: chemical				A				I				P						T							
Filter				H					F									V			T				
Regenerator						I				IP					T										
Tank: floating roof						K							U												D
Reactor: cracking							I							I							T				
Pine supports							P					SO													
Utilities: gas meter									Q																
Utilities: electric transformer									H					I						T					
Electric motor										H								I							V
Blower										Q										T					
Fractionation column											R			T											
Pressure vessel horizontal												PI						T							
Utilities: gas regulator												I								MQ					
Extraction column													I							V	T				
Steam turbine															I						M	S			V
Heat exchanger															I			T							
Tank sphere																I						I	T		
Pressure vessel vertical																					I	T			
Pump																					I		Y		

A	Windows and gauges break
B	Louvers fall at 0.3–0.5 psi
C	Switchgear is damaged from roof collapse
D	Roof collapses
E	Instruments are damaged
F	Inner parts are damaged
G	Bracket cracks
H	Debris-missile damage occurs
I	Unit moves and pipes break
J	Bracing fails
K	Unit uplifts (half filled)
L	Power lines are severed
M	Controls are damaged
N	Block wall fails
O	Frame collapses
P	Frame deforms
Q	Case is damaged
R	Frame cracks
S	Piping breaks
T	Unit overturns or is destroyed
U	Unit uplifts (0.9 filled)
V	Unit moves on foundations

4.3.2.1 Vapour Cloud Explosions (VCEs)

The release of a flammable component into the atmosphere could result in formation of a flash fire, as described in the subsection on flash fires, or a vapour cloud explosion (VCE). In the case of a VCE, an ignited vapour cloud between the higher explosive limits (HEL) and the lower explosive limit (LEL) could form a fireball with overpressures that could result in injury or damage to property.

4.3.2.2 Tank Explosions

A confined gas explosion occurs when the exploding flammable mixture is restricted from expanding by physical barriers, such as walls, equipment or other obstacles.

A fixed-roof tank explosion is a confined gas explosion within a tank. The explosive mass is calculated as the volume of the tank at its lower flammable limit (LFL). It should be noted that an explosion can only occur if a flammable atmosphere can be formed. For this study, only flammable components with flashpoints lower than 38°C were considered.

4.3.2.3 Boiling Liquid Expanding Vapour Explosions (BLEVEs)

A boiling liquid expanding vapour explosion (BLEVE) can occur when a flame impinges on a pressure cylinder, particularly in the vapour space region where cooling by evaporation of the contained material does not occur; the cylinder shell would weaken and rupture with a total loss of the contents, and the issuing mass of material would burn as a massive fireball.

The major consequence of a BLEVE is intense thermal radiation from the fireball, a blast wave and propelled fragments from the shattered vessel. These fragments may be projected to considerable distances. Analyses of the travel range of fragment missiles from a number of BLEVEs suggest that the majority land within 700 m from the incident. A blast wave from a BLEVE is fairly localised but can cause significant damage to immediate equipment.

A BLEVE occurs sometime after the vessel has been engulfed in flames. Should an incident occur that could result in a BLEVE, people should be evacuated to beyond the 1% fatality line.

4.4 Risk Analysis

4.4.1 Background

It is important to understand the difference between hazard and risk.

A hazard is anything that has the potential to cause damage to life, property and the environment. Furthermore, it has constant parameters (like those of petrol, chlorine, ammonia, etc.) that pose the same hazard wherever present.

On the other hand, risk is the probability that a hazard will actually cause damage and goes along with how severe that damage will be (consequence). Risk is therefore the probability that a hazard will manifest itself. For instance, the risks of a chemical accident or spill depends upon the amount present, the process the chemical is used in, the design and safety features of its container, the exposure, the prevailing environmental and weather conditions and so on.

Risk analysis consists of a judgement of probability based on local atmospheric conditions, generic failure rates and severity of consequences, based on the best available technological information.

Risks form an inherent part of modern life. Some risks are readily accepted on a day-to-day basis, while certain hazards attract headlines even when the risk is much smaller, particularly in the field of environmental protection and health. For instance, the risk of one-in-ten-thousand chance of death per year associated with driving a car is acceptable to most people, whereas the much lower risks associated with nuclear facilities (one-in-ten-million chance of death per year) are deemed unacceptable.

A report by the British Parliamentary Office of Science and Technology (POST), entitled ‘Safety in Numbers? Risk Assessment and Environmental Protection’, explains how public perception of risk is influenced by a number of factors in addition to the actual size of the risk. These factors were summarised as follows in Table 4-6.

Table 4-6: Influence of public perception of risk on acceptance of that risk, based on the POST report

Control	People are more willing to accept risks they impose upon themselves or they consider to be ‘natural’ than to have risks imposed upon them
Dread and Scale of Impact	Fear is greatest where the consequences of a risk are likely to be catastrophic rather than spread over time
Familiarity	People appear more willing to accept risks that are familiar rather than new risks
Timing	Risks seem to be more acceptable if the consequences are immediate or short term, rather than if they are delayed (especially if they might affect future generations)
Social Amplification and Attenuation	Concern can be increased because of media coverage, graphic depiction of events or reduced by economic hardship
Trust	A key factor is how far the public trusts regulators, policy makers or industry; if these bodies are open and accountable (being honest as well as admitting mistakes and limitations and taking account of differing views without disregarding them as emotive or irrational), then the public is more likely consider them credible

A risk assessment should be seen as an important component of ongoing preventative action, aimed at minimising or hopefully avoiding accidents. Reassessments of risks should therefore follow at regular intervals and after any changes that could alter the nature of the hazard, so contributing to an overall prevention programme and emergency response plan of the facility. Risks should be ranked with decreasing severity and the top risks reduced to acceptable levels.

Procedures for predictive hazard evaluation have been developed for the analysis of processes when evaluating very low probability accidents with very high consequences (for which there is little or no experience) as well as more likely releases with fewer consequences (for which there may be more information available). These addresses both the probability of an accident as well as the magnitude and nature of undesirable consequences of that accident. Risk is usually defined as some simple function of both the probability and consequence.

4.4.2 Predicted Risk

Physical and consequence modelling addresses the impact of a release of a hazardous component without taking into account probability of occurrence. This merely illustrates the significance and the extent of the impact in the event of a release. Modelling should also analyse cascading or knock-on effects due to incidents in the facility and the surrounding industries and suburbs.

During a risk analysis, the likelihood of various incidents is assessed, the consequences calculated and finally the risk for the facility is determined.

4.4.2.1 Generic Equipment Failure Scenarios

In order to characterise various failure events and assign a failure frequency, fault trees were constructed starting with a final event and working from the top down to define all initiating events and frequencies. Unless otherwise stated, analysis was completed using published failure rate data (RIVM 2009). Equipment failures can occur in tanks, pipelines and other items handling hazardous chemical components. These failures may result in:

- Release of combustible, flammable and explosive components with fires or explosions upon ignition;
- Release of toxic or asphyxiant components.

- **Storage Vessels**

Scenarios involving storage vessels can include catastrophic failures that would lead to leakage into the bund with a possible bund fire. A tank-roof failure could result in a possible tank-top fire. The fracture of a nozzle or transfer pipeline could also result in leakage into the bund.

Typical failure frequencies for atmospheric and pressure vessels are listed, respectively, in Table 4-7 and Table 4-8.

Table 4-7: Failure frequencies for atmospheric vessels

Event	Leak Frequency (per item per year)
Small leaks	$1x10^{-4}$
Severe leaks	$3x10^{-5}$
Catastrophic failure	$5x10^{-6}$

Table 4-8: Failure frequencies for pressure vessels

Event	Failure Frequency (per item per year)
Small leaks	$1x10^{-5}$
Severe leaks	$5x10^{-7}$
Catastrophic failure	$5x10^{-7}$

- **Transport and Process Piping**

Piping may fail as a result of corrosion, erosion, mechanical impact damage, pressure surge (water hammer) or operation outside the design limitations for pressure and temperature. Failures caused by corrosion and erosion usually result in small leaks, which are easily detected and corrected quickly. For significant failures, the leak duration may be from 10–30 minutes before detection.

Generic data for leak frequency for process piping is generally expressed in terms of the cumulative total failure rate per year for a 10 m section of pipe for each pipe diameter. Furthermore, failure frequency normally decreases with increasing pipe diameter. Scenarios and failure frequencies for a pipeline apply to pipelines with connections, such as flanges, welds and valves.

The failure data given in Table 4-9 represents the total failure rate, incorporating all failures of whatever size and due to all probable causes. These frequencies are based on an assumed environment where no excessive vibration, corrosion, erosion or thermal cyclic stresses are expected. For incidents causing significant leaks (such as corrosion), the failure rate will be increased by a factor of 10.

Table 4-9: Failure frequencies for process pipes

Description	Frequencies of Loss of Containment for Process Pipes (per meter per year)	
	Full Bore Rupture	**Leak**
Nominal diameter < 75 mm	$1x10^{-6}$	$5x10^{-6}$
75 mm < nominal diameter < 150 mm	$3x10^{-7}$	$2x10^{-6}$
Nominal diameter > 150 mm	$1x10^{-7}$	$5x10^{-7}$

For scenarios and failure frequencies no distinction is made between process pipes and transport pipes, the materials from which a pipeline is made, the presence of cladding, the design pressure of a pipeline or its location on a pipe bridge. However, a distinction is made between aboveground pipes and underground pipes. The scenarios for aboveground pipes are given in Table 4-10, and those for underground pipes are given in Table 4-11.

Transport pipelines aboveground can be compared, under certain conditions, with underground pipes in a pipe bay. The necessary conditions for this are external damage being excluded, few to no flanges and accessories present and the pipe is clearly marked. In very specific situations the use of a lower failure frequency for transport pipes aboveground can be justified.

Table 4-10: Failure frequencies for aboveground transport pipelines

Description	Frequency (per meter per annum)		
	Nominal Diameter < 75 mm	**75 mm > Nominal Diameter > 150 mm**	**Nominal Diameter > 150 mm**
Full bore rupture	$1x10^{-6}$	$3x10^{-7}$	$1x10^{-7}$
Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm	$5x10^{-6}$	$2x10^{-6}$	$5x10^{-7}$

Table 4-11: Failure frequencies for underground transport pipelines

Description	Frequency (per meter per annum)		
	Pipeline in Pipe Lane[1]	**Pipeline Complies with NEN 3650**	**Other Pipelines**
Full bore rupture	$7x10^{-9}$	$1.525x10^{-7}$	$5x10^{-7}$
Leak with an effective diameter of 20 mm	$6.3x10^{-8}$	$4.575x10^{-7}$	$1.5x10^{-6}$

1 A pipeline located in a 'lane' is a pipeline located with a group of pipelines on a dedicated route. Loss-of-containment frequencies for this situation are lower because of extra preventive measures.

- **Pumps and Compressors**

Pumps can be subdivided roughly into two different types, reciprocating pumps and centrifugal pumps. This latter category can be further subdivided into canned pumps (sealless pumps) and gasket (pumps with seals). A canned pump can be defined as an encapsulated pump where the process liquid is located in the space around the rotor (impeller), in which case gaskets are not used.

Compressors can also be subdivided roughly into reciprocating compressors and centrifugal compressors.

Failure rates for pumps and compressors are given in Table 4-12 and Table 4-13.

Table 4-12: Failure frequency for centrifugal pumps and compressors

Event	Canned (No Gasket) Frequency (per annum)	Gasket Frequency (per annum)
Catastrophic failure	$1.0x10^{-5}$	$1.0x10^{-4}$
Leak (10% diameter)	$5.0x10^{-5}$	$4.4x10^{-3}$

Table 4-13: Failure frequency for reciprocating pumps and compressors

Event	Frequency (per annum)
Catastrophic failure	$1.0x10^{-4}$
Leak (10% diameter)	$4.4x10^{-3}$

- **Loading and Offloading**

Loading can take place from a storage vessel to a transport unit (road tanker, tanker wagon or ship) or from a transport unit to a storage vessel. The failure frequencies for loading and offloading arms are given in Table 4-14.

Table 4-14: Failure frequencies for loading and offloading arms and hoses

Event	Frequency (per hour)	
	Loading and Offloading Arms	Loading and Offloading Hoses
Rupture	$3x10^{-8}$	$4x10^{-6}$
Leak with effective diameter at 10% of nominal diameter to max. 50 mm	$3x10^{-7}$	$4x10^{-5}$

- **Road or Rail Tankers within the Establishment**

Road or rail tankers are transport vehicles with fixed and removable tanks. In addition, they include battery wagons and, insofar as these are fitted on a transport vehicle, tank containers, swap-body tanks and MEGCs (multiple element gas containers).

The failure rate of tankers on an establishment is dependent on the pressure rating of the tank and is given in Table 4-15 and Table 4-16.

Table 4-15: Failure frequencies for road tankers with an atmospheric tank

Event	Frequency (per annum)
Instantaneous release of the entire contents	$1x10^{-5}$
Release of contents from the largest connection	$5x10^{-7}$

Table 4-16: Failure frequencies for road tankers with a pressurised tank

Event	Frequency (per annum)
Instantaneous release of the entire contents	$1x10^{-7}$
Release of contents from the largest connection	$5x10^{-7}$

It should be noted that no scenarios are included for loss of containment as a result of external damage to tanker or fire in the surrounding areas. It is assumed that sufficient measures are taken to prevent external damage to the tanker.

- **Human Failure**

Human error and failure can occur during any life cycle or mode of operation of a facility. Human failure can be divided into the following categories:

- Human failure during design, construction and modification of the facility;
- Human failure during operation and maintenance;
- Human failure due to errors of management and administration.

Human failure during design, construction and modification is part of the generic failure given in this subsection. Human failure due to errors of organisation and management are influencing factors. Some of the types of tasks that have been evaluated for their rates of human failure are given in Table 4-17.

Table 4-17: Human failure rates of specific types of tasks (CPR 12E 2005; Red Book)

Tasks	Human Failure (events per year)
Totally unfamiliar, performed at speed with no real idea of likely consequences	0.55
Failure to carry out rapid and complex actions to avoid serious incident such as an explosion	0.5
Complex task requiring high level of comprehension and skill	0.16
Failure to respond to audible alarm in control room within 10 minutes	$1.0x10^{-1}$
Failure to respond to audible alarm in quiet control room by some more complex action such as going outside and selecting one correct value among many	$1.0x10^{-2}$
Failure to respond to audible alarm in quiet control room by pressing a single button	$1.0x10^{-3}$
Omission or incorrect execution of step in a familiar start-up routine	$1.0x10^{-3}$
Completing a familiar, well-designed, highly-practiced, routine task occurring several times per hour, performed to highest possible standards by a highly-motivated, highly-trained and experienced person totally aware of implications of failures, with time to correct potential error but without the benefit of significant job aids	$4.0x10^{-4}$

- **Ignition Probability of Flammable Gases and Liquids**

Estimation of probability of an ignition is a key step in assessment of risk for installations where flammable liquids or gases are stored. There is a reasonable amount of data available relating to characteristics of ignition sources and effects of release type and location.

Probability of ignition for stationary installations is given in Table 4-18 (along with classification of flammable substances in Table 4-19). These can be replaced with ignition probabilities related to surrounding activities. For example, probability of a fire from a flammable release at an open flame would increase to a value of 1.

Table 4-18: Probability of direct ignition for stationary installations (RIVM 2009)

Substance Category	Source-Term Continuous	Source-Term Instantaneous	Probability of Direct Ignition
Category 0 Average to high reactivity	< 10 kg/s 10 – 100 kg/s > 100 kg/s	< 1000 kg 1000 – 10 000 kg > 10 000 kg	0.2 0.5 0.7
Category 0 Low reactivity	< 10 kg/s 10 – 100 kg/s > 100 kg/s	< 1000 kg 1000 – 10 000 kg > 10 000 kg	0.02 0.04 0.09
Category 1	All flow rates	All quantities	0.065
Category 2	All flow rates	All quantities	0.0043[1]
Category 3 Category 4	All flow rates	All quantities	0

Table 4-19: Classification of flammable substances

Substance Category	Description	Limits
Category 0	Extremely flammable	Liquids, substances and preparations that have a flashpoint lower than 0°C and a boiling point (or the start of the boiling range) less than or equal to 35°C Gaseous substances and preparations that may ignite at normal temperature and pressure when exposed to air
Category 1	Highly flammable	Liquids, substances and preparations that have a flashpoint of below 21°C
Category 2	Flammable	Liquids, substances and preparations that have a flashpoint equal to 21°C and less than 55°C
Category 3		Liquids, substances and preparations that have a flashpoint greater than 55°C and less than or equal to 100°C
Category 4		Liquids, substances and preparations that have a flashpoint greater than 100°C

1 This value is taken from the CPR 18E (Purple Book; 1999). RIVM (2009) gives the value of delayed ignition as zero. RISCOM (PTY) LTD believes the CPR 18E is more appropriate for warmer climates and is a conservative value.

4.4.3 Risk Calculations

4.4.3.1 Maximum Individual Risk Parameter

Standard individual risk parameters include: average individual risk; weighted individual risk; maximum individual risk; and, the fatal accident rate. The lattermost parameter is more applicable to occupational exposures.

Only the maximum individual risk (MIR) parameter will be used in this assessment. For this parameter frequency of fatality is calculated for an individual who is presumed to be present at a specified location. This parameter (defined as the consequence of an event multiplied by the likelihood of the event) is not dependent on knowledge of populations at risk. So, it is an easier parameter to use in the predictive mode than average individual risk or weighted individual risk. The unit of measure is the risk of fatality per person per year.

4.4.3.2 Acceptable Risks

The next step, after having characterised a risk and obtained a risk level, is to recommend whether the outcome is acceptable.

In contrast to the employees at a facility, who may be assumed to be healthy, the adopted exposure assessment applies to an average population group that also includes sensitive subpopulations. Sensitive subpopulation groups are those people that for reasons of age or medical condition have a greater than normal response to contaminants. Health guidelines and standards used to establish risk normally incorporate safety factors that address this group.

Among the most difficult tasks of risk characterisation is the definition of acceptable risk. In an attempt to account for risks in a manner similar to those used in everyday life, the UK Health and Safety Executive (HSE) developed the risk ALARP triangle. Applying the triangle involves deciding:

- Whether a risk is so high that something must be done about it;
- Whether the risk is or has been made so small that no further precautions are necessary;
- If a risk falls between these two states so that it has been reduced to levels as low as reasonably practicable (ALARP).

This is illustrated in Figure 4-4.

ALARP stands for 'as low as reasonably practicable'. As used in the UK, it is the region between that which is intolerable, at $1x10^{-4}$ per year, and that which is broadly acceptable, at $1x10^{-6}$ per year. A further lower level of risk, at $3x10^{-7}$ per year, is applied to either vulnerable or very large populations for land-use planning.

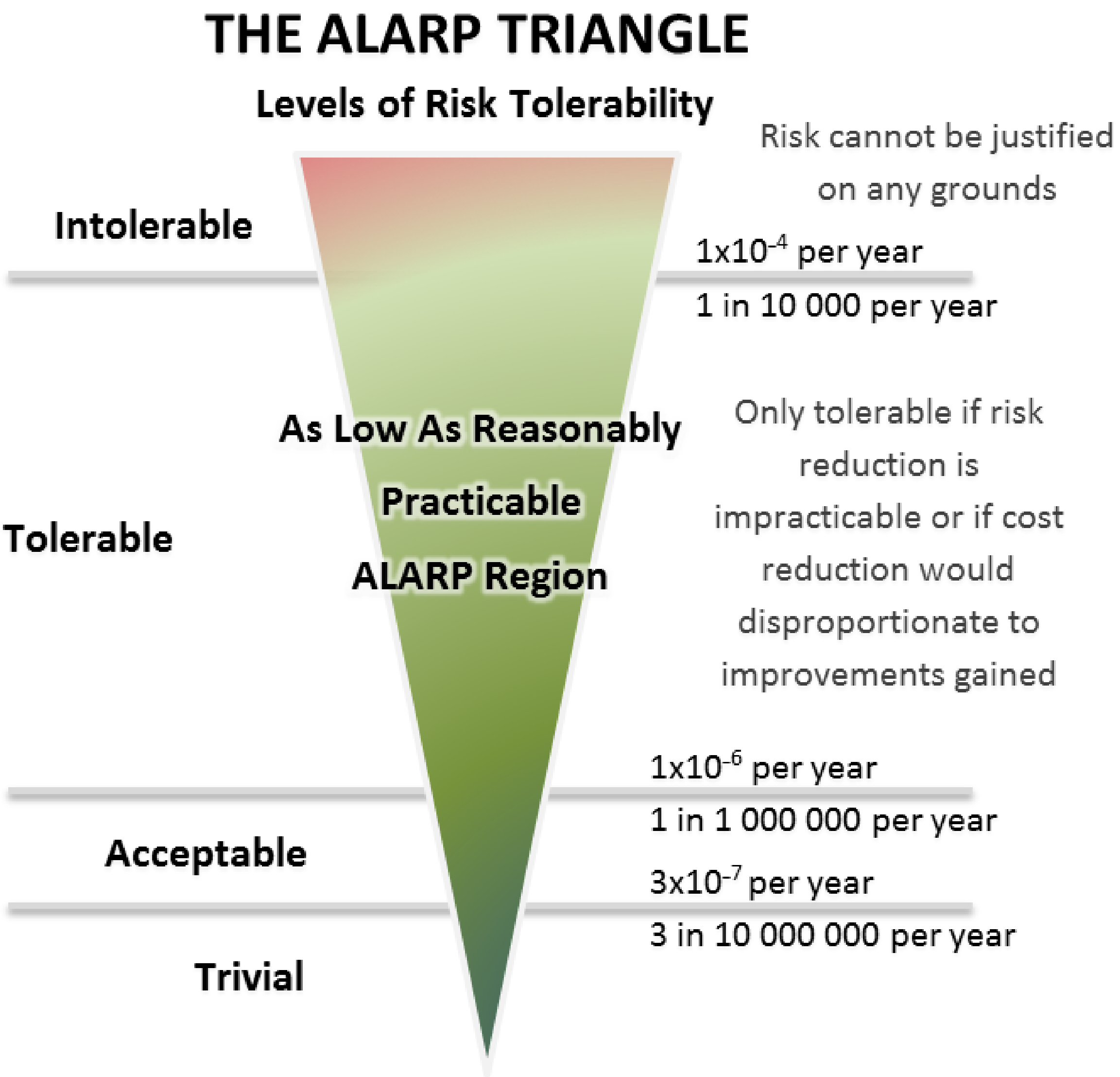


Figure 4-4: UK HSE decision-making framework

It should be emphasised that the risks considered acceptable to employees are different to those considered acceptable to the public. This is due to the fact that employees have personal protection equipment (PPE), are aware of the hazards, are sufficiently mobile to evade or escape the hazards and receive training in preventing injuries.

The HSE (UK) gives more detail on the word practicable in the following statement:

" In essence, making sure a risk has been reduced to ALARP is about weighing the risk against the sacrifice needed to further reduce it. The decision is weighted in favour of health and safety because the presumption is that the duty-holder should implement the risk reduction measure. To avoid having to make this sacrifice, the duty-holder must be able to show that it would be grossly disproportionate to the benefits of risk reduction that would be achieved. Thus, the process is not one of balancing the costs and benefits of measures but, rather, of adopting measures except where they are ruled out because they involve grossly disproportionate sacrifices. Extreme examples might be:

- *To spend £1m to prevent five staff members suffering bruised knees is obviously grossly disproportionate; but,*
- *To spend £1m to prevent a major explosion capable of killing 150 people is obviously proportionate.*

Proving ALARP means that if the risks are lower than $1x10^{-4}$ fatalities per person per year, it can be demonstrated that there would be no more benefit from further mitigation, sometimes using cost benefit analysis. "

4.4.3.3 Land Planning

There are no legislative land-planning guidelines in South Africa and in many parts of the world. Further to this, land-planning guidelines vary from one country to another, and thus it is not easy to benchmark the results of this study to international criteria. In this instance, RISCOM would only advise on applicable land planning and would require governmental authorities to make final decisions.

Land zoning applied in this study follows the HSE (UK) approach of defining the area affected into three zones, consistent to the ALARP approach (HSE 2011).

The three zones are defined as follows:

- The inner zone is enclosed by the risk of $1x10^{-5}$ fatalities per person per year isopleth;
- The middle zone is enclosed by the risk of $1x10^{-5}$ fatalities per person per year and the risk of $1x10^{-6}$ fatalities per person per year isopleths;
- The outer zone is enclosed by the risk $1x10^{-6}$ fatalities per person per year and the risk of $3x10^{-7}$ fatalities per person per year isopleths.

The risks decrease from the inner zone to the outer zone as shown in Figure 4-5 and Figure 4-6.

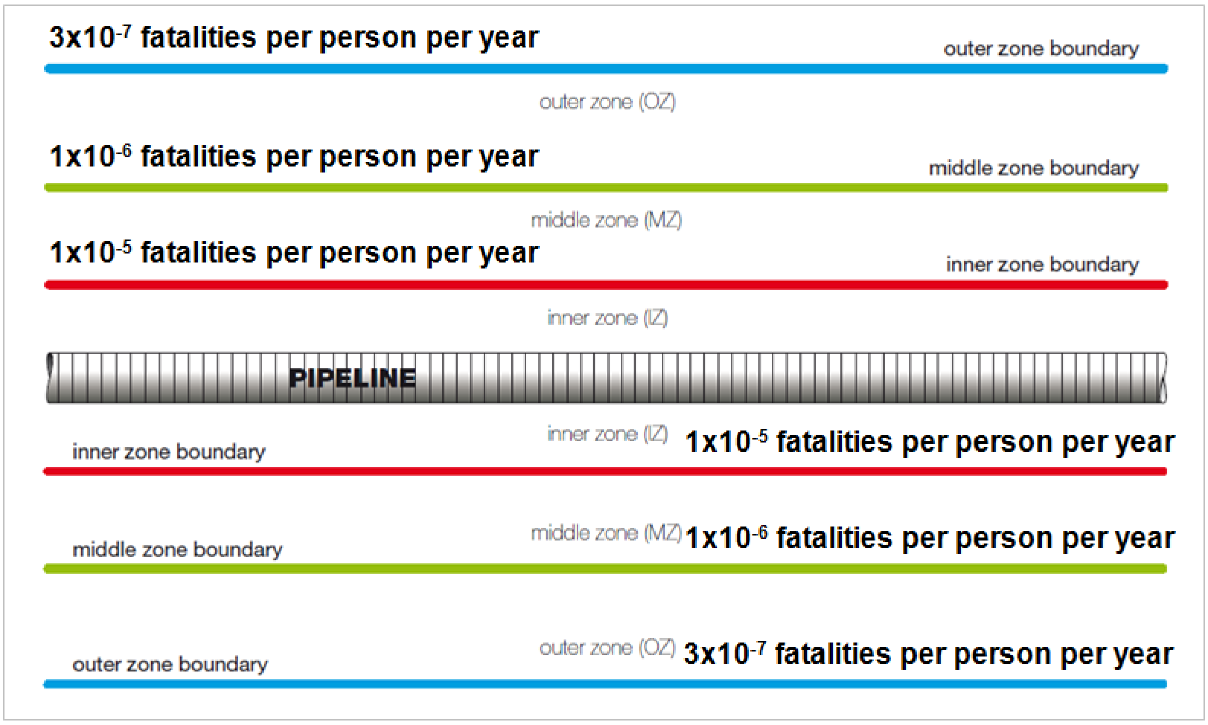


Figure 4-5: Town-planning zones for pipelines

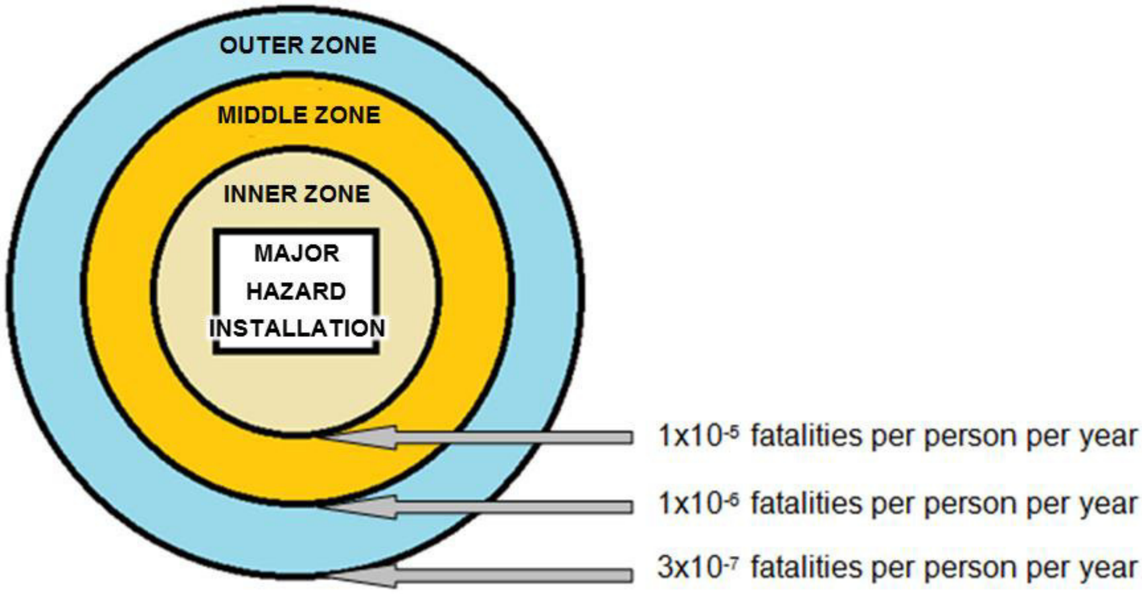


Figure 4-6: Town-planning zones

Once the zones are calculated, the HSE (UK) methodology then determines whether a development in a zone should be categorised as 'advised against' (AA) or as 'don't advise against' (DAA), depending on the sensitivity of the development, as indicated in Table 4-20. There are no land-planning restrictions beyond the outer zone.

Table 4-20: Land-use decision matrix

Level of Sensitivity	Development in Inner Zone	Development in Middle Zone	Development in Outer Zone
1	DAA	DAA	DAA
2	AA	DAA	DAA
3	AA	AA	DAA
4	AA	AA	AA

The sensitivity levels are based on a clear rationale: progressively more severe restrictions are to be imposed as the sensitivity of the proposed development increases.

There are four sensitivity levels, with the sensitivity for housing defined as follows:

- Level 1 is based on workers who have been advised of the hazards and are trained accordingly;
- Level 2 is based on the general public at home and involved in normal activities;
- Level 3 is based on the vulnerability of certain members of the public (e.g. children, those with mobility difficulties or those unable to recognise physical danger);
- Level 4 is based on large examples of Level 2 and of Level 3.

Refer to Appendix C for detailed planning advice for developments near hazardous installations (PADHI) tables. These tables illustrate how the HSE land-use decision matrix, generated using the three zones and the four sensitivity levels, is applied to a variety of development types.

4.5 Quantitative Risk Assessment (QRA) Scenarios

4.5.1 Methodology

Due to the absence of South African legislation regarding determination methodology for quantitative risk assessment (QRA), the methodology of this assessment is based on the legal requirements of the Netherlands, outlined in CPR 18E (Purple Book; 1999) and RIVM (2009).

The evaluation of the acceptability of the risks is done in accordance with the Health and Safety Executive (HSE; UK) ALARP criteria, which clearly covers land use, based on the determined risks.

The QRA process is summarised with the following steps:

1. Identification of components that are flammable, toxic, reactive or corrosive and that have potential to result in a major incident from fires, explosions or toxic releases;
2. Development of accidental loss of containment (LOC) scenarios for equipment containing hazardous components (including release rate, location and orientation of release);
3. For each incident developed in Step 2, determination of consequences (such as thermal radiation, domino effects, toxic-cloud formation and so forth);
4. For scenarios with off-site consequences (greater than 1% fatality off-site), calculation of maximum individual risk (MIR), taking into account all generic failure rates, initiating events (such as ignition), meteorological conditions and lethality.

Scenarios included in this QRA have impacts external to the establishment. The 1% fatality from acute affects (thermal radiation, blast overpressure and toxic exposure) is determined as the endpoint (RIVM 2009). Thus, a scenario producing a fatality of less than 1% at the establishment boundary under worst-case meteorological conditions would be excluded from the QRA.

4.5.2 Scenario Selection

Guidelines for selection of scenarios is given in RIVM (2009) and CPR 18E (Purple Book; 1999). A particular scenario may produce more than one major consequence. In such cases, consequences are evaluated separately and assigned failure frequencies in the risk analysis. Some of these phenomena are described in the subsections that follow.

4.5.2.1 Scenarios for Release of a Pressurised Liquefied Gas

The nature of the release of a liquefied gas from a pressurised vessel is dependent on the position of the hole.

A hole above the liquid level will result in a vapour release only, and the release rate would be related to the size of the hole and internal pressure of the tank. Over a period of time, bulk temperature reduces, with an associated decrease in the vapour release rate.

A hole below the liquid level will result in a release of a liquid stream. In the reduced pressure of the atmosphere, a portion of the liquid will vaporise at the normal boiling point. This phenomenon is called flashing and is shown in Figure 4-7. The pool, formed after flashing, then evaporates at a rate proportional to the pool area, surrounding temperature and wind velocity.

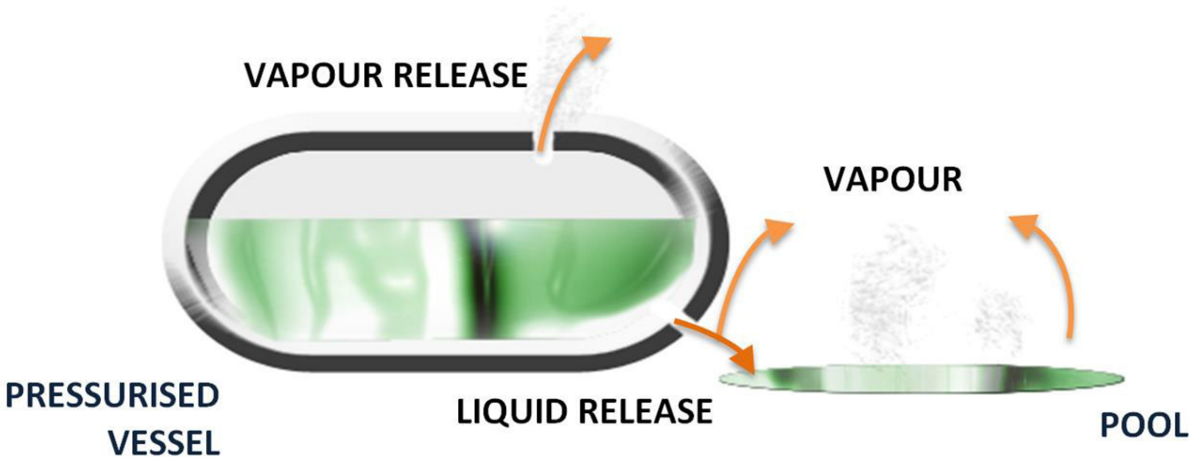


Figure 4-7: Airborne vapours from a loss of containment of liquefied gas stored in a pressurised vessel

- **Instantaneous Release of a Pressured Liquefied Flammable Gas**

An instantaneous loss of containment of a liquefied flammable gas could result in the consequences given in the event tree of Figure 4-8. Probability of the events occurring is dependent on a number of factors and is determined accordingly. All the scenarios shown in the figure are determined separately and reported in relevant subsections of the report.

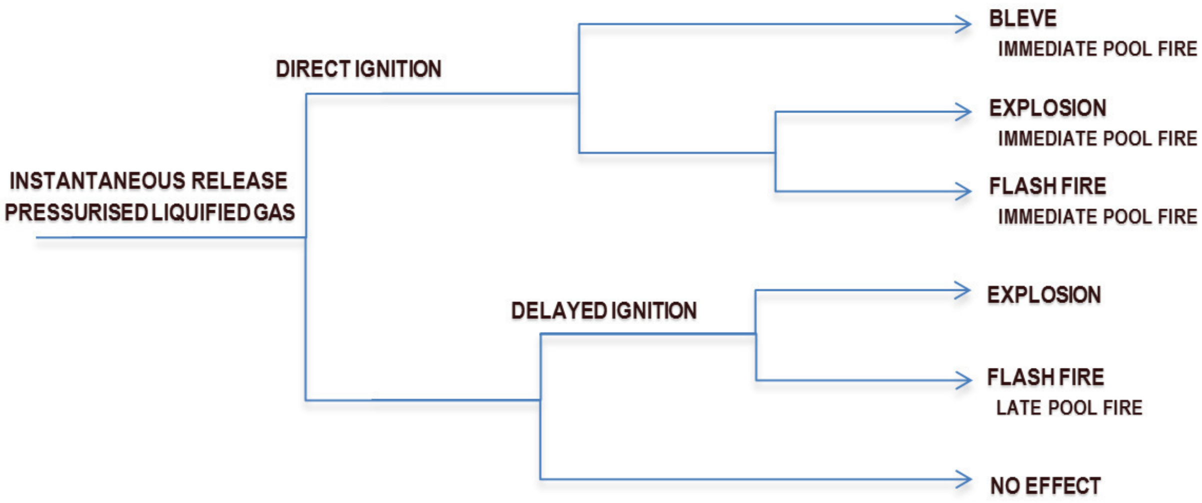


Figure 4-8: Event tree for an instantaneous release of a liquefied flammable gas

- **Continuous Release of a Pressurised Liquefied Flammable Gas**

The continuous loss of containment of a liquefied flammable gas could result in the consequences given in the event tree of Figure 4-9. Probability of the events occurring is dependent on a number of factors and is determined accordingly. All the scenarios shown in the figure are determined separately and reported in relevant subsections of the report.

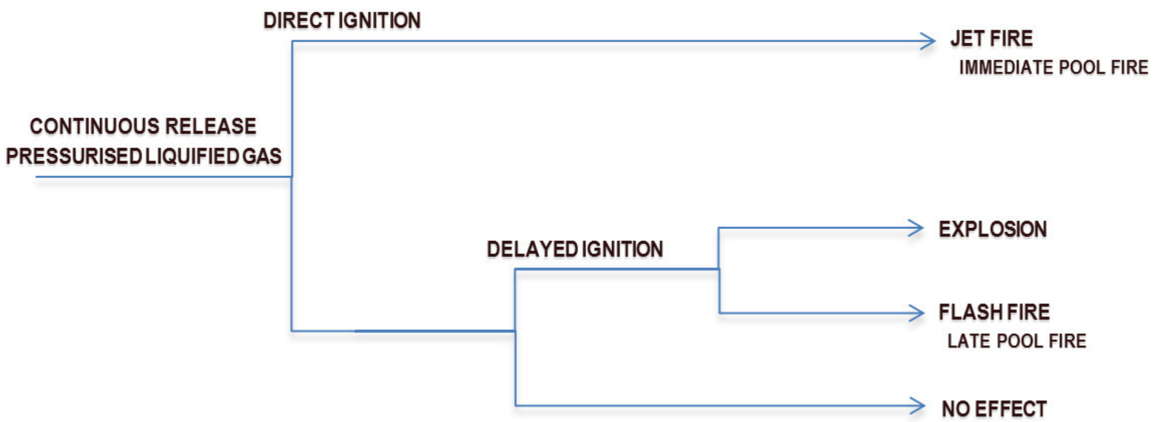


Figure 4-9: Event tree for a continuous release of a liquefied flammable gas

4.5.2.2 Continuous Release of a Flammable Gas

The continuous loss of containment of a flammable gas could result in the consequences given in the event tree of Figure 4-10. Probability of the events occurring is dependent on a number of factors and is determined accordingly. All the scenarios shown in the figure are determined separately and reported in relevant subsections of the report.

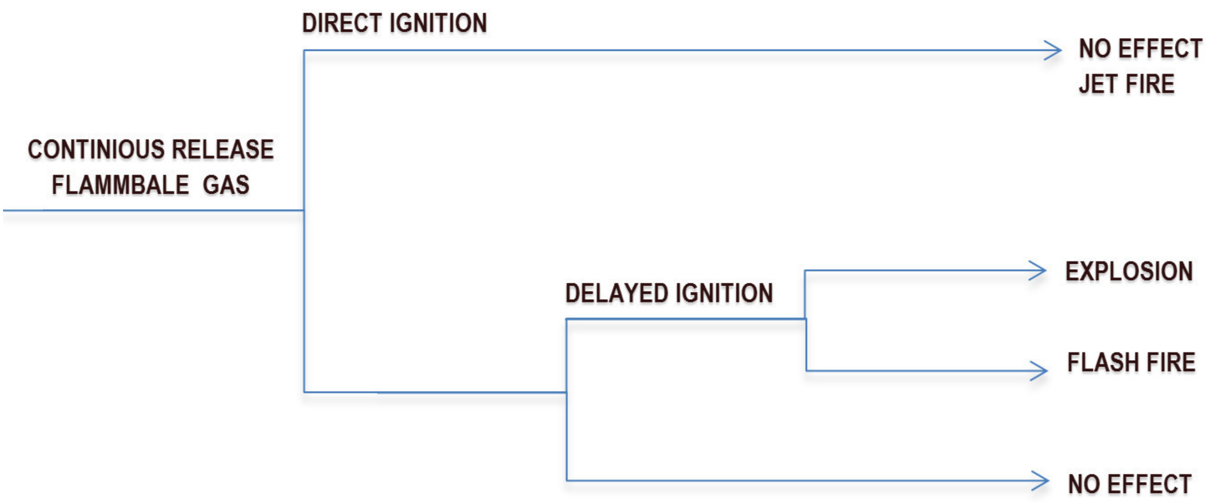


Figure 4-10: Event tree for a continuous release of a flammable gas

4.5.2.3 Continuous Release of a Flammable Liquid

The continuous loss of containment of a flammable liquid could result in the consequences given in the event tree of Figure 4-11. Probability of the events occurring is dependent on a number of factors and is determined accordingly. All the scenarios shown in the figure are determined separately and reported in relevant subsections of the report.

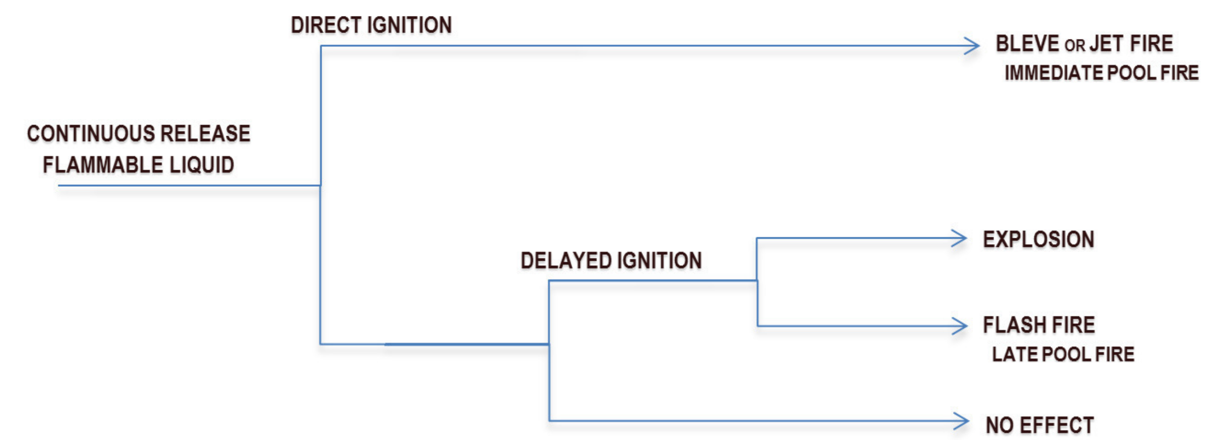


Figure 4-11: Event tree for a continuous release of a flammable liquid

4.6 Impact Assessment Methodology

The standard methodology used in the environmental impact assessment to determine the significance rating of the potential impacts are outlined in this section.

4.6.1 Significance

The significance of an impact is defined as the combination of the consequence of the impact occurring and the probability that the impact will occur. The nature and type of impact may be direct or indirect and may also be positive or negative, refer to Table 4-21 for the specific definitions.

Table 4-21: Nature and type of impact

	Nature and Type of Impact:		
IMPACT	**Direct**	Impacts that are caused directly by the activity and generally occur at the same time and place as the activity	✓/✗
	Indirect	Indirect or induced changes that may occur because of the activity. These include all impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place because of the activity	✓/✗
	Cumulative	Those impacts associated with the activity which add to, or interact synergistically with existing impacts of past or existing activities, and include direct or indirect impacts which accumulate over time and space	✓/✗
	Positive	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes will benefit significantly, and includes neutral impacts (those that are not considered to be negative	✓
	Negative	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will be comprised	✗

Table 4-22 presents the defined criteria used to determine the consequence of the impact occurring which incorporates the extent, duration and intensity (severity) of the impact.

Table 4-22: Consequence of the Impact occurring

CONSEQUENCE	**Extent of Impact:**	
	Site	Impact is limited to the site and immediate surroundings, within the study site boundary or property (immobile impacts)
	Neighbouring	Impact extends across the site boundary to adjacent properties (mobile impacts)
	Local	Impact occurs within a 5km radius of the site
	Regional	Impact occurs within a provincial boundary
	National	Impact occurs across one or more provincial boundaries
	Duration of Impact:	
	Incidental	The impact will cease almost immediately (within weeks) if the activity is stopped, or may occur during isolated or sporadic incidences
	Short-term	The impact is limited to the construction phase, or the impact will cease within 1 - 2 years if the activity is stopped
	Medium-term	The impact will cease within 5 years if the activity is stopped
	Long-term	The impact will cease after the operational life of the activity, either by natural processes or by human intervention
	Permanent	Where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient
	Intensity or Severity of Impact:	
	Low	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are not affected
	Low-Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are modified insignificantly
	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are altered
	Medium-High	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes are severely altered
	High	Impacts affect the environment in such a way that natural, cultural and / or social functions and processes will permanently cease

The probability of the impact occurring is the likelihood of the impacts occurring and is determined based on the classification provided in Table 4-23.

Table 4-23: Probability and confidence of impact prediction

PROBABILITY	**Probability of Potential Impact Occurrence:**	
	Improbable	The possibility of the impact materialising is very low either because of design or historic experience
	Possible	The possibility of the impact materialising is low either because of design or historic experience
	Likely	There is a possibility that the impact will occur
	Highly Likely	There is a distinct possibility that the impact will occur
	Definite	The impact will occur regardless of any prevention measures

The significance of the impact is determined by considering the consequence and probability without considering any mitigation or management measures and is then ranked according to the ratings listed in Table 4-24.

Table 4-24: Significance rating of the impact

SIGNIFICANCE	**Significance Ratings:**	
	Low	Neither environmental nor social and cultural receptors will be adversely affected by the impact. Management measures are usually not provided for low impacts
	Low-Medium	Management measures are usually encouraged to ensure that the impacts remain of Low-Medium significance. Management measures may be proposed to ensure that the significance ranking remains low-medium
	Medium	Natural, cultural and/or social functions and processes are altered by the activities, and management measures must be provided to reduce the significance rating
	Medium-High	Natural, cultural and/or social functions and processes are altered significantly by the activities, although management measures may still be feasible
	High	Natural, cultural, and/or social functions and processes are adversely affected by the activities. The precautionary approach will be adopted for all high significant impacts and all possible measures must be taken to reduce the impact

Once significance rating has been determined for each impact, management and mitigation measures must be determined for all impacts that have a significance ranking of Medium and higher in order to attempt to reduce the level of significance that the impact may reflect.

The EIA Regulations, 2014 specifically require a description is provided of the degree to which these impacts:

- can be reversed;
- may cause irreplaceable loss of resources; and
- can be avoided, managed or mitigated.

Based on the proposed mitigation measures the EAP will determined a mitigation efficiency (Table 4-25) whereby the initial significance is re-evaluated and ranked again to effect a significance that incorporates the mitigation based on its effectiveness. The overall significance is then re-ranked, and a final significance rating is determined.

Table 4-25: Mitigation efficiency

MITIGATION EFFICIENCY	**Mitigation Efficiency**	
	None	Not applicable
	Very Low	Where the significance rating stays the same, but where mitigation will reduce the intensity of the impact. Positive impacts will remain the same
	Low	Where the significance rating reduces by one level, after mitigation
	Medium	Where the significance rating reduces by two levels, after mitigation
	High	Where the significance rating reduces by three levels, after mitigation
	Very High	Where the significance rating reduces by more than three levels, after mitigation

The reversibility is directly proportional the "Loss of Resource" where no loss of resource is experienced, the impact is completely reversible; where a substantial "Loss of resource" is experienced there is a medium degree of reversibility; and an irreversible impact relates to a complete loss of resources, i.e. irreplaceable (Table 4-26).

Table 4-26: Degree of reversibility and loss of resources

DEGREE REVERSABILITY & LOSS OF RESOURCES	**Loss of Resources:**	
	No Loss	No loss of social, cultural and/or ecological resource(s) are experienced. Positive impacts will not experience resource loss
	Minimal	The activity results in an insignificant loss of social, cultural and/or ecological resource(s)
	Partial	The activity results in a partial loss of social, cultural and/or ecological resource(s)
	Irreplaceable	The activity results in the complete and irreplaceable social, cultural and/or ecological loss of resource(s)
	Reversibility:	
	Irreversible	Impacts on natural, cultural and/or social functions and processes are irreversible to the pre-impacted state in such a way that the application of resources will not cause any degree of reversibility
	Medium Degree	Impacts on natural, cultural and/or social functions and processes are partially reversible to the pre-impacted state if less than 50% resources are applied
	High Degree	Impacts on natural, cultural and/or social functions and processes are partially reversible to the pre-impacted state if more than 50% resources are applied
	Reversible	Impacts on natural, cultural and/or social functions and processes are fully reversible to the pre-impacted state if adequate resources are applied

5 RISK ASSESSMENT

Risk assessment was done of each section by firstly selecting a scenario and then completing consequence and outflow modelling. Consequences with possible impacts beyond the site boundary were retained for risk analysis of the unit.

Finally, the risk of the entire facility is determined as a combination of the risk calculated for each unit.

5.1 Transport Pipelines from Tie-in Point to the BTG Terminal

5.1.1 Purpose of the Processing Unit

Above ground, transport pipelines would be used to transport the BTG products and LPG to and from the terminal from the berths and will tie in to common lines approximately 2.8 km from the BTG facility.

5.1.2 Hazard Identification

Flammable or combustible components to be stored, transported or processed

LPG and ULP petrol are highly flammable substances, while paraffin/Jet-A1 and diesel are considered combustible and may sustain combustion after ignition. None of these components are considered to be acutely toxic.

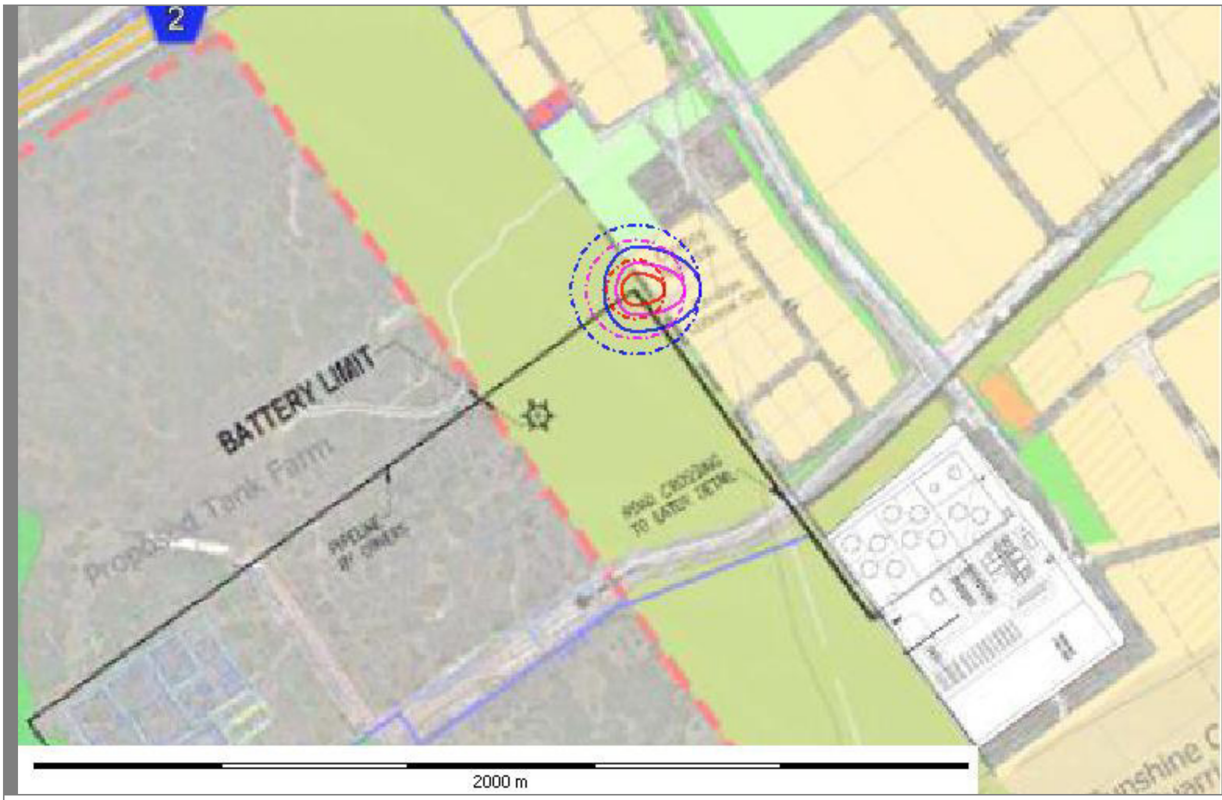
5.1.3 Consequence Modelling

Pool fires

A failure of a transport pipeline would form a pool that would spread until it could spread no more, or until it was contained by natural barriers. The maximum area of a spill is assumed to be 3 000 m^2 (RIVM 2009). A full-bore rupture as well as a leak from a hole of 50 mm would both produce a flammable pool limited to 3 000 m^2.

Figure 5-1 shows the extent of a pool fire, at a single point, from a loss of containment of petrol from the pipeline. The solid lines represent the extent of the impacts during a westerly wind, while the dashed lines indicate the extent of the impact from all wind directions.

The 1% fatality is represented by the 10 kW/m^2 thermal radiation isopleth. Thermal radiation that would result in 100% fatality and damage to steel, represented by the 35 kW/m^2 isopleth.



LEGEND	THERMAL RADIATION/DISTANCE (kW/m^2)/m
(blue line)	4/147
(magenta line)	10/112
(red line)	35/67

Figure 5-1: Thermal-radiation isopleths from petrol pool fires resulting from a pipeline failure

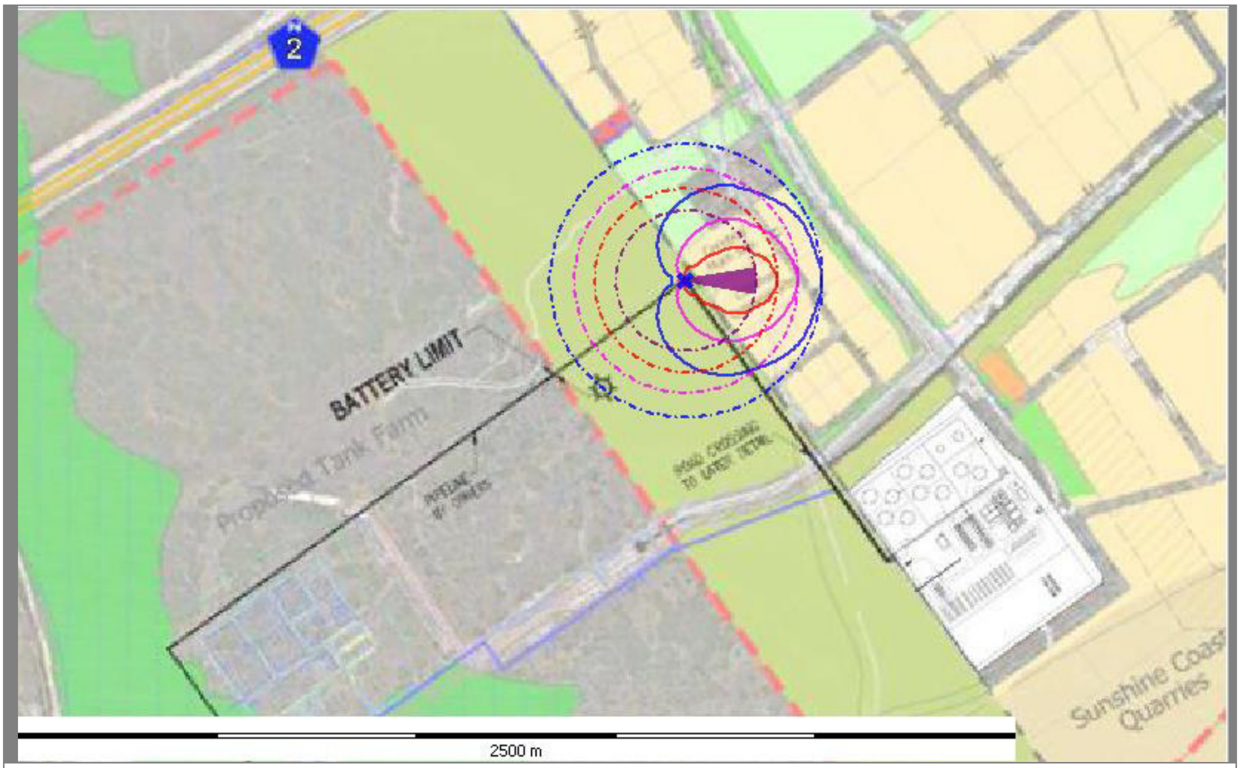
Jet fires

A release of LPG under pressure could result in a jet fire. The simulations assume the jet fire to be in the worst orientation i.e. horizontal for aboveground pipelines. The most significant scenarios are described in the following subsections.

Full-bore rupture

The worst-case release orientation would be in the horizontal plane producing a flame length of 171 m. The edge of the flame would have over 202 kW/m^2 of thermal radiation and could cause severe damage to equipment as well as result in fatalities, within a short time and a short distance from the flame.

Figure 5-2 gives the thermal radiation for a full-bore rupture of pipeline at a single point, illustrating the distance of the jet fires and the rapid drop in thermal radiation with distance. The solid lines indicate the flame, while the dashed lines indicate the effect zone with flames in all orientations. While the effect zone appears large, the actual damage at high thermal radiation would be limited to a relatively small area.



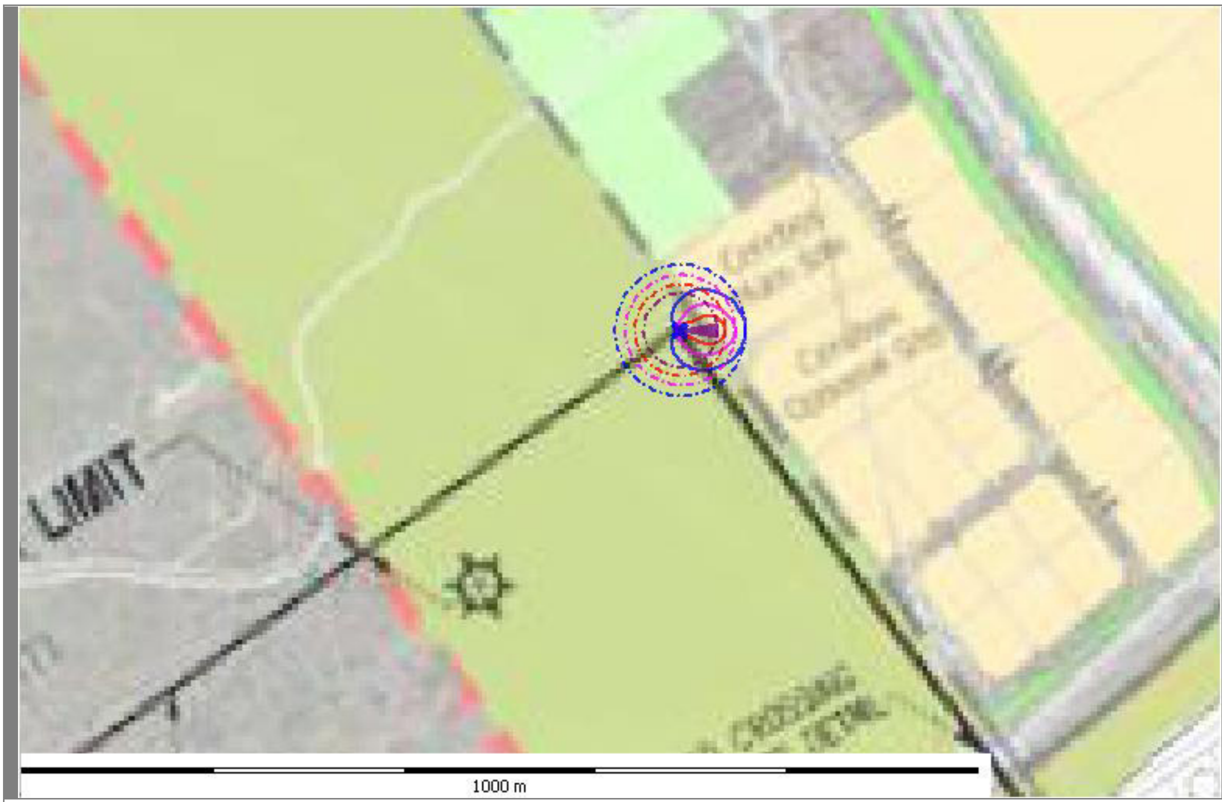
LEGEND	THERMAL RADIATION/DISTANCE (kW/m^2)/m
(blue line)	4/343
(magenta line)	10/282
(red line)	35/229
(purple line)	Flame/171

Figure 5-2: Thermal radiation for a jet fire from a full-bore rupture of the LPG pipeline

A 30 mm hole

A 30 mm hole represents approximately 10% of the possible pipeline diameter. The worst-case release orientation would be in the horizontal plane producing a flame length of 38 m in still air. The edge of the flame would have over 113 kW/m^2 of thermal radiation and could cause severe damage to equipment as well as result in fatalities, within a short time and a short distance from the flame.

Figure 5-3 gives the thermal radiation at a single point, illustrating the distance of the jet fires and the rapid drop in thermal radiation with distance. The solid lines indicate the flame, while the dashed lines indicate the effect zone with flames in all orientations.



LEGEND	THERMAL RADIATION/DISTANCE (kW/m^2)/m
	4/71
	10/60
	35/48
	Flame/34

Figure 5-3: Thermal radiation for a jet fire from a release from a 30 mm hole in the LPG pipeline

In either scenario, an accidental jet fire from the LPG gas pipeline could have considerable reach and, depending on the orientation and point of release, could damage surrounding pipelines and equipment, but would not extend beyond the Coega SEZ into areas occupied by the general public

Flash fires

A flash fire would extend to the lower flammable limit (LFL) but could extend beyond this limit, due to the formation of pockets. It is assumed that people within the flash fire would experience lethal injuries while people outside of the flash fire would remain unharmed.

Flash fires from an LPG pipeline failure are the dominant scenarios and could extend 528 m from a single point of release as shown in Figure 5-4. The solid lines represent the extent of the impacts as indicated by the LFL during a westerly wind, while the dashed lines indicate the extent of the impact from all wind directions.

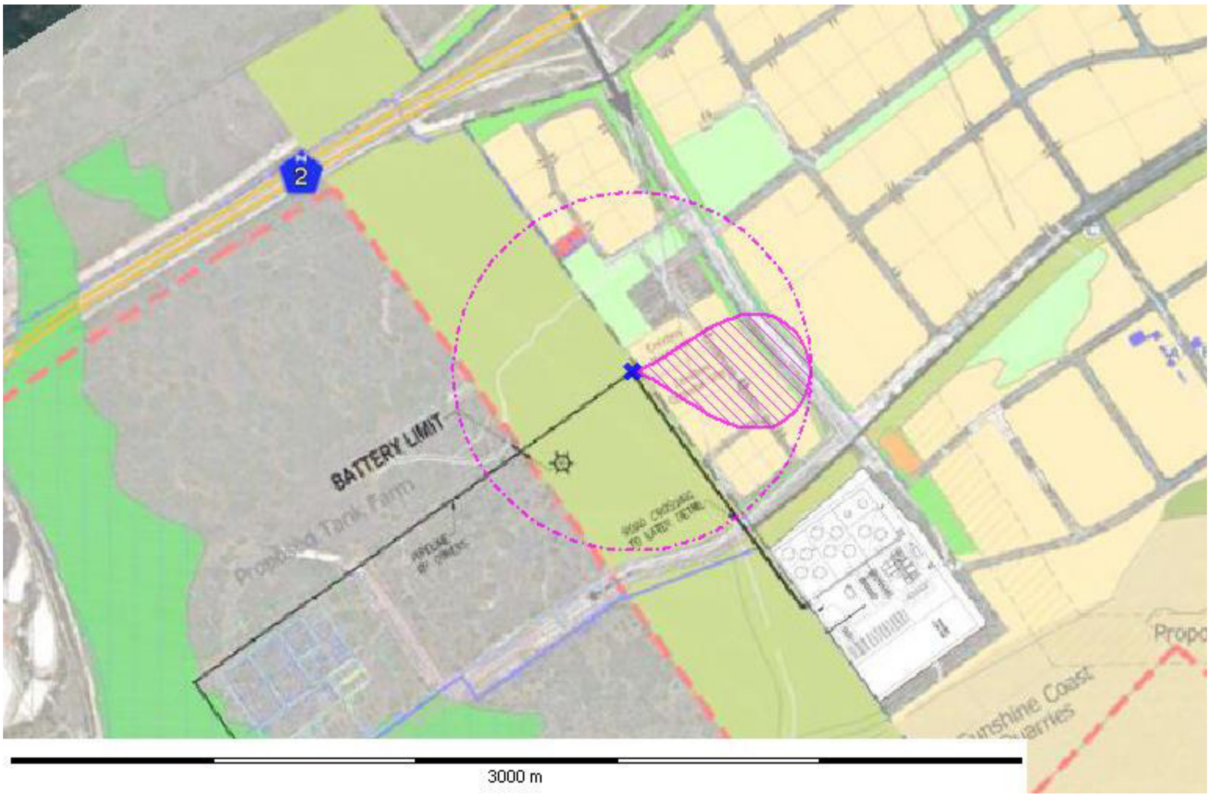


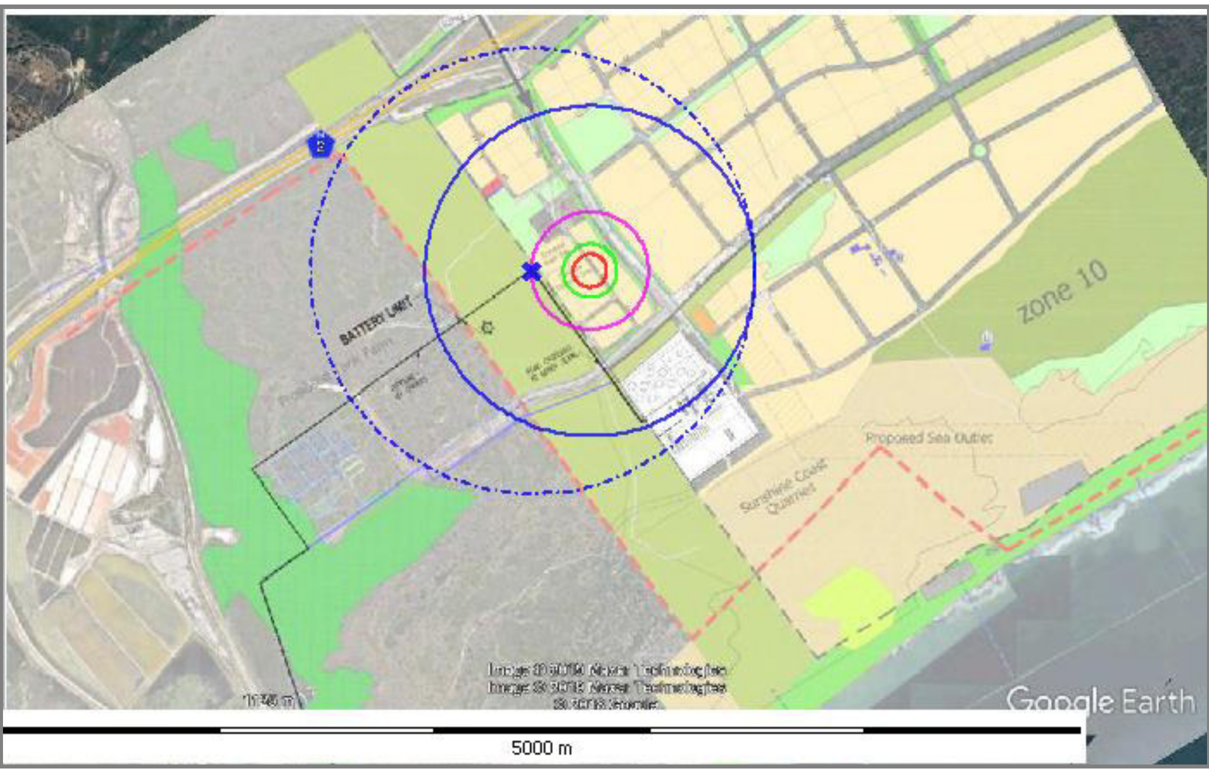
Figure 5-4: The extent of a flash fire from a LPG pipeline failure as indicated by the LFL

Vapour cloud explosions (VCEs)

A vapour cloud explosion (VCE) from a LPG release would have endpoint distances for overpressures of 0.1 bar (representing the 1% fatality and partial damage to buildings) extending up to 548 m from the point of release, shown in Figure 5-5. In the scenario modelled, the vapours drifted to an ignition point before detonating. This is referred to as a 'late explosion'. The solid lines indicate the overpressures from vapours drifting during a westerly wind, while the dashed lines show the effect zone from drifting clouds from all wind directions. While the effect zone appears large, the actual explosion damage at high overpressures would be limited to a relatively small area.

The 0.7 bar overpressure isopleth indicates total destruction of equipment, and the 0.3 bar overpressure isopleth indicates severe damage to brick buildings. The effects of the blast could damage nearby pipelines, and adjacent facilities. Fatalities would not be expected beyond the Coega IDZ into areas occupied by the general public

VCEs from petrol would be more localised.

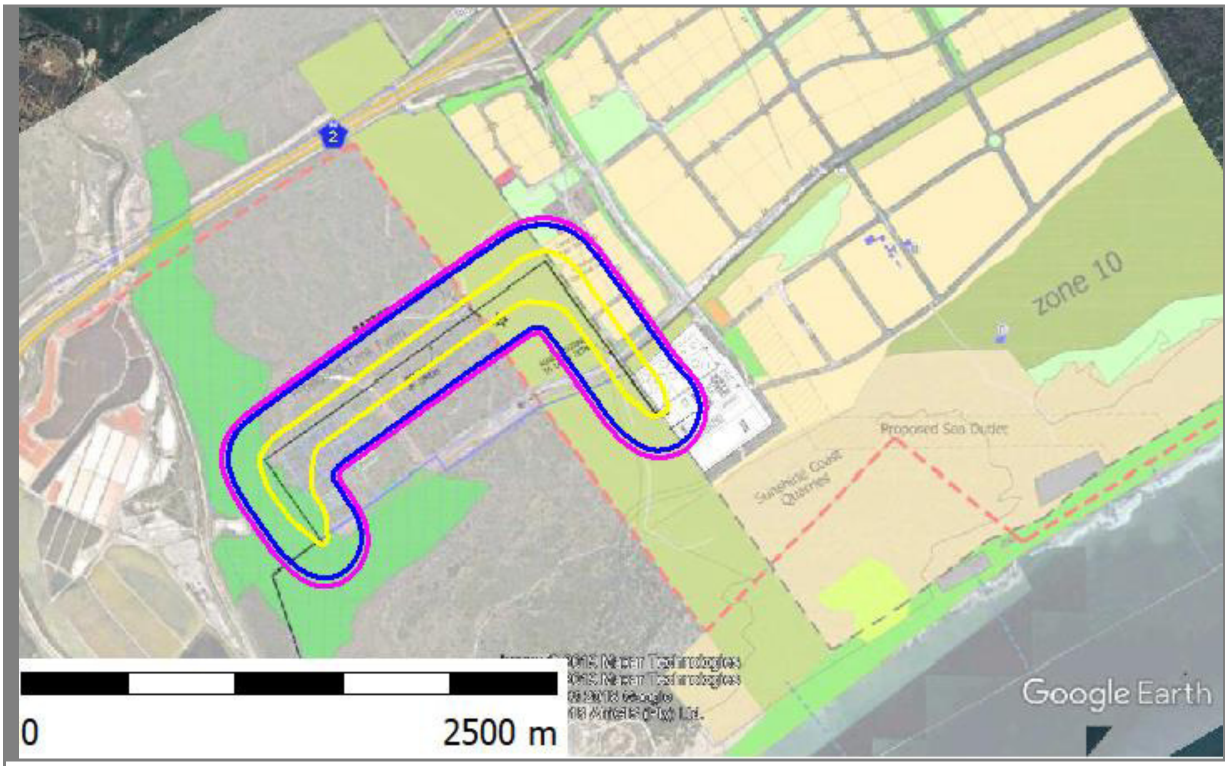


LEGEND	BLAST OVERPRESSURE (bar)
(blue line)	0.03
(yellow line)	0.1
(green line)	0.3
(red line)	0.7

Figure 5-5: Blast overpressures from a large LPG pipeline release resulting in a VCE

5.1.4 Maximum Individual Risk (MIR)

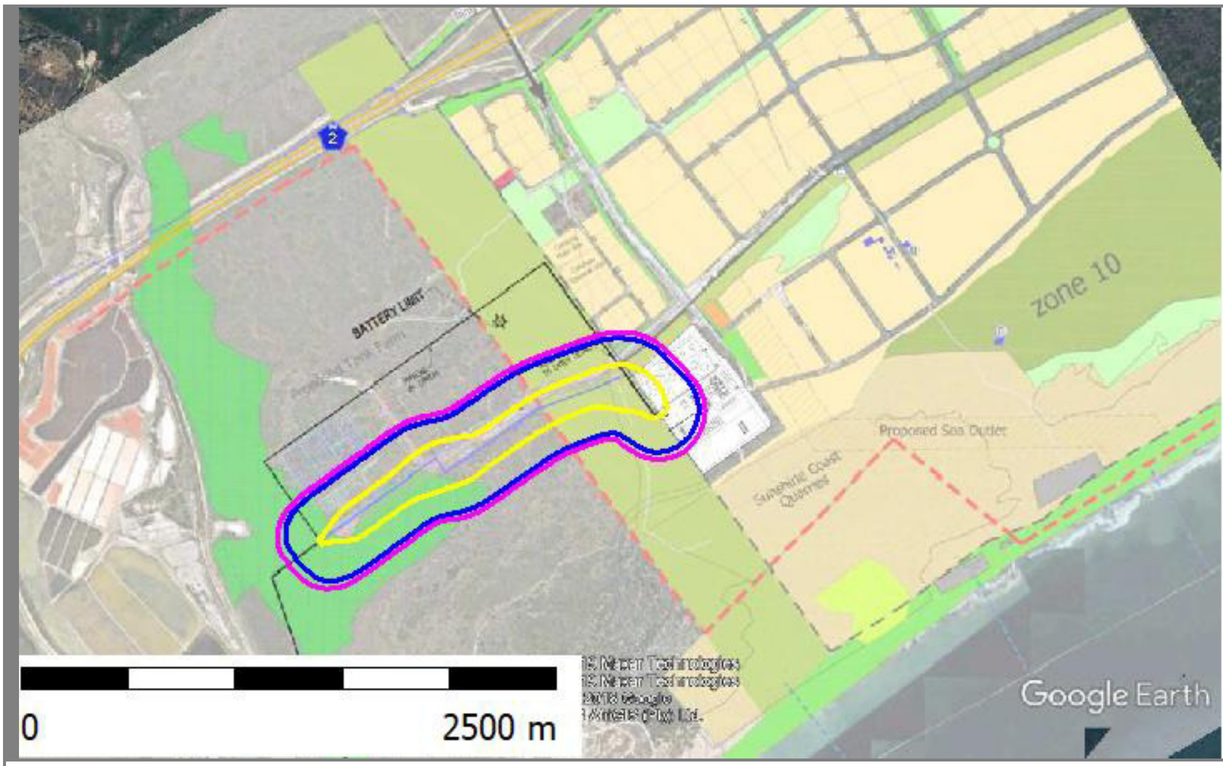
The MIR for the transport pipelines is shown in Figure 5-6 for the alternative 1 (pipeline 1) route and Figure 5-7 for the alternative 2 route (pipeline 2). The risks are dominated by the flash fire and VCE risks. However, the risk of $1x10^{-6}$ fatalities per person per year isopleth follows the pipeline and always remains within the Port of Ngqura and the Coega SEZ areas; therefore, there is no risk to the public.



LEGEND **RISK (fatalities per person per year)**

- Red: $1x10^{-4}$ (not reached)
- Yellow: $1x10^{-5}$
- Blue: $1x10^{-6}$
- Magenta: $3x10^{-7}$

Figure 5-6: Combined risks for the transport pipelines (Alternative 1)



LEGEND	RISK (fatalities per person per year)
(red line)	1×10^{-4} (not reached)
(yellow line)	1×10^{-5}
(blue line)	1×10^{-6}
(magenta line)	3×10^{-7}

Figure 5-7: Combined risks for the transport pipelines (Alternative 2)

5.1.5 Reduction of Risk

From the simulations performed, a number of events have risks that extend beyond the point of release with potential to impact on future developments.

Mitigation that can be considered to reduce the risks to acceptable levels is listed in following subsections. It should be emphasised that suggested mitigation is for consideration only. RISCOM does not imply that the suggested mitigation must be implemented or that any suggested mitigation is the only measure to reduce risks. Implementation of mitigation should always be done in accordance with recognised engineering practices, using applicable codes and standards. Implementation of some or all of the mitigation would not guarantee full compliance with the Major Hazard Installation regulations.

Mitigation for consideration is included in the following subsections.

5.1.5.1 Risk Ranking

This risk assessment considered numerous scenarios assigning both a consequence and a probability of release. Some scenarios have more serious consequences than others. However, the scenarios of particular interest are those with high risk frequencies extending beyond the boundary of the site.

The most significant risk is the failure of the LPG pipeline. Thus, the overall risk would improve with mitigation to the LPG pipeline.

5.1.5.2 Codes and Standards

A number of international codes are available for the design, manufacture and maintenance of cross-country pipelines, such as the ASME B31 range covering both gas and liquid pipelines. It is recommended that the transport pipelines be fully compliant with ASME B31 or an equivalent.

5.1.5.3 Buried Pipeline

The major contribution to the pipeline risks is gas transmission. The risk assessment assumes a horizontal release of gas as the worst orientation for aboveground pipelines. Burying the pipeline to a depth required by the standards would reduce the risks by ensuring that the release is in the vertical plane as well as fire and explosion distances.

5.1.5.4 Pressure Surges

A sudden closure of a valve along a pipeline produces a pressure surge that could break supporting pipeline structures or exceed the pressure rating of the pipeline, resulting in a possible loss of containment of the transported material. It is recommended that the designers of the pipeline demonstrate that pressure surges would not occur during the operation of the pipeline or that maximum pressure surges have been incorporated into the design such that the pipeline or associated equipment would not be damaged and there would not be loss of containment.

5.1.5.5 Reverse Flow

The risk assessment assumed that a loss of containment along the pipeline would be from the pumping operation and that there would be no reverse flow of material from storage containment to the point of release. It is thus recommended that the pipeline designs ensure that reverse flow from the storage containment is not a plausible scenario.

5.1.5.6 Traffic Impacts

All pipelines that can be impacted by road vehicles should be adequately protected to prevent a loss of containment of product from the pipelines from nearby vehicles. This is particularly important with respect to Pipeline alternative 2.

Furthermore, consideration should be given to removing all liquid LPG from the transportation line after receiving a load i.e. the liquid LPG would be placed in the storage vessels leaving only LPG vapours in the line. In this case the LPG inventory in the line has been reduced, as well as no thermal release being required for a compressible gas.

5.1.5.7 Removal of Natural Vegetation Near Pipelines

Burning of natural vegetation near pipelines could result in damage to pipelines with potential releases. Thus, vegetation below the pipelines, and in the near vicinity of the pipelines must be kept to a minimum.

5.2 LPG Bulk Storage and Gantries

5.2.1 Purpose of The Processing Unit

LPG would be transported from ships to the LPG storage vessels from there the LPG will be loaded into road tankers.

5.2.2 Hazard Identification

5.2.2.1 Notifiable Substances

As more than 25 t of LPG would be stored in a single vessel in both Phase 1 and Phase 2, LPG would then be classified as a notifiable substance and automatically the facility would be classified as a Major Hazard Installation.

5.2.2.2 Flammable or combustible components to be stored, transported or processed

LPG is considered to be an extremely flammable component but is not considered acutely toxic. See Section 4.1.2.1 for the description of LPG.

5.2.3 Consequence Modelling

5.2.3.1 Pool Fires

No pool fires would be expected as the released LPG would flash into the vapour state with liquid LPG droplets evaporating rapidly. Further to this, the LPG tanks would be mounded preventing the formation of flammable LPG pools below the storage vessels.

5.2.3.2 Jet fires

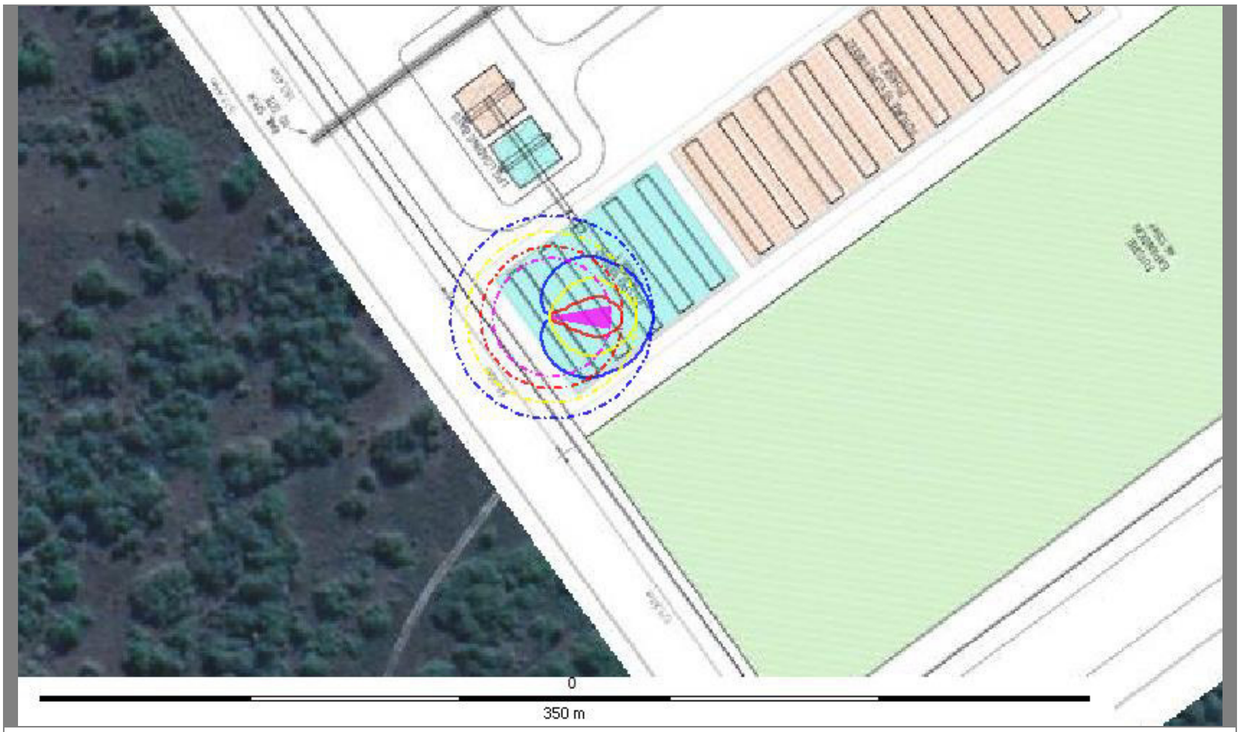
A release of LPG under pressure could result in a jet fire. The simulations assume the jet fire to be in the worst orientation i.e. horizontal for all releases except a PSV release which would be in the vertical orientation. The most significant scenarios are described in the following subsections.

10 mm hole

A 10 mm hole would be typical of a small hole or flange gasket failure. The worst-case release orientation would be in the horizontal plane producing a flame length of 20 m in still air. The edge of the flame would have over 100 kW/m^2 of thermal radiation and could cause severe damage to equipment as well as result in fatalities, within a short time and a short distance from the flame.

Figure 5-8 gives the thermal radiation for a single vessel, illustrating the distance of the jet fires and the rapid drop in thermal radiation with distance. The contours indicate the flame from a single release orientation.

The 1% fatality, represented by the 10 kW/m^2 thermal radiation isopleth, extends beyond the site boundary but not beyond the IDZ area, under certain circumstances.



LEGEND	THERMAL RADIATION/ DISTANCE (kW/m^2)/m
Blue	4/37
Yellow	10/32
Red	35/23
Magenta	Flame/20

Figure 5-8: Thermal radiation of a LPG jet fire from a 10 mm hole at Phase 1 storage

Pressure safety valve (PSV) failure

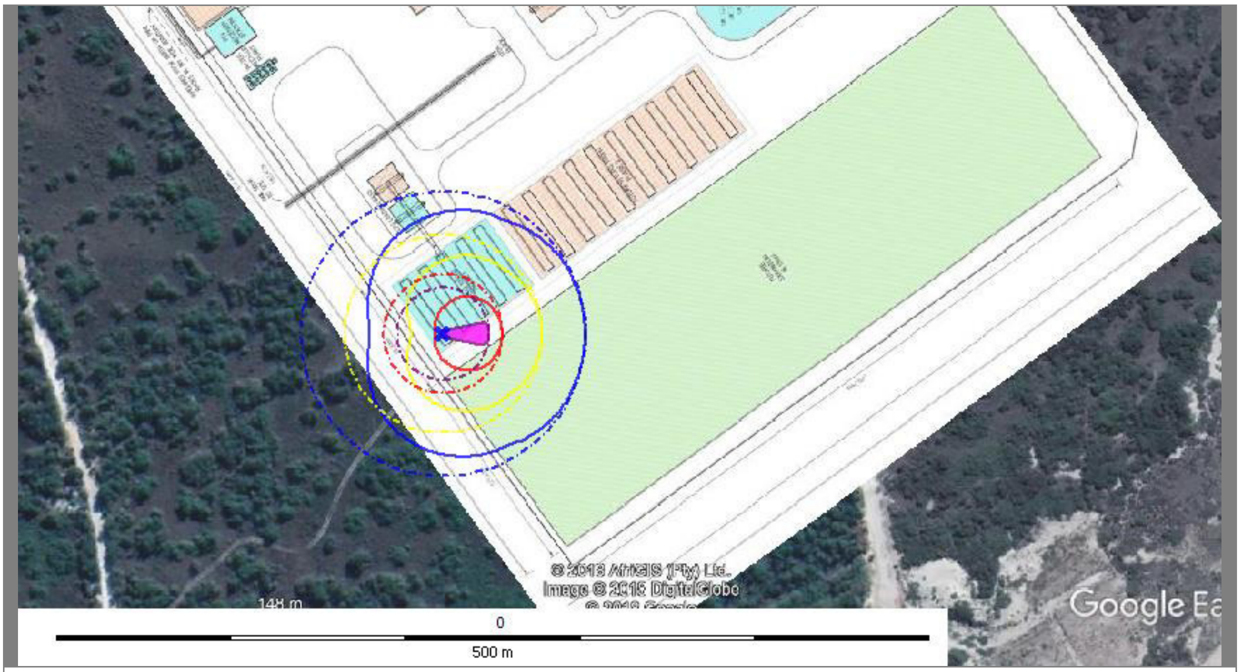
A pressure safety valve (PSV) would be located on the LPG tanks and is a statutory requirement to protect the vessel in the event of overpressure. A failure of the PSV would result in a vertical release. A strong wind could tilt the flame giving the largest distance for ground thermal radiation.

A PSV release from an assumed 6"opening would be in the vertical plane producing a flame length of 57 m in still air. The edge of the flame would have over 178 kW/m^2 of thermal radiation and could cause damage to an adjacent unprotected LPG vessel.

Figure 5-9 gives the maximum thermal radiation for a single vessel, illustrating the distance of the jet fires and the rapid drop in thermal radiation with distance, at a high windspeed of 9 m/s. The solid lines indicate the flame, while the dashed lines indicate the effect zone with flames in all orientations. While the effect zone appears large, the actual damage at high thermal radiation would be limited to a relatively small area.

The 1% fatality, represented by the 10 kW/m^2 thermal radiation isopleth, extends beyond the site boundary but not beyond the IDZ area, under certain circumstances.

Thermal radiation that would result in 100% fatality and damage to steel, represented by the 35 kW/m^2 isopleth, could extend a distance with potential to damage surrounding LPG and liquid fuel tanks with cascading effects.



LEGEND	THERMAL RADIATION/ DISTANCE (kW/m^2)/m
(blue)	4/82
(yellow)	10/57
(red)	35/34
(magenta)	Flame/29

Figure 5-9: Thermal radiation of an LPG jet fire from a PSV failure at Phase 1 storage at high wind speeds

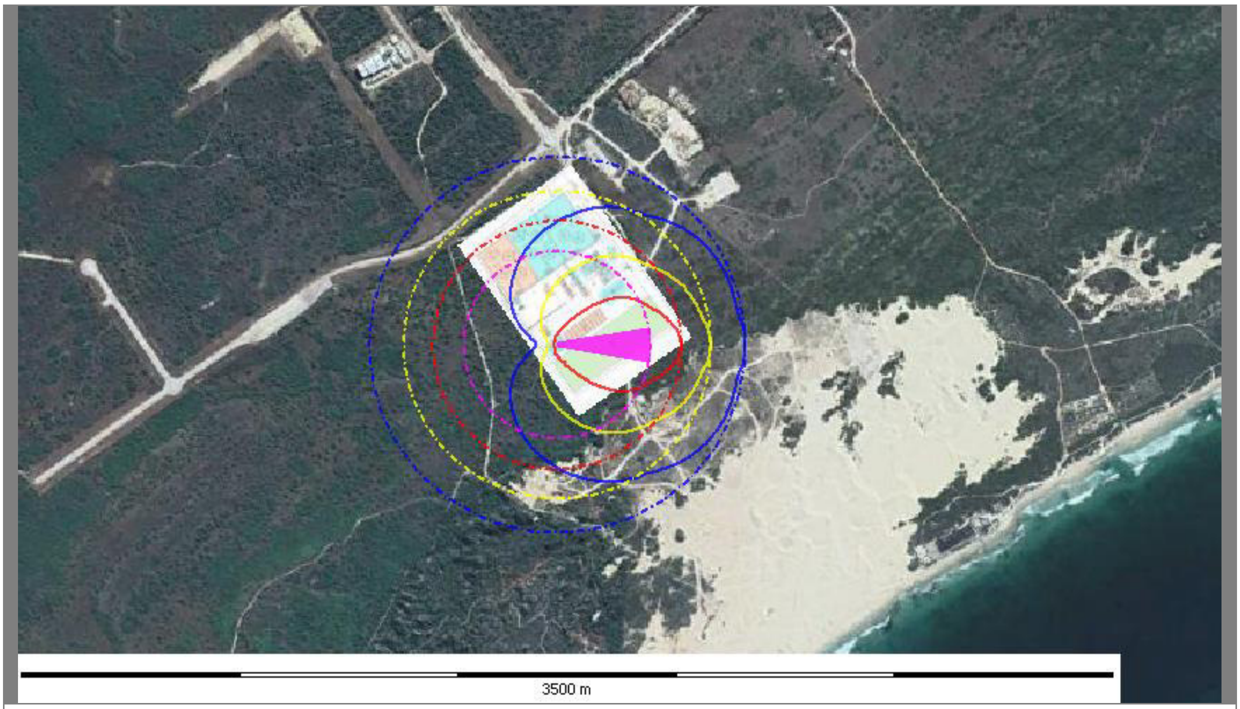
Vessel empties in 10 minutes (Fixed duration)

The design of the mounded LPG tanks would determine if a jet fire from a vessel failure could be a plausible scenario. Assuming the mound covers the vessel only, a 1000 m^3 LPG vessel that empties in 10 minutes would have a mass flow of 836 kg/s producing a flame length of 295 m for a short duration. The edge of the flame would have over 346 kW/m^2 of thermal radiation that could cause damage to an adjacent unprotected LPG equipment. As the vessels will be mounded, damage to adjacent vessels would not be expected.

Figure 5-10 gives the thermal radiation for a single vessel, illustrating the distance of the jet fires and the rapid drop in thermal radiation with distance. The solid lines indicate the flame, while the dashed lines indicate the effect zone with flames in all orientations.

The 1% fatality, represented by the 10 kW/m^2 thermal radiation isopleth, extends beyond the site boundary but not beyond the IDZ area.

Thermal radiation that would result in 100% fatality and damage to steel, represented by the 35 kW/m^2 isopleth, could extend a *considerable* distance with potential to damage surrounding LPG and liquid fuel tanks with cascading effects.



LEGEND	THERMAL RADIATION/ DISTANCE (kW/m^2)/m
Blue	4/604
Yellow	10/493
Red	35/398
Magenta	Flame/295

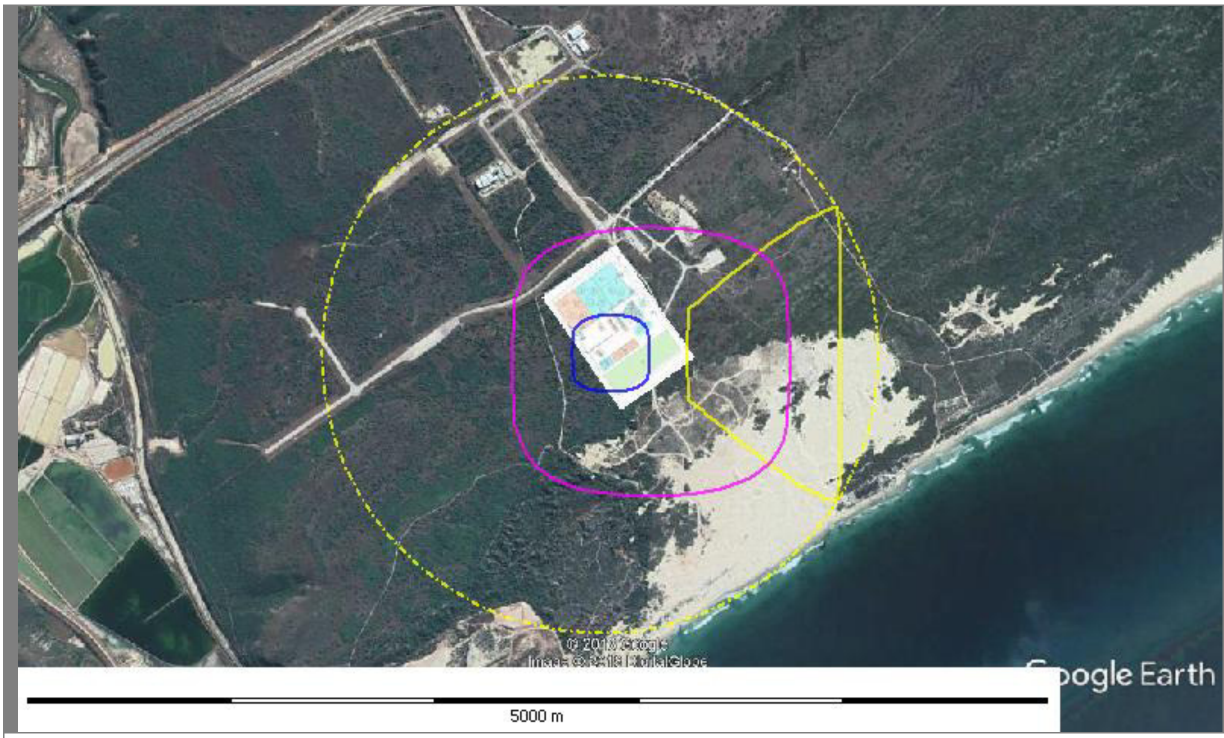
Figure 5-10: Thermal radiation of a LPG jet fire from a fixed duration release at Phase 1 storage

5.2.3.3 Flash fires

A flash fire would extend to the lower flammable limit (LFL) but could extend beyond this limit, due to the formation of pockets. It is assumed that unprotected people within the flash fire would experience lethal injuries while people outside of the flash fire would remain unharmed.

The dominant flash fire scenario would be the failure of a single 1000 m^3 storage vessel, as shown in Figure 5-11. Off-site impacts are indicated by the LFL, which in the worst-case scenario can extend 1.4 km downwind of the release.

In the worst conditions, a flash fire from a loss of containment of LPG could extend beyond the BTG site boundary, but would not extend into the Coega IDZ.



LEGEND	FLASH-FIRE SCENARIO/ DISTANCE FROM RELEASE (m)	
(yellow)	LPG storage vessel:	Empties in 10 min/ 1385 m
(magenta)	LPG storage vessel:	Catastrophic failure/898
(blue)	LPG road tanker:	Catastrophic failure/242

Figure 5-11: Maximum extent of the impact from LPG flash fires at Phase 1 storage

5.2.3.4 Vapour cloud explosions (VCEs)

Figure 5-12 indicates the off-site blast overpressures of 0.1 bar (representing the 1% fatality and partial damage to buildings) due to loss of containment of LPG vapours from a single 1000 m^3 storage vessel in the worst meteorological conditions.

In the scenario modelled, the vapours drifted to an ignition point before detonating. This is referred to as a 'late explosion'. The solid lines indicate the overpressures from vapours drifting during a westerly wind, while the dashed lines show the effect zone from drifting clouds from all wind directions. For clarity, the all wind direction was shown for the largest endpoint distance only. While the effect zone appears large, the actual explosion damage at high overpressures would be limited to a relatively small area.

LEGEND	FLASH-FIRE SCENARIO/ DISTANCE FROM RELEASE (m)	
(yellow)	LPG storage vessel:	Empties in 10 min
(magenta)	LPG storage vessel:	Catastrophic failure
(blue)	LPG road tanker:	Catastrophic failure

Figure 5-12: Maximum distances to the 0.1 bar overpressure for LPG VCEs at Phase 1 storage

The worst-case blast overpressures would be the fixed duration release of a single LPG storage vessel, as shown in Figure 5-13. The solid lines indicate the overpressures from vapours drifting during a westerly wind, while the dashed lines show the effect zone from drifting clouds from all wind directions. For clarity, the all wind direction was shown for the largest endpoint distance only.

The 0.7 bar overpressure isopleth indicates total destruction of equipment, and the 0.3 bar overpressure isopleth indicates severe damage to brick buildings. A large release of LPG could result in extensive damage and fatalities up to 1.4 km downwind of the release.

No lethal effects are expected below 0.1 bar overpressure for people in the open. In the worst conditions, a VCE from a loss of containment of LPG could extend across the bay into the harbour area but would not extend into the residential areas.

LEGEND **BLAST OVERPRESSURE (bar)**

blue	0.1
yellow	0.3
red	0.7

Figure 5-13: Blast overpressures for the worst-case vapour cloud explosion from a release from a single 1000 m^3 LPG storage vessel

5.2.3.5 Boiling liquid expanding vapour explosions (BLEVEs)

A boiling liquid expanding vapour explosion (BLEVE) could occur if a flame impinges on an LPG pressure vessel, particularly in the vapour space region where cooling by evaporation of the contained LPG does not occur.

The major consequences of a BLEVE are intense thermal radiation from the fireball, a blast wave and fragments from the shattered vessel. These fragments may be projected to considerable distances. Analyses of the travel range of fragment missiles from a number of BLEVEs suggest that the majority land within 700 m from the incident. A blast wave from a BLEVE is fairly localised but can cause significant damage to immediate equipment.

The bulk LPG vessels would not be mounded and thus BLEVEs of the vessels are a possibility. A BLEVE could also be formed at the LPG road tankers. The characteristics of these BLEVEs are indicated in Table 5-1.

Table 5-1: Characteristics of LPG BLEVEs for at the road tankers

Parameter	LPG Bullet	Road Tanker (50 m^3)
Initial mass in vessel (kg)	5.02E+05	25102
Duration of the fire ball (s)	24.0	11.3
Maximum diameter of the fire ball (m)	461	170
Maximum height of the fire ball (m)	691	255
Distance to 1% fatality (m)	787	216

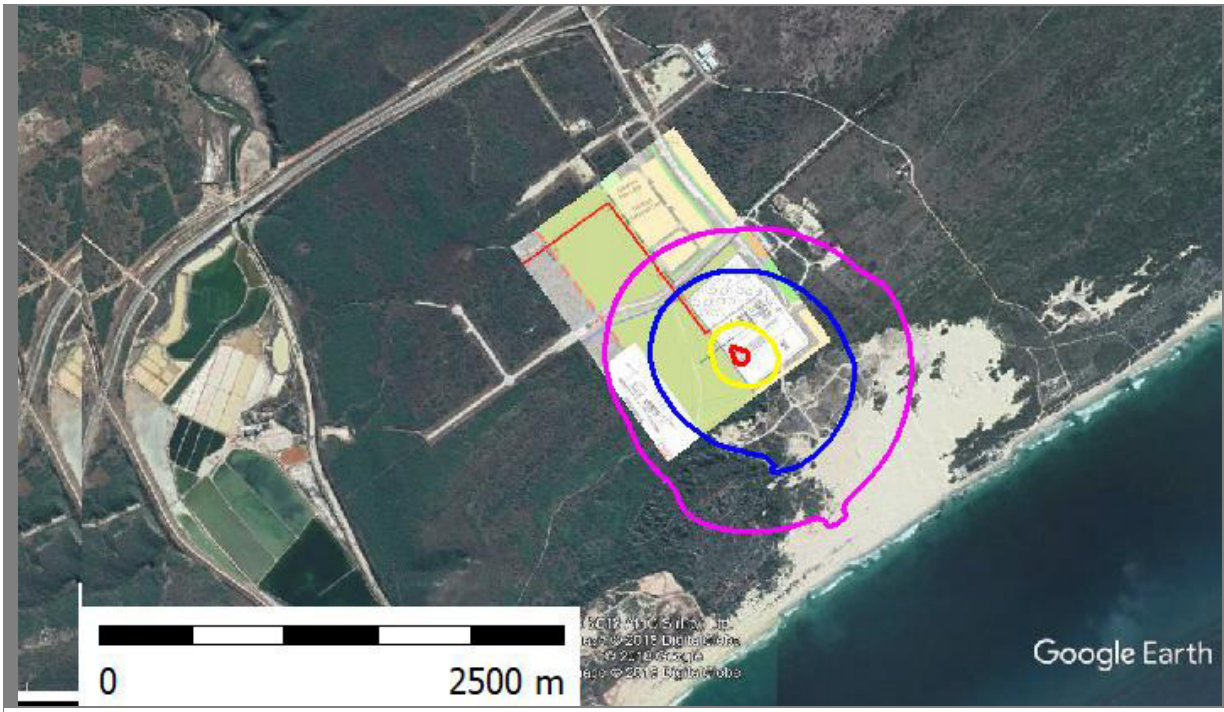
The extent of the1%, fatality from bulk LPG storage vessels and tankers are shown in Figure 5-14. While the impacts from LPG BLEVEs could extend beyond the BTG facility, no fatalities would be expected outside of the IDZ area.

LEGEND	SCENARIO
Yellow line	LPG vessel
Red line	LPG road tanker

Figure 5-14: The extent of the 1% fatality from LPG BLEVEs

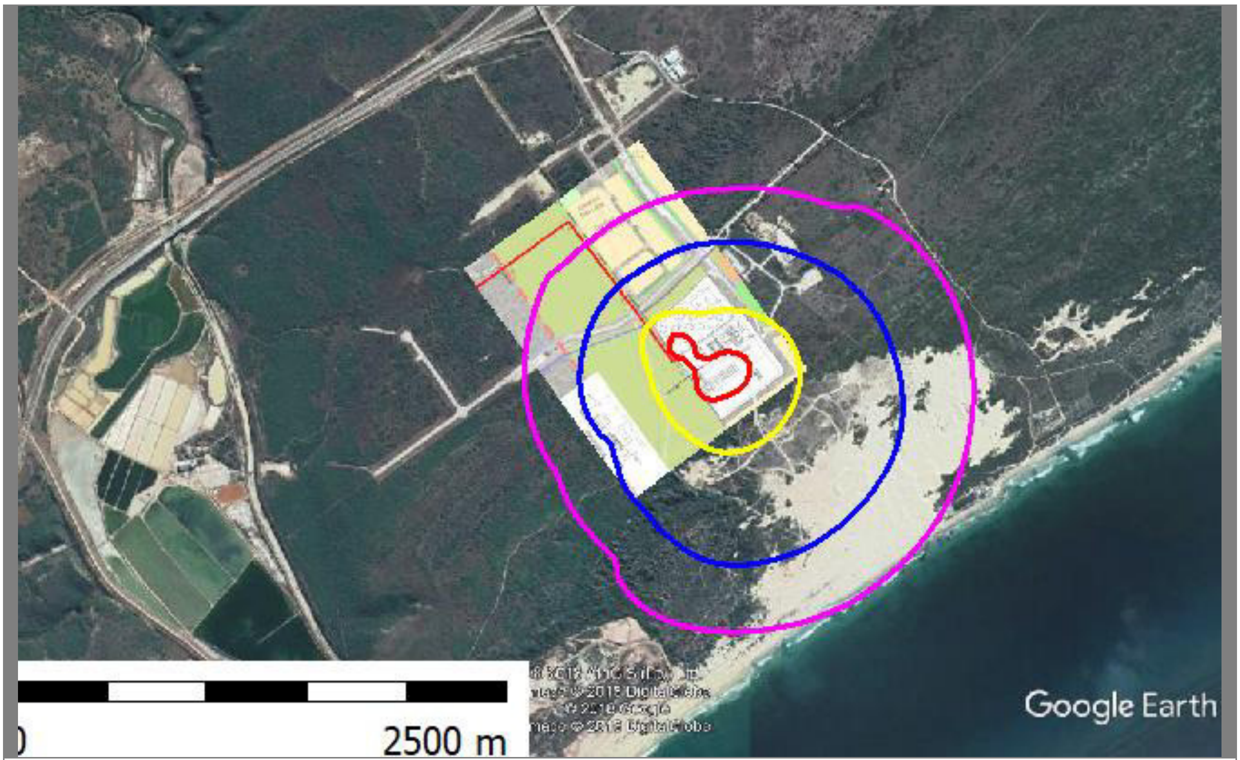
5.2.4 Maximum Individual Risk (MIR)

The risks for LPG bulk storage and gantries for Phase 1 and subsequent phases are shown in Figure 5-15. The risk of 3×10^{-7} fatalities per person per year isopleth, representing trivial risk, extends about 1.3 km downwind from the release and remain within the Coega IDZ and did not into the residential areas. The risk of 1×10^{-6} fatalities per person per year isopleth would remain within the Coega IDZ. Thus, the risk due to the proposed facility would be considered acceptable provided that the PADHI land use restrictions are applied.



LEGEND	RISK (fatalities per person per year)
red line	1×10^{-4}
yellow line	1×10^{-5}
blue line	1×10^{-6}
magenta line	3×10^{-7}

Figure 5-15: Risk contours for LPG releases at the bulk storage and gantries at the end of Phase 1



LEGEND	RISK (fatalities per person per year)
red line	$1x10^{-4}$
yellow line	$1x10^{-5}$
blue line	$1x10^{-6}$
magenta line	$3x10^{-7}$

Figure 5-16: Risk contours for LPG releases at the bulk storage and gantries at the end of Phase 2

5.2.5 Reduction of Risks

From the simulations performed, a number of events have risks that extend beyond the point of release with potential to impact on future developments.

Mitigation that can be considered to reduce the risks to acceptable levels is listed in following subsections. It should be emphasised that suggested mitigation is for consideration only. RISCOM does not imply that the suggested mitigation must be implemented or that any suggested mitigation is the only measure to reduce risks. Implementation of mitigation should always be done in accordance with recognised engineering practices, using applicable codes and standards. Implementation of some or all of the mitigation would not guarantee full compliance with the Major Hazard Installation regulations.

Mitigation for consideration is included in the following subsections.

5.2.5.1 LPG Storage Tank Mounding

Mounding of the LPG storage vessels is a common practice and prevents the formation of BLEVEs by preventing the formation of liquid below the vessel and protecting the vessel from jet fires.

5.2.5.2 Codes and Standards

It has been indicated that the applicable standard for the design would be SANS 10087. This is an acceptable standard and *full compliance* with this standard would be expected. Full compliance with SANS 10108, covering the types of electrical instrumentation required for a process in order to reduce ignition sources, as well as *full compliance* of SANS 347 (Pressure Equipment Regulations), would also be mandatory.

5.2.5.3 Safety Instrumented Systems

IEC 61508/11 (Safety Instrumented Systems) are codes specifically related to the instrumentation requirements to ensure adequate protection from the hazards in chemical plants and is applicable to the *life cycle* of the plant. These codes are aimed at reducing to acceptable levels risks to surrounding populations.

The significance of the code is that designs would be evaluated against the criteria of the code and instrumentation with specific failure rates would be specified as well as minimum periods of checking. Thus, the selection of instrumentation is not based on price alone. Further to this, instrumentation cannot be reduced or changed without reviewing the code. The specification of this code implies that designs presented at EIA and MHI evaluations cannot be altered at construction for the sole function of reducing costs. Moreover, the code ensures that the plant would continue to maintain the safety functions for the *life cycle* of the plant, retaining a safe working environment for both workers and the public.

The European standards body (CENELEC) has adopted this standard as EN 61511. This means that in each of the member states of the European Union, the standard is published as a national standard. For example, in Great Britain, it is published by the national standards body as BS EN 61511. The content of these national publications is identical to that of IEC 61511. However, kindly note that the code is not harmonized under any directive of the European Commission.

In the United States ANSI/ISA 84.00.01-2004 was issued in September 2004. It mirrors IEC 61511 in content with the exception that it contains a grandfathering clause:

> " *Compliance with IEC 61508 and IEC 61511 (or ANSI/ISA 84.00.01-2004) would be a requirement in many countries around the world to achieve an acceptable risk to workers and public.* "

Demonstrating compliance with the IEC 61508/11 can be achieved only once full-detail designs have been completed, and it is thus premature at this stage in the project.

5.3 Bulk Atmospheric Storage and Gantries

5.3.1 Purpose of The Processing Unit

The terminal would receive diesel, ULP, HFO and Jet -A1 liquid fuels that would be stored in bulk tanks and dispatched by ship or road.

5.3.2 Hazard Identification

5.3.2.1 Notifiable Substances

Liquid fuels are not considered notifiable substances.

5.3.2.2 Flammable or Combustible Components to Be Stored, Transported or Processed

ULP is considered highly flammable substances, while diesel, Jet A-1 and HFO considered combustible and may sustain combustion after ignition. None of these components are considered to be acutely toxic.

5.3.3 Consequence Modelling

5.3.3.1 Catastrophic Tank Failure

The instantaneous of failure of a storage vessel can result if a proportion of the material overflows the top of the bund, which is referred to as overtopping. For the scenario of an instantaneous release, the amount of overtopping is taken to be an average of 33% and this is translated to the risk assessment by increasing the surface area of the bund by 50% (RIVM 2009).

The thermal radiation isopleths representing the worst-case radiation at a high wind speed and is shown in Figure 5-17 for a catastrophic failure of storage tanks within the bunded area. The solid lines represent the thermal radiation shape from a westerly wind, while the dashed lines represent the maximum flame shape from all wind directions.

The 4 kW/m^2 thermal-radiation isopleths, representing the end of the emergency plan where people in the open can escape the effects. The 10 kW/m^2 thermal radiation isopleths, represents a 1% fatality, damage to plastics and instrumentation and the lower limit for ignition of vegetation. The 35 kW/m^2 thermal radiation represents the limit for ignition of hair and clothing resulting in a 100%. This value is also the lower limit for damage to steel.

The 35 kW/m^2 thermal radiation would remain within the flame and represents the extent of the flammable pool. The flame surface is limited to 20 kW/m^2 thermal radiation due to the suite formation on the flame surface. Thus, steel damage would be limited to items within the flame.

The 1% fatality could extend beyond the suite boundaries into neighbouring properties but, would not extend beyond the Coega IDZ, or into nearby residential areas.

LEGEND	THERMAL RADIATION (kW/m^2)	1 DISTANCE (m)	2 DISTANCE (m)	3 DISTANCE (m)	4 DISTANCE (m)
blue	4	157	198	248	248
magenta	10	101	136	147	147
red	35	65	96	100	100

Figure 5-17: Maximum thermal radiation extents from catastrophic tank failures, within the bunded areas

5.3.3.2 Severe Tank Leak (Not Catastrophic)

A release that is not considered catastrophic, such as a large hole in the vessel, overfill or a piping failure within the bund, would not result in overtopping and would be contained within the major bunded area in the worst case. This case assumes that the minor bunds inside the major bund were exceeded and that the released material extended to the maxim area contained by the major bund.

The thermal radiation isopleths representing the worst-case radiation at a high wind speed and is shown in Figure 5-18.The solid lines represent the thermal radiation shape from a westerly wind, while the dashed lines represent the maximum flame shape from all wind directions.

The 4 kW/m^2 thermal-radiation isopleths, representing the end of the emergency plan where people in the open can escape the effects. The 10 kW/m^2 thermal radiation isopleths, represents a 1% fatality, damage to plastics and instrumentation and the lower limit for ignition of vegetation. The 35 kW/m^2 thermal radiation represents the limit for ignition of hair and clothing resulting in a 100%. This value is also the lower limit for damage to steel.

The 1% fatality could extend beyond the suite boundaries into neighbouring properties but, would not extend beyond the Coega SEZ, or into nearby residential areas.

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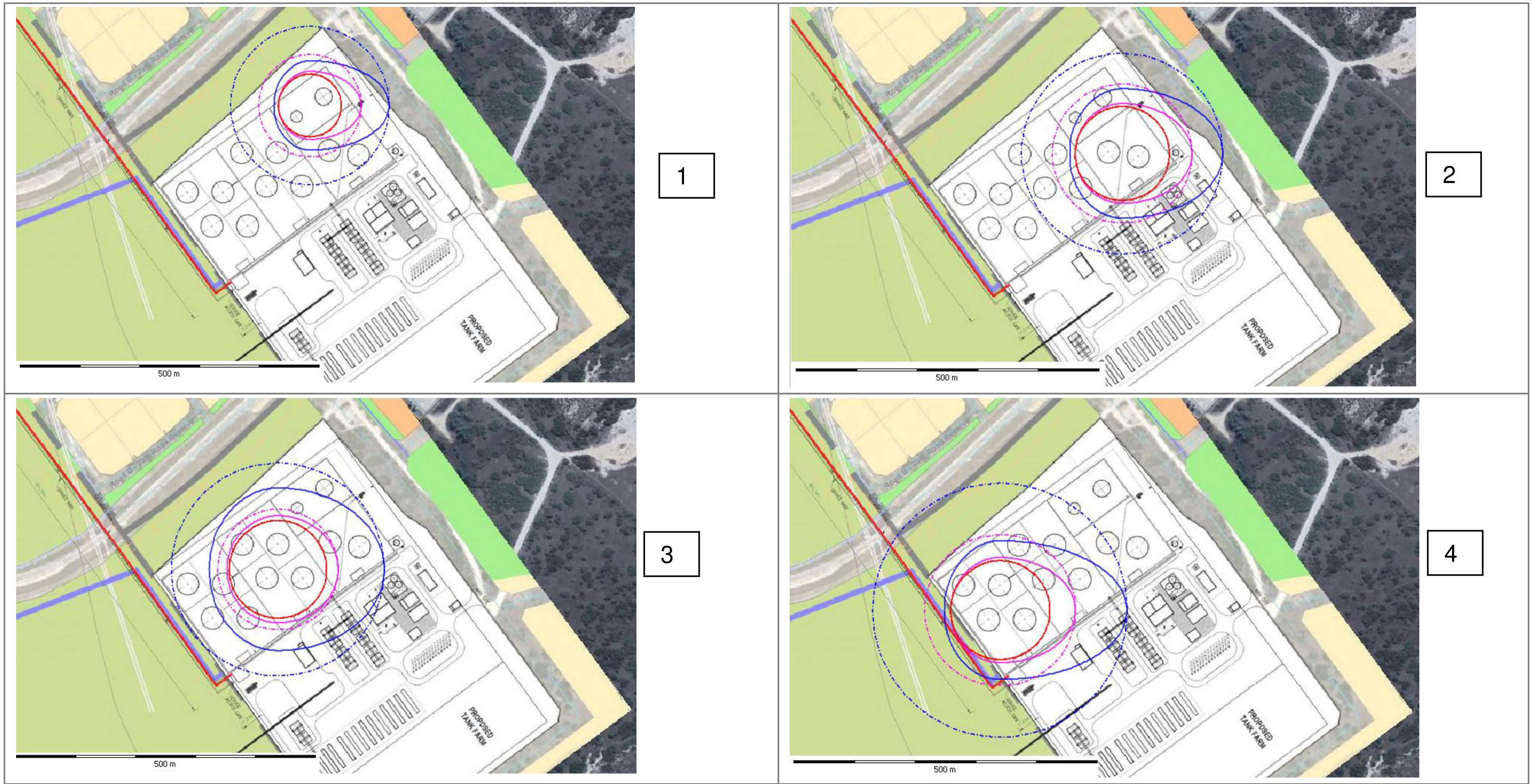


LEGEND	THERMAL RADIATION (kW/m^2)	1 DISTANCE (m)	2 DISTANCE (m)	3 DISTANCE (m)	4 DISTANCE (m)
Blue line	4	133	166	210	210
Magenta line	10	86	115	125	125
Red line	35	53	78	82	82

Figure 5-18: Maximum thermal radiation extents from tank severe leaks within the bunded areas

5.3.3.3 Tank-top fires

A tank-top fire would occur if the flammable vapours above the stored liquid ignite. The resulting fire would be contained within the tank but could cascade into a bund fire with the collapsing of the tank.

The maximum effect from tank-top fires are shown in Figure 5-19 a high wind speed of 9 m/s conditions. For clarity, only one tank shows the impacts from all directions, represented by dashed lines.

The thermal-radiation isopleths from a single tank-top fire, representing the largest tank, are shown in the 1% fatality, represented by the 10 kW/m^2 thermal radiation isopleth, remains within the site boundary. As no external consequences from this scenario are expected, no further analysis would be required.

LEGEND **THERMAL RADIATION (kW/m^2)**

(blue)	4
(magenta)	10
(red)	35

Figure 5-19: Thermal radiation from tank-top fires for the first phase of BTG storage

5.3.3.4 Flash fires

A flash fire would extend to the lower flammable limit (LFL) but could extend beyond this limit, due to the formation of pockets. It is assumed that unprotected people within the flash fire would experience lethal injuries while people outside of the flash fire would remain unharmed.

Flash fires from large bund spillages of petrol at the storage tanks. would be expected to remain within the bunded areas.

Flash fires would remain on site and would only pose a threat to workers in the immediate vicinity. As flash fires would not extend beyond the site boundary, no further action would be required. It is recommended that under emergency conditions, people should be evacuated well beyond the LFL.

It should be noted that the flashpoint of diesel, paraffin and Jet -A1 are sufficiently high to preclude flash fires.

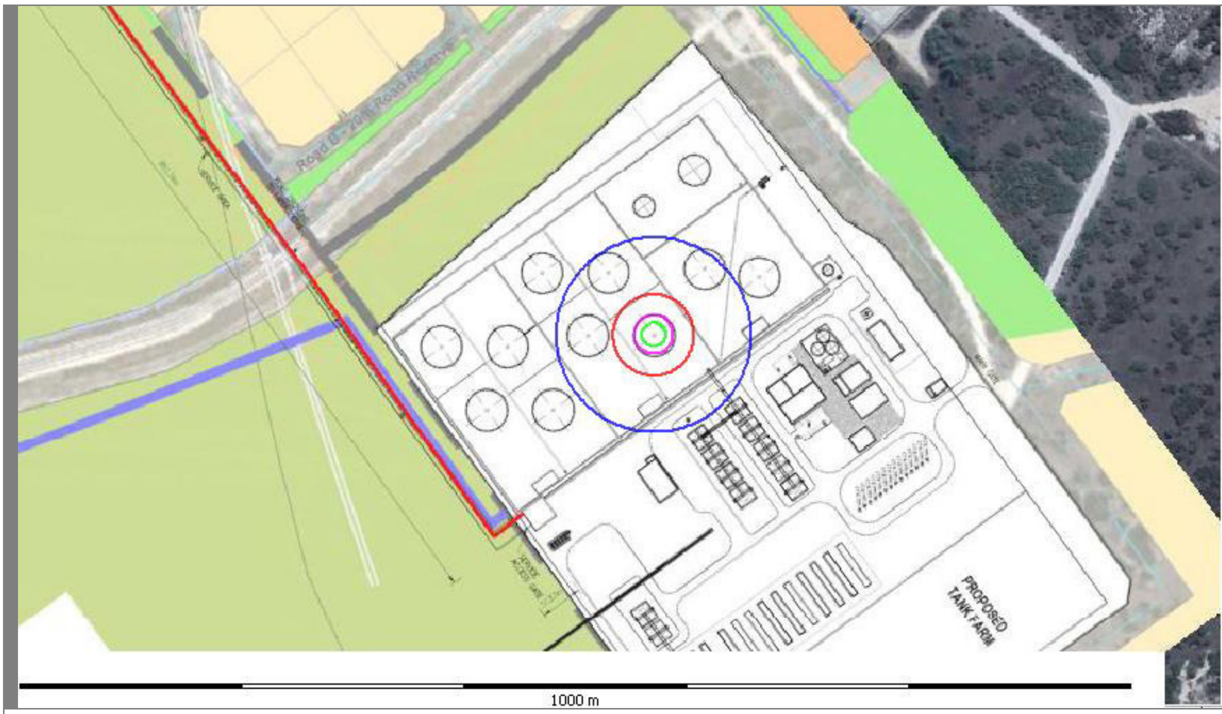
5.3.3.5 Tank explosions

Petrol tanks would have internal floating roofs eliminating the formation of a flammable cloud above the liquid level. However, the floating roof rests on legs approximately 1.8 m above the base of the tank. Thus, under certain conditions when the tank is almost empty flammable vapours can occupy the space below the floating roof. The mass used in the explosion calculations is the volume of flammable material at its lower flammability limit.

The blast overpressures from a fixed-roof explosion at a single petrol storage tank for Phase 1 is shown in Figure 5-20.

As the 0.1 bar overpressure isopleth, representing the 1% fatality and partial damage to buildings, does not extend beyond the site boundary, there would be no off-site consequences from fixed-tank explosions.

The 0.7 bar overpressure isopleth indicates total destruction of equipment, and the 0.3 bar overpressure isopleth indicates severe damage to brick buildings. A large explosion may damage the storage tank as well as surrounding tanks with cascading effects.



LEGEND	(bar)	TANK EXPLOSION
Blue line	0.03	Glass breaks, minor injuries
Red line	0.1	1% fatality, some walls destroyed
Magenta line	0.3	100% fatality, major structural damage
Green line	0.7	Almost total destruction

Figure 5-20: Blast overpressures for a single fixed-roof tank explosion at the first phase of BTG storage

5.3.3.6 Vapour cloud explosions (VCEs)

The expected blast overpressures from a large release of petrol from the storage tanks, would remain within the bunded area. Thus, bund blast impacts would remain on site without potential injuries to the public.

5.3.3.7 Boiling liquid expanding vapour explosions (BLEVEs)

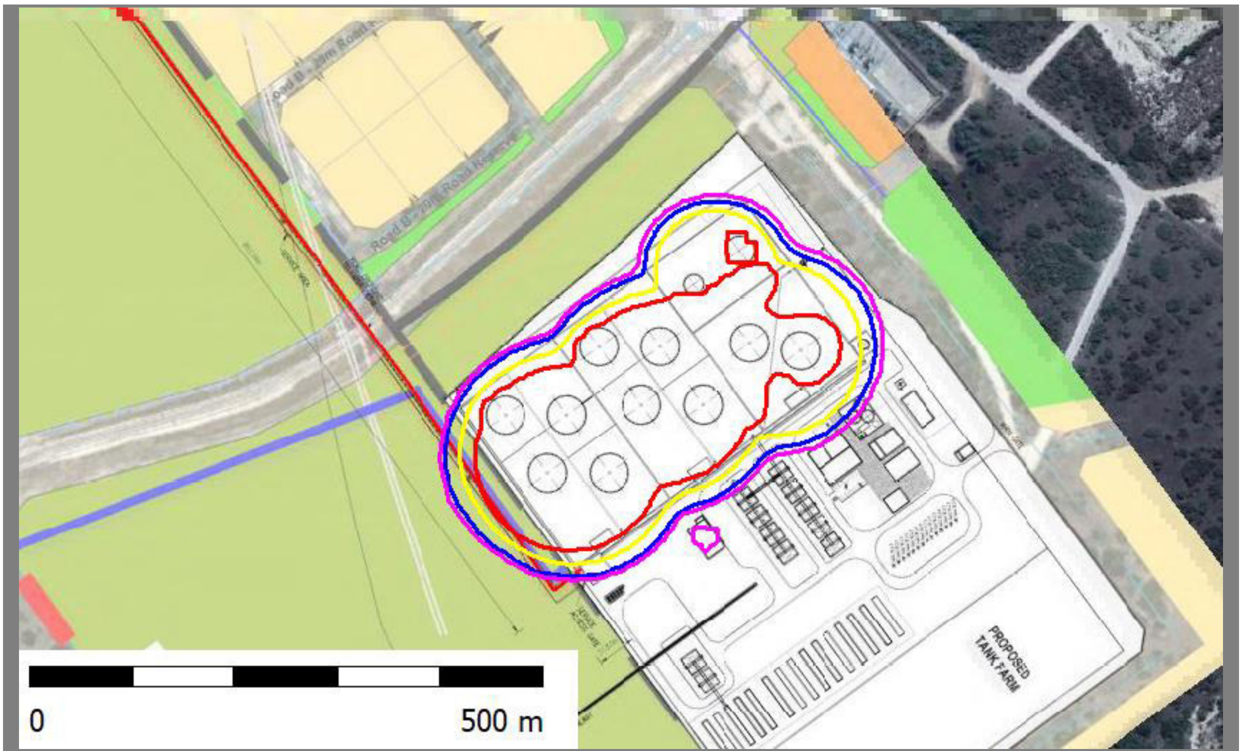
A boiling liquid expanding vapour explosion (BLEVE) could occur if a flame impinges on a petrol road or rail tanker, particularly in the vapour space region where cooling by evaporation of the contained petrol does not occur.

However, the process description provided indicated that spillages at the road gantry would be directed to the sump, making BLEVEs of road and rail tankers an implausible scenario.

5.3.4 Maximum Individual Risk

Each vessel would have two level transmitters that would signal the level to the control system. At high level, an alarm would be activated in the control room for remedial action. At the high level, the independent switch will close the incoming valve. The level transmitters would be independent and would not suffer common mode failure. The failure rate of the level controllers has not been given, and thus the lowest SIL value of 2 (0.01 failure per annum) was assigned.

The risk isopleths for the tank farm after completion of all phases are indicated in Figure 5-21. The risk of $1x10^{-4}$fatalities per person per year is close in value to the risk of $3x10^{-7}$ fatalities per person per year, as the risk drops rapidly from the point of release. The risk of $1x10^{-4}$fatalities per person per year extends beyond the site boundary on the southern and eastern site boundaries but would not extend beyond the SEZ area. Thus, the risks to the public would be considered acceptable.



LEGEND **RISK**
(fatalities per person per year)

$1x10^{-4}$
$1x10^{-5}$
$1x10^{-6}$
$3x10^{-7}$

Figure 5-21: Risk isopleths after the final phase for of the bulk atmospheric storage

5.3.5 Reduction of Risks

From the simulations performed, a number of events have risks that extend beyond the point of release with potential to impact on future developments.

Mitigation that can be considered to reduce the risks to acceptable levels is listed in the following subsections. It should be emphasised that suggested mitigation is for consideration only. RISCOM does not imply that the suggested mitigation must be implemented or that any suggested mitigation is the only measure to reduce risks. Implementation of mitigation should always be done in accordance with recognised engineering practices, using applicable codes and standards. Implementation of some or all of the mitigation would not guarantee full compliance with the Major Hazard Installation Regulations.

Mitigation for consideration is included in the following subsections.

5.3.6 Risk Ranking

This risk assessment considered numerous scenarios for the bulk atmospheric storage that could result in fires and explosions on the site. Some of these scenarios have more serious consequences than other scenarios. The scenarios of particular interest are those with high risk frequencies extending beyond the boundaries of the site.

Risk reduction starts with the identification of the scenarios with the highest contribution to the overall risk, after which BTG can determine appropriate mitigation.

The overriding contribution to the risk profile is the overfilling scenario followed by an ignition.

5.3.6.1 Codes and Standards

It has been indicated that the applicable standard for the design would be SANS 10089. This is an acceptable standard and full compliance with this standard would be expected. Full compliance with SANS 10108, covering the types of electrical instrumentation required for a process in order to reduce ignition sources, would also be mandatory.

- **Safety Instrumented Systems**

IEC 61508/11 (Safety Instrumented Systems) are codes specifically related to the instrumentation requirements to ensure adequate protection from the hazards in chemical plants and is applicable to the *life cycle* of the plant. These codes are aimed at reducing to acceptable levels risks to surrounding populations.

The significance of the code is that designs would be evaluated against the criteria of the code and instrumentation with specific failure rates would be specified as well as minimum periods of checking. Thus, the selection of instrumentation is not based on price alone. Further to this, instrumentation cannot be reduced or changed without reviewing the code. The specification of this code implies that designs presented at EIA and MHI evaluations cannot be altered at construction for the sole function of reducing costs. Moreover, the code ensures that the plant would continue to maintain the safety functions for the *life cycle* of the plant, retaining a safe working environment for both workers and the public.

The European standards body (CENELEC) has adopted this standard as EN 61511. This means that in each of the member states of the European Union, the standard is published as a national standard. For example, in Great Britain, it is published by the national standards body as BS EN 61511. The content of these national publications is identical to that of IEC 61511. However, kindly note that the code is not harmonized under any directive of the European Commission.

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Demonstrating compliance with the IEC 61508/11 can be achieved only once full-detail designs have been completed, and it is thus premature at this stage in the project.

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Compliance with IEC 61508 and IEC 61511 (or ANSI/ISA 84.00.01-2004) would be a requirement in many countries around the world to achieve an acceptable risk to workers and public.

Demonstrating compliance with the IEC 61508/11 can be achieved only once full-detail designs have been completed, and it is thus premature at this stage in the project.

It should be noted that RISCOM would recommend compliance with the IEC 61508/11.

- **Buncefield Recommendations**

Due to the similarity of the BTG depot in the Coega SEZ to the terminal involved in the Buncefield incident, the recommendations from the Buncefield report are listed in Appendix E and should be applied to the BTG facility where applicable.

5.4 Consolidated Risks

The risks of fires and explosion from Phase 1 would be extremely low due to the high flash point of the CBO/HFO. The risks from fires and explosions for Phase 1 of the project would be trivial.

The consolidated risk is combined from the MIRs described in the previous subsections, for the completed BTG tank farm is shown in Figure 5-22. The risk of 1×10^{-4} fatalities per person per year isopleth (generally considered the upper limit of tolerable) remains within the Coega SEZ area and does not enter areas used by the general public.

Similarly, the risk of 1×10^{-6} fatalities per person per year isopleth, representing the lower limit of tolerable, does not extend into areas used by the general public. Risks less than 3×10^{-7} fatalities per person per year would be considered trivial and acceptable for land use by vulnerable populations, such as hospitals, nursery schools, retirement homes, etc.

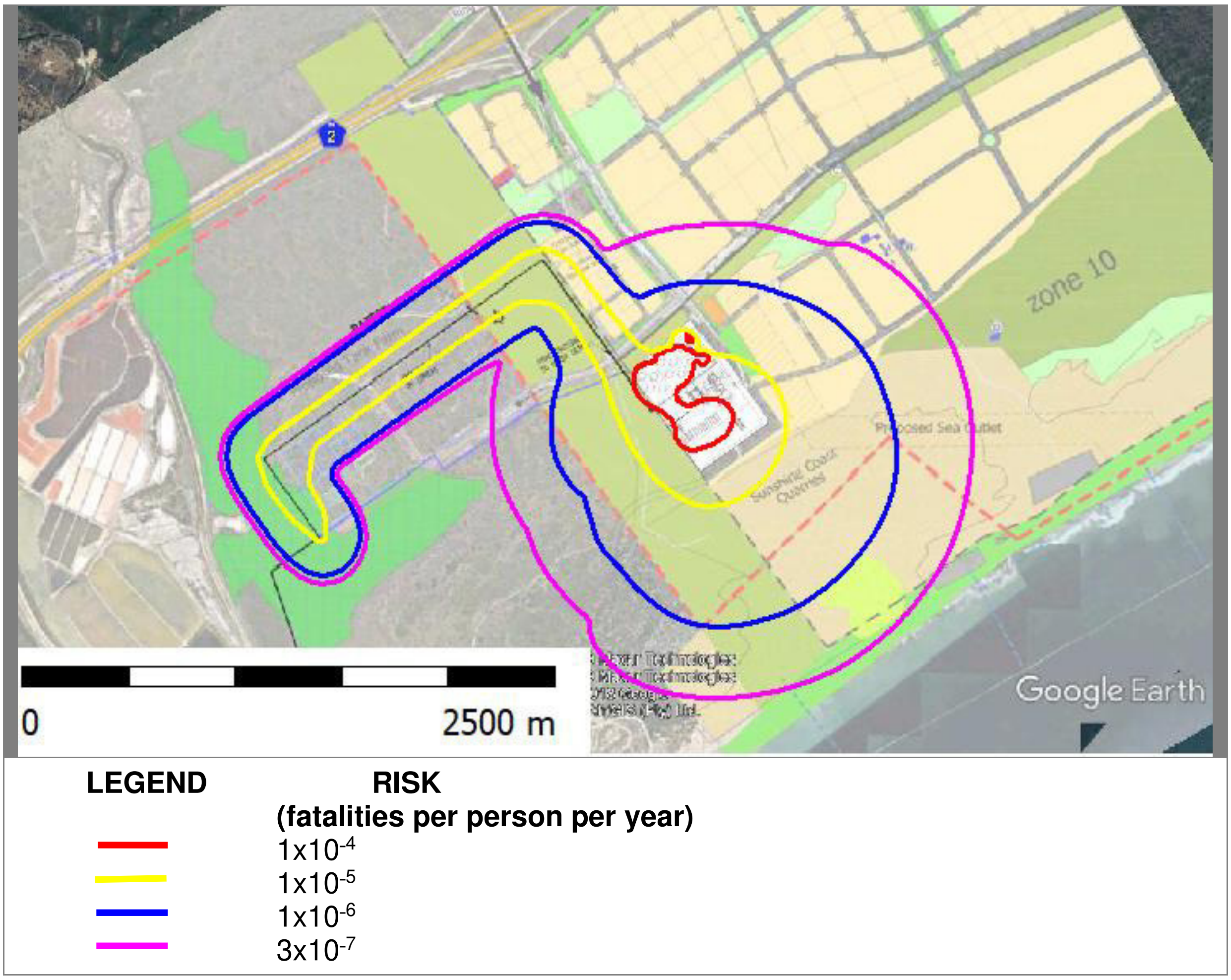

Figure 5-22: Combined risks after completion of all the phases of the BTG project

5.5 Assessment Rating of Potential Impacts

The assessment rating of potential impacts, shown in was done according to the methodology given in Section4.6. The methodology for assessing the potential impacts is qualitative and subjective with time frames of less than 20 years and without benchmarking to acceptable criteria. In comparison, this report is quantitative where probabilities are calculated to 1 in 10 000 years and lower; the risk isopleths have been calculated and presented. Therefore, the assessment of the potential impacts using qualitative analysis is not compatible with quantitative risk assessment and the assessment rating was completed for EIA compliance only.

The accuracy of the study is dependent on the accuracy of the information presented. Furthermore, this is not the final design, and changes could be made with the application of mitigation. However, major changes are not expected, giving a good confidence of accuracy. The methodology used to determine the impacts is based on international standards and could be reproduced by other parties using similar inputs.

Table 5-2: Classification of impacts for assessment of the BTG terminal in Coega

	IMPACTS				CONSEQUENCE			PROBABILITY	Significance (WOM) (A+B+C x P)	Confidence	MITIGATION		Significance (WM)	DEGREE	
	Type	Description	Cumulative	Nature	Extent (A)	Duration (B)	Intensity (C)	Probability (P)			Implementation of Management Measures	Mitigation Effectiveness		Loss of Resources	Reversibility
OPERATIONAL PHASE															
Plant Risk Assessment	Direct	Loss of containment of liquid materials from transportation pipelines - fires and explosions	No	Negative	Local	Permanent	Medium	Improbable	Medium	High	Correct designs to standards and codes	Good	Low	Partial	Irreversible
	Direct	Loss of containment of liquid materials from transportation pipelines - environmental	No	Negative	Local	Short term	Medium	Improbable	Medium	High	Correct designs to standards and codes	Good	Low	Partial	Reversable
	Direct	Loss of containment of liquid materials from tank farm and gantries - fires and explosions	No	Negative	Local	Permanent	Medium	Improbable	Medium	High	Correct designs to standards and codes	Good	Low	Partial	Irreversible
	Direct	Loss of containment of LPG materials from transportation pipelines - fires and explosions	No	Negative	Local	Permanent	Medium	Improbable	Medium	High	Correct designs to standards and codes	Good	Low	Partial	Irreversible
	Direct	Loss of containment of LPG materials from tank farm and gantries - fires and explosions	No	Negative	Local	Permanent	Medium	Improbable	Medium	High	Correct designs to standards and codes	Good	Low	Partial	Irreversible

6 CONCLUSIONS

Risk calculations are not precise. Accuracy of predictions is determined by the quality of base data and expert judgements.

This risk assessment included the consequences of fires and explosions at the BTG facility in the Coega SEZ. A number of well-known sources of incident data were consulted and applied to determine the likelihood of an incident to occur.

This risk assessment was performed with the assumption that the site would be maintained to an acceptable level and that all statutory regulations would be applied. It was also assumed that the detailed engineering designs would be done by competent people and would be correctly specified for the intended duty. For example, it was assumed that tank wall thicknesses have been correctly calculated, that vents have been sized for emergency conditions, that instrumentation and electrical components comply with the specified electrical area classification, that material of construction is compatible with the products, etc.

It is the responsibility of the owners and their contractors to ensure that all engineering designs would have been completed by competent persons and that all pieces of equipment would have been installed correctly. All designs should be in full compliance with (but not limited to) the Occupational Health and Safety Act 85 of 1993 and its regulations, the National Buildings Regulations and the Buildings Standards Act 107 of 1977 as well as local bylaws.

A number of incident scenarios were simulated, taking into account the prevailing meteorological conditions, and described in the report.

6.1 Notifiable Substances

The General Machinery Regulation 8 and its Schedule A on notifiable substances requires any employer who has a substance equal to or exceeding the quantity listed in the regulation to notify the divisional director. A site is classified as a Major Hazard Installation if it contains one or more notifiable substances or if the off-site risk is sufficiently high. The latter can only be determined from a quantitative risk assessment.

As more than 25 t of LPG would be stored in a single vessel, the LPG storage would be classified as a notifiable substance and automatically the facility would be classified as a Major Hazard Installation.

6.2 Transportation Pipeline

Four product pipelines would be provided to transport the products from the common import line to the terminal. The four pipelines would include:

- Dedicated HFO/CBO pipeline
- Dedicated LPG pipeline
- Two multi product (MPP) pipelines

The tie-in point will be located approximately 2.5 km from the terminal and travel above ground, with potential below ground section for the road crossing. Two alternative pipeline routings were reviewed, one to the north of the OTGC facility and the other along the road servitude.

A loss of containment of the lines containing liquids would result in the formation of a flammable pools, which if ignited would form pool fires. The consequences from these pool fire would be localised and could impact direct facilities bordering the pipeline servitude.

A loss of containment from a pressurised LPG pipeline could result in large jet fires. Again, under such circumstances, the impacts would be localised affecting companies bordering the pipeline.

Impacts from major incidents resulting from a loss of containment of transportation pipelines would remain with the Coega SEZ and would not extend into residential areas. Providing there is adequate protection from vehicle impacts, both routes would have similar risks and would be acceptable to the general public outside of the Coega SEZ

6.3 LPG Storage and Road-Tanker Filling

LPG to be transported from the ship would initially be stored in five large storage vessels with the addition of ten more vessels at a later stage. The LPG would be loaded into road tankers at a dedicated bay and transported to customers.

The current designs of the LPG gas storage are conceptual, but would be in accordance to the SANS 10087 standard.

The effects of a major incident, including flash fires and vapour cloud explosions, from a loss of containment of LPG could extend some distance, but would remain within the Coega SEZ

The risks from the proposed BTG facility, at the end of Phase 2, could extend beyond the site boundary, but would not extend beyond the Coega SEZ facility and would not impact onto the general public

6.4 Bulk Atmospheric Storage Tank Farm and Road Gantry

Liquid fuels transported from the ship would be stored in eight atmospheric tanks with the potential of four more tanks at a later stage. The fuels would be loaded into road tankers that will be transported offsite to end users.

The current designs are conceptual. They state that the vessels would be compliant to the applicable petroleum storage standard of SANS 10089 with the low flash point ULP tanks of having internal floating roofs.

Phase 1 of the project, consisting of the construction of the CGO/HFO storage tanks and associated pipeline and infrastructure, would have a minimal risk footprint, due to the high flash point of the CBO/HFO

The risks after completion of all phases of the project, could extend a short distance beyond the site boundary, but would not extend beyond the Coega SEZ.

6.5 Impacts onto Neighbouring Properties, Residential Areas and Major Hazard Installations

Large LPG jet fires, flash fires, vapour cloud explosions and boiling liquid expanding vapour explosions (BLEVEs) could extend to the beyond the proposed BTG facility, but would not extend beyond the Coega SEZ. Thus, the risks to the public, outside the Coega SEZ from such releases will be considered acceptable.

None of the neighbouring companies have identified themselves to BTG as being classified as a Major Hazard Installation.

6.6 Major Hazard Installation

It should be noted that Section 2 of the MHI regulations applies only if the risk posed by the installation poses a risk to both employees and the public. The definition of an employee under the OHS Act No. 85 of 1993 is that an employee receives remuneration and works under supervision. As all personnel entering the Coega ISE, do so at the access point and have business within the secured boundaries of the complex, such personnel would be considered employees under that definition.

The risk of $1x10^{-6}$ fatalities per person per year isopleth for modelled releases on site does not extend beyond the Coega SEZ. As the general public is located beyond the complex boundary, the proposed operations would not pose a risk to both employees and the public. However, due to the inventory capacities of the LPG to be stored on-site. LPG would-be classified as notifiable substance and will automatically classify the proposed bulk liquid storage facility as a Major Hazard Installation

This study is not intended to replace the Major Hazard Installation risk assessment which should be completed prior to construction of the BGT facility

7 RECOMMENDATIONS

As a result of the risk assessment study conducted for the proposed BTG facility (including the pipeline routing alternatives) in the Coega IDZ, a number of events were found to have risks beyond the BTG site boundary.

While the design presented is conceptual, RISCOM did not find any fatal flaws that would prevent the project proceeding to the detailed engineering phase of the project.

RISCOM would support the project with the following conditions:

- Compliance with all statutory requirements, i.e. National Building Regulations & Building Standards Act 103 of 1977, Pressure Equipment Regulations (PER);
- Compliance with applicable SANS codes, i.e. SANS 10087, SANS 10089, SANS 10108, SANS 347 etc.;
- Incorporation of a rational fire design, with approval from local authority;
- Demonstration that preventative measures are in place to prevent the above ground pipelines from being damaged from road vehicles;
- Demonstration that above ground pipelines are protected from vegetation fires below or near the pipelines and cannot be damaged or exceed the design ratings of the pipelines, under such circumstances;
- Demonstration that the pipelines will not exceed the design pressure when not in use, due to thermal expansion, or pressure surges (liquid hammer);
- LPG vessels to be mounded, or detailed justification provided for non-mounding vessels, with adequate mitigation provided to prevent a major incident;
- Incorporation of applicable guidelines or equivalent international recognised codes of good design and practice into the designs;
- Completion of a recognised process hazard analysis (such as a HAZOP study, FMEA, etc.) on the proposed facility prior to construction to ensure design and operational hazards have been identified and adequate mitigation put in place;
- Full compliance with IEC 61508 and IEC 61511 (Safety Instrument Systems) standards or equivalent to ensure that adequate protective instrumentation is included in the design and would remain valid for the full life cycle of the tank farm:
  - Including demonstration from the designer that sufficient and reliable instrumentation would be specified and installed at the facility;
- Preparation and issue of a safety document detailing safety and design features reducing the impacts from fires, explosions and flammable atmospheres to the MHI assessment body at the time of the MHI assessment:
  - Including compliance to statutory laws, applicable codes and standards and world's best practice;
  - Including the listing of statutory and non-statutory inspections, giving frequency of inspections;
  - Including the auditing of the built facility against the safety document;
  - Noting that codes such as IEC 61511 can be used to achieve these requirements;
- Demonstration by BTG or their contractor for the final designs would reduce the risks posed by the installation to internationally acceptable guidelines;
- Signature of all facility designs by a professional engineer registered in South Africa in accordance with the Professional Engineers Act, who takes responsibility for suitable designs;

- Completion of an emergency preparedness and response document for on-site and off-site scenarios prior to initiating the MHI risk assessment (with input from local authorities);
- Permission not being granted for increases to the product list or product inventories without redoing part of or the full EIA;
- Final acceptance of the facility risks with an MHI risk assessment that must be completed in accordance to the MHI regulations:
  - Basing such a risk assessment on the final design and including engineering mitigation.

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9 ABBREVIATIONS AND ACRONYMS

AIA	See **Approved Inspection Authority**
ALARP	The UK Health and Safety Executive (HSE) developed the risk **ALARP** triangle, in an attempt to account for risks in a manner similar to those used in everyday life. This involved deciding: • Whether a risk is so high that something must be done about it; • Whether the risk is or has been made so small that no further precautions are necessary; • Whether a risk falls between these two states and has been reduced to levels '**as low as reasonably practicable'** (ALARP). Reasonable practicability involves weighing a risk against the trouble, time and money needed to control it.
Approved Inspection Authority	An **approved inspection authority** (AIA) is defined in the Major Hazard Installation regulations (July 2001)
Asphyxiant	An **asphyxiant** is a gas that is nontoxic but may be fatal if it accumulates in a confined space and is breathed at high concentrations since it replaces oxygen containing air.
Blast Overpressure	**Blast overpressure** is a measure used in the multi-energy method to indicate the strength of the blast, indicated by a number ranging from 1 (for very low strengths) up to 10 (for detonative strength).
BLEVE	**Boiling liquid expanding vapour explosions** result from the sudden failure of a vessel containing liquid at a temperature above its boiling point. A **BLEVE** of flammables results in a large fireball.
BTG	**Bay Terminal Group**
CBO	**Carbon Black Oil**
Deflagration	**Deflagration** is a chemical reaction of a substance, in which the reaction front advances into the unreacted substance at less than sonic velocity.
Detonation	**Detonation** is a release of energy caused by extremely rapid chemical reaction of a substance, in which the reaction front of a substance is determined by compression beyond the auto-ignition temperature.
Emergency Plan	An **emergency plan** is a plan in writing that describes how potential incidents identified at the installation together with their consequences should be dealt with, both on site and off site.
Explosion	An **explosion** is a release of energy that causes a pressure discontinuity or blast wave.
Flammable Limits	**Flammable limits** are a range of gas or vapour concentrations in the air that will burn or explode if a flame or other ignition source is present. The lower point of the range is called the lower flammable limit (LFL). Likewise, the upper point of the range is called the upper flammable limit (UFL).
Flammable Liquid	The Occupational Health and Safety Act 85 of 1993 defines a **flammable liquid** as any liquid which produces a vapour that forms an explosive mixture with air and includes any liquid with a closed cup flashpoint of less than 55°C. Flammable products have been classified according to their flashpoints and boiling points, which ultimately determine the propensity to ignite. Separation distances described in the various codes are dependent on the flammability classification.

	Class **Description** 0 Liquefied petroleum gas (LPG) IA Liquids that have a closed cup flashpoint of below 23°C and a boiling point below 35°C IB Liquids that have a closed cup flashpoint of below 23°C and a boiling point of 35°C or above IC Liquids that have a closed cup flashpoint of 23°C and above but below 38°C II Liquids that have a closed cup flashpoint of 38°C and above but below 60.5°C IIA Liquids that have a closed cup flashpoint of 60.5°C and above but below 93°C
Flash Fire	A **flash fire** is defined as combustion of a flammable vapour and air mixture in which the flame passes through the mixture at a rate less than sonic velocity so that negligible damaging overpressure is generated.
Frequency	**Frequency** is the number of times an outcome is expected to occur in a given period of time.
HFO	**Heavy Furnace Oil**
IDZ	**Industrial development Zone**
Ignition Source	An **ignition source** is a source of temperature and energy sufficient to initiate combustion.
Individual Risk	**Individual risk** is the probability that in one year a person will become a victim of an accident if the person remains permanently and unprotected in a certain location. Often the probability of occurrence in one year is replaced by the frequency of occurrence per year.
Isopleth	See **Risk Isopleth**
Jet	A **jet** is the outflow of material emerging from an orifice with significant momentum.
Jet Fire or Flame	A **jet fire or flame** is combusting material emerging from an orifice with a significant momentum.
LFL	**Lower Flammable Limit** see Flammable Limits
LOC	See **Loss of Containment**
Local Government	**Local government** is defined in Section 1 of the Local Government Transition Act, 1993 (Act No. 209 of 1993).
Loss of Containment	**Loss of containment** (LOC) is the event resulting in a release of material into the atmosphere.
Major Hazard Installation	**Major Hazard Installation** (MHI) means an installation: • Where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily; • Where any substance is produced, used, handled or stored in such a form and quantity that it has the potential to cause a major incident (the potential of which will be determined by the risk assessment).
Major Incident	A **major incident** is an occurrence of catastrophic proportions, resulting from the use of plant or machinery or from activities at a workplace. When the outcome of a risk assessment indicates that there is a possibility that the public will be involved in an incident, then the incident is catastrophic.
Material Safety	According to ISO-11014, a **material safety data sheet** (MSDS) is a

Data Sheet	document that contains information on the potential health effects of exposure to chemicals or other potentially dangerous substances and on safe working procedures when handling chemical products. It is an essential starting point for the development of a complete health and safety program. It contains hazard evaluations on the use, storage, handling and emergency procedures related to that material. An MSDS contains much more information about the material than the label and it is prepared by the supplier. It is intended to tell what the hazards of the product are, how to use the product safely, what to expect if the recommendations are not followed, what to do if accidents occur, how to recognize symptoms of overexposure and what to do if such incidents occur.
MHI	See **Major Hazard Installation**
MIR	**Maximum Individual Risk** (see Individual Risk)
MSDS	See **Material Safety Data Sheet**
OHS Act	**Occupational Health and Safety Act**, 1993 (Act No. 85 of 1993)
PAC	See **Protective Action Criteria**
PADHI	**PADHI** (**planning advice for developments near hazardous installations**) is the name given to a methodology and software decision support tool developed and used in the HSE. It is used to give land-use planning (LUP) advice on proposed developments near hazardous installations. PADHI uses two inputs into a decision matrix to generate either an ‘advise against’ or ‘don’t advise against’ response: • The zone in which the development is located of the three zones that HSE sets around the major hazard: o The inner zone (> $1x10^{-5}$ fatalities per person per year); o The middle zone ($1x10^{-5}$ fatalities per person per year to $1x10^{-6}$ fatalities per person per year); o The outer zone ($1x10^{-6}$ fatalities per person per year to $3x10^{-7}$ fatalities per person per year); • The ‘sensitivity level’ of the proposed development which is derived from an HSE categorisation system of ‘development types’ (see the ‘development type tables’ in Appendix C).
QRA	See **Quantitative Risk Assessment**
Quantitative Risk Assessment	A **quantitative risk assessment** is the process of hazard identification, followed by a numerical evaluation of effects of incidents, both consequences and probabilities and their combination into the overall measure of risk.
Risk	**Risk** is the measure of the consequence of a hazard and the frequency at which it is likely to occur. Risk is expressed mathematically as: **Risk = Consequence x Frequency of Occurrence**
Risk Assessment	**Risk assessment** is the process of collecting, organising, analysing, interpreting, communicating and implementing information in order to identify the probable frequency, magnitude and nature of any major incident which could occur at a major hazard installation and the measures required to remove, reduce or control potential causes of such an incident.
Risk Contour	See **Risk Isopleth**
Societal Risk	**Societal risk** is risk posed on a societal group who are exposed to a

	hazardous activity.
Temporary Installation	A **temporary installation** is an installation that can travel independently between planned points of departure and arrival for the purpose of transporting any substance and which is only deemed to be an installation at the points of departure and arrival, respectively.
UFL	**Upper Flammable Limit** (see Flammable Limits)
ULP	**Unleaded petrol**
Vapour Cloud Explosion	A **vapour cloud explosion** (VCE) results from ignition of a premixed cloud of a flammable vapour, gas or spray with air, in which flames accelerate to sufficiently high velocities to produce significant overpressure.
VCE	See **Vapour Cloud Explosion**

10 APPENDIX A: REQUIREMENT FROM APPENDIX 6 OF GN 982 OF 4 DECEMBER 2014

10.1 Checklist of EIA requirements

Requirement from Appendix 6 of GN 982 of 4 December 2014 [as amended]	Reference in report
(a) Details of - (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae	 Front cover Appendix A
(b) Declaration that the specialist is independent in a form as may be specified by the competent authority	Appendix A
(c) Indication of the scope of, and the purpose for which, the report was prepared	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	No Existing impacts Cumulative impacts see Section 5.4
(d) The duration date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 2.2
(e) Description of the methodology adopted in preparing the report or carrying out the specialised process, inclusive of equipment and modelling used.	Section 4
(f) Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives.	Section 5
(g) Identification of any areas to be avoided, including buffers	Section 5
(h) Map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 5
(I) Description of any assumptions made and any uncertainties or gaps in knowledge	Section 1.6
(j) Description of the findings and potential implications of such findings on the impact of the proposed activity or activities.	Section 5
(k) Mitigation measures for inclusion in the EMPr	N/A
(l) Conditions for inclusion in the environmental authorisation	Section 7
(m) Monitoring requirements for inclusion in the EMPr or environmental authorisation	N/A
(n) Reasoned opinion - (i) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (ii)if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 7
(o) Description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(q) Any other information requested by the competent authority	N/A

10.2 Specialist Declaration

10.3 Specialist Details

10.3.1 Curriculum Vitae

10.3.2 Professional Body Registration

10.3.3 Other Registrations

labour

Department:
Labour
REPUBLIC OF SOUTH AFRICA

National Department of Labour
Republic of South Africa

APPROVED INSPECTION AUTHORITY

Registered in accordance with the provisions of the Occupational Health and Safety Act, Act 85 of 1993, as amended and the Major Hazard Installation Regulations.

This is to certify that:

RISCOM (PTY) LTD

has been registered by the Department of Labour as an Approved Inspection Authority: Type A, to conduct Major Hazard Installation Risk Assessment, in terms of Regulation 5(5)(a), of the Major Hazard Installation Regulations.

CONDITIONS OF REGISTRATION:

- The AIA must at all time comply with the requirements of the Occupational Health and Safety Act, Act 85 of 1993, as amended.
- This registration certificate is not transferable.
- This registration will lapse if there is a name change of the AIA or change in ownership.

CHIEF INSPECTOR

Valid from: **27 May 2017**
Expires: **26 May 2021**
Certificate Number: **CI MHI 0005**

sanas
South African National Accreditation System

CERTIFICATE OF ACCREDITATION

In terms of section 22(2)(b) of the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, 2006 (Act 19 of 2006), read with sections 23(1), (2) and (3) of the said Act, I hereby certify that:-

RISCOM (PTY) LTD
Co. Reg. No.: 2002/019697/07
JOHANNESBURG

Facility Accreditation Number: **MHI0013**

is a South African National Accreditation System accredited Inspection Body to undertake **TYPE A** inspection provided that all SANAS conditions and requirements are complied with

This certificate is valid as per the scope as stated in the accompanying schedule of accreditation, Annexure "A", bearing the above accreditation number for

THE ASSESSMENT OF RISK ON MAJOR HAZARD INSTALLATIONS

The facility is accredited in accordance with the recognised International Standard

ISO/IEC 17020:2012

The accreditation demonstrates technical competency for a defined scope and the operation of a management system

While this certificate remains valid, the Accredited Facility named above is authorised to use the relevant SANAS accreditation symbol to issue facility reports and/or certificates

Mr R Josias
Chief Executive Officer

Effective Date: 27 May 2017
Certificate Expires: 26 May 2021

This certificate does not on its own confer authority to act as an Approved Inspection Authority as contemplated in the Major Hazard Installation Regulations. Approval to inspect within the regulatory domain is granted by the Department of Labour.

ANNEXURE A

SCHEDULE OF ACCREDITATION

Facility Number: MHI0013

TYPE A

Permanent Address: Riscom (Pty) Ltd 33 Brigish Dr Northcliff Johannesburg 2195 Tel: (011) 431-2198 Fax: 086 624 9423 Mobile: 082 457 3258 E-mail: mike@riscom.co.za	**Postal Address:** P O Box 2541 Cresta Johannesburg 2118 Issue No.: 12 Date of issue: 28 February 2013 Expiry date: 26 May 2017	
Nominated Representative: Mr M Oberholzer	**Quality Manager:** Mr M Oberholzer **Technical Manager:** Mr M Oberholzer	**Technical Signatory:** Mr M Oberholzer
Field of Inspection	**Service Rendered**	**Codes and Regulations**
Regulatory: 1) Explosive chemicals 2) Gases: i) Flammable Gases ii) Non-flammable, non toxic gases (asphyxiants) iii) Toxic gases 3) Flammable liquids 4) Flammable solids, substances liable to spontaneous combustion, substances that on contact with water release flammable gases 5) Oxidizing substances and organic peroxides 6) Toxic liquids and solids	Specific Services: i) Frequency/ Probability Analysis ii) Consequence Modelling iii) Hazard Identification and Analysis including HAZARD and Operability studies (HAZOP) iv) Emergency planning reviews	Programmes, guidelines, regulations and codes: MHI regulation par. **5 (5) (b)** Reference Manual Bevi Risk Assessments version 3.2 (2009) CPR 18E (1999), Guideline for quantitative risk assessment ("Purple Book"), TNO Apeldoorn. CPR 14E (1997). Methods for the Calculation of Physical Effects ("Yellow Book"), 3rd Edition, TNO, Apeldoorn. CPR 16E (1992). Methods for the Determination of Possible Damage ("Green Book"), 1st Edition, TNO, Apeldoorn. Lees FP (2001). Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control, 2nd Edition, Butterworths, London, UK.

Original date of accreditation: 27 May 2005

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ISSUED BY THE SOUTH AFRICAN NATIONAL ACCREDITATION SYSTEM

Field Manager

11 APPENDIX B: NOTIFICATION OF MAJOR HAZARD INSTALLATION

Prior to assessment of potential impacts of various accidental spills, reference needs to be made to the legislation, regulations and guidelines governing the operation of the development.

Section 1 of the Occupational Health and Safety Act (OHS Act; Act No. 85 of 1993) defines a "major hazard installation" to mean an installation:

" (a) *Where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily;*

(b) *Where any substance is produced, processed, used, handled or stored in such a form and quantity that it has the potential to cause a major incident (our emphasis).* "

It should be noted that if either (a) or (b) is satisfied, the Major Hazard Installation (MHI) regulations will apply. The prescribed quantity of a chemical can be found in Section 8(1) of the General Machinery Regulation 8 (our emphasis).

A major incident is defined as: "an occurrence of catastrophic proportions, resulting from the use of plant and machinery or from activities at a workplace". Catastrophic in this context means loss of life and limbs or severe injury to employees or members of the public, particularly those who are in the immediate vicinity (our emphasis).

It is important to note that the definition refers to an occurrence, whereas Section 1b) refers to potential to cause a major incident. If potential to cause a major incident exists, then the OHS Act and the Major Hazard Installation regulations will apply (our emphasis).

On the 16th of January 1998, the MHI regulations were promulgated under the OHS Act (Act No. 85 of 1993), with a further amendment on the 30th of July 2001. The provisions of the regulations apply to installations that have on their premises a certain quantity of a substance that can pose a significant risk to the health and safety of employees and the public.

The scope of application given in Section 2 of the MHI regulations is as follows:

" (1) *Subject to the provisions of Subregulation (3) these regulations shall apply to employers, self-employed persons and users, who have on their premises, either permanently or temporarily, a major hazard installation or a quantity of a substance which may pose a risk that could affect the health and safety of employees and the public (our emphasis);*

(2) *These regulations shall apply to local governments, with specific reference to Regulation 9.* "

It is important to note that the regulations refer to a substance, and furthermore the regulations are applicable to risks posed by the substance and **NOT** merely the potential consequences (our emphasis).

The regulations essentially consist of six parts, namely:

1. Duties for notification of a Major Hazard Installation (existing or proposed), including:
    a. Fixed (see List 1);
    b. Temporary installations;
2. Minimum requirements for a quantitative risk assessment (see List 2);
3. Requirements of an on-site emergency plan (see List 3);
4. Reporting steps of risk and emergency occurrences (see List 4);
5. General duties required of suppliers;
6. General duties required of local government.

Notification of installation (List 1) indicates that:

- Applications need to be made in writing to the relevant local authority and the provincial director for permission:
    - To erect any Major Hazard Installation;
    - Prior to the modification of any existing installation that may significantly increase risk related to it (e.g. an increase in storage or production capacity or alteration of a process);
- Applications need to include the following information:
    - The physical address of installation;
    - Complete material safety data sheets of all hazardous substances;
    - The maximum quantity of each substance envisaged to be on premises at any one time;
    - The risk assessment of the installation (see List 2);
    - Any further information that may be deemed necessary by an inspector in interests of health and safety to the public;
- Applications need to be advertised in at least one newspaper serving the surrounding communities and by way of notices posted within these communities.

The risk assessment (List 2):

- Is the process of collecting, organising, analysing, interpreting, communicating and implementing information in order to identify the probable frequency, magnitude and nature of any major incident which could occur at a Major Hazard Installation and measures required to remove, reduce or control the potential causes of such an incident;
- Needs to be undertaken at intervals not exceeding 5 years and needs to be submitted to the relevant local emergency services;
- Must be made available in copies to the relevant health and safety committee, with 60 days given to comment thereon and the results of the assessment made available to any relevant representative or committee to comment thereon;
- Should be undertaken by competent person(s) and include the following:
  - A general process description;
  - A description of major incidents associated with this type of installation and consequences of such incidents (including potential incidents);
  - An estimation of the probability of a major incident;
  - The on-site emergency plan;
  - An estimation of the total result in the case of an explosion;
  - An estimation of the effects of thermal radiation in the case of fire;
  - An estimation of concentration effects in the case of a toxic release;
  - Potential effects of a major incident on an adjacent major hazard installation or part thereof;
  - Potential effects of a major incident on any other installation, members of the public (including all persons outside the premises) and on residential areas;
  - Meteorological tendencies;
  - Suitability of existing emergency procedures for risks identified;
  - Any requirements laid down in terms of the Environmental Conservation Act of 1989 (Act No. 73 of 1989);
  - Any organisational measures that may be required;
- The employer shall ensure that the risk assessment is of an acceptable standard and shall be reviewed should:
  - It be suspected that the preceding assessment is no longer valid;
  - Changes in the process that affect hazardous substances;
  - Changes in the process that involve a substance that resulted in the installation being classified a Major Hazard Installation or in the methods, equipment or procedures for the use, handling or processing of that substance;
  - Incidents that have brought the emergency plan into operation and may affect the existing risk assessment;
- Must be made available at a time and place and in a manner agreed upon between parties for scrutiny by any interested person that may be affected by the activities.

Requirements related to the on-site emergency plan (List 3) are:

- After submission of the notification, the following shall be established:
  - An on-site emergency plan must be made available and must be followed inside the premises of the installation or the part of the installation classified as a Major Hazard Installation, in consultation with the relevant health and safety representative or committee;
  - The on-site emergency plan must be discussed with the relevant local government, taking into consideration any comment on the risk related to the health and safety of the public;
  - The on-site emergency plan must be reviewed and where necessary updated, in consultation with the relevant local government, at least once every three years;
  - A copy of the on-site emergency plan must be signed in the presence of two witnesses, who shall attest the signature;
  - The on-site emergency plan must be readily available at all times for implementation and use;
  - All employees must be conversant with the on-site emergency plan;
  - The on-site emergency plan must be tested in practice at least once a year, and a record must be kept of such testing;
- Any employer, self-employed person and user owning or in control of a pipeline that could pose a threat to the general public shall inform the relevant local government and shall be jointly responsible with the relevant local government for establishment and implementation of an on-site emergency plan.

In reporting of risk and emergency occurrences (List 4):

- Following an emergency occurrence, the user of the installation shall:
  - Subject to the provisions of Regulation 6 of the General Administrative Regulations, within 48 hours by means of telephone, facsimile or similar means of communication, inform the chief inspector, the provincial director and relevant local government of the occurrence of a major incident or an incident that brought the emergency plan into operation or any near miss;
  - Submit a report in writing to the chief inspector, provincial director and local government within seven days;
  - Investigate and record all near misses in a register kept on the premises, which shall at all times be available for inspection by an inspector and local government representatives.

The duties of the supplier refer specifically to:

- Supplying of material safety data sheets for hazardous substances employed or contemplated at the installation;
- Assessment of the circumstances and substance involved in an incident or potential incident and the informing all persons being supplied with that substance of the potential dangers surrounding it;
- Provision of a service that shall be readily available on a 24-hour basis to all employers, self-employed persons, users, relevant local government and any other body concerned to provide information and advice in the case of a major incident with regard to the substance supplied.

The duties of local government are summarised as follows:

" *9. (1) Without derogating from the provisions of the National Building Regulations and Building Standards Act of 1977 (Act No. 103 of 1977), no local government shall permit the erection of a new major hazard installation at a separation distance less than that which poses a risk to:*

(a) Airports;

(b) Neighbouring independent major hazard installations;

(c) Housing and other centres of population; or,

(d) Any other similar facility…

Provided that the local government shall permit new property development only where there is a separation distance which will not pose a <u>*risk*</u> *(our emphasis) in terms of the risk assessment: Provided further that the local government shall prevent any development adjacent to an installation that will result in that installation being declared a major hazard installation.*

(2) Where a local government does not have facilities available to control a major incident or to comply with the requirements of this regulation that local government shall make prior arrangements with a neighbouring local government, relevant provincial government or the employer, self-employed person and user for assistance…

(3) All off-site emergency plans to be followed outside the premises of the installation or part of the installation classified as a major hazard installation shall be the responsibility of the local government… "

12 APPENDIX C: PADHI LAND-PLANNING TABLES

12.1 Development Type Table 1: People at Work, Parking

Development Type	Examples	Development Detail and Size	Justification
DT1.1 Workplaces	Offices, factories, warehouses, haulage depots, farm buildings, nonretail markets, builder's yards	Workplaces (predominantly nonretail), providing for less than 100 occupants in each building and less than 3 occupied storeys (Level 1)	Places where the occupants will be fit and healthy and could be organised easily for emergency action Members of the public will not be present or will be present in very small numbers and for a short time
		Exclusions	
		DT1.1 x1 Workplaces (predominantly nonretail) providing for 100 or more occupants in any building or 3 or more occupied storeys in height (Level 2 except where the development is at the major hazard site itself, where it remains Level 1)	Substantial increase in numbers at risk with no direct benefit from exposure to the risk
	Sheltered workshops, Remploy	DT1.1 x2 Workplaces (predominantly nonretail) specifically for people with disabilities (Level 3)	Those at risk may be especially vulnerable to injury from hazardous events or they may not be able to be organised easily for emergency action
DT1.2 Parking Areas	Car parks, truck parks, lockup garages	Parking areas with no other associated facilities (other than toilets; Level 1)	
		Exclusions	
	Car parks with picnic areas or at a retail or leisure development or serving a park and ride interchange	DT1.2 x1 Where parking areas are associated with other facilities and developments the sensitivity level and the decision will be based on the facility or development	

12.2 Development Type Table 2: Developments for Use by the General Public

Development Type	Examples	Development Detail and Size	Justification
DT2.1 Housing	Houses, flats, retirement flats or bungalows, residential caravans, mobile homes	Developments up to and including 30 dwelling units and at a density of no more than 40 per hectare (Level 2)	Development where people live or are temporarily resident It may be difficult to organise people in the event of an emergency
	Exclusions		
	Infill, back-land development	DT2.1 x1 Developments of 1 or 2 dwelling units (Level 1)	Minimal increase in numbers at risk
	Larger housing developments	DT2.1 x2 Larger developments for more than 30 dwelling units (Level 3)	Substantial increase in numbers at risk
		DT2.1 x3 Any developments (for more than 2 dwelling units) at a density of more than 40 dwelling units per hectare (Level 3)	High-density developments
DT2.2 Hotel or Hostel or Holiday Accommodation	Hotels, motels, guest houses, hostels, youth hostels, holiday camps, holiday homes, halls of residence, dormitories, accommodation centres, holiday caravan sites, camping sites	Accommodation up to 100 beds or 33 caravan or tent pitches (Level 2)	Development where people are temporarily resident It may be difficult to organise people in the event of an emergency
	Exclusions		
	Smaller: guest houses, hostels, youth hostels, holiday homes, halls of residence, dormitories, holiday caravan sites, camping sites	DT2.2 x1 Accommodation of less than 10 beds or 3 caravan or tent pitches (Level 1)	Minimal increase in numbers at risk
	Larger: hotels, motels, hostels, youth hostels, holiday camps, holiday homes, halls of residence, dormitories, holiday caravan sites, camping sites	DT2.2 x2 Accommodation of more than 100 beds or 33 caravan or tent pitches (Level 3)	Substantial increase in numbers at risk

Development Type	Examples	Development Detail and Size	Justification
DT2.3 Transport Links	Motorway, dual carriageway	Major transport links in their own right i.e. not as an integral part of other developments (Level 2)	Prime purpose is as a transport link Potentially large numbers exposed to risk but exposure of an individual is only for a short period
	Exclusions		
	Estate roads, access roads	DT2.3 x1 Single carriageway roads (Level 1)	Minimal numbers present and mostly a small period of time exposed to risk Associated with other development
	Any railway or tram track	DT2.3 x2 Railways (Level 1)	Transient population, small period of time exposed to risk Periods of time with no population present

Development Type	Examples	Development Detail and Size	Justification
DT2.4 Indoor Use by Public	Food and drink: restaurants, cafes, drive-through fast food, pubs Retail: shops, petrol filling station (total floor space based on shop area not forecourt), vehicle dealers (total floor space based on showroom or sales building not outside display areas), retail warehouses, super-stores, small shopping centres, markets, financial and professional services to the public Community and adult education: libraries, art galleries, museums, exhibition halls, day surgeries, health centres, religious buildings, community centres. adult education, 6th form college, college of FE Assembly and leisure: Coach or bus or railway stations, ferry terminals, airports, cinemas, concert or bingo or dance halls, conference centres, sports or leisure centres, sports halls, facilities associated with golf courses, flying clubs (e.g. changing rooms, club house), indoor go kart tracks	Developments for use by the general public where total floor space is from 250 m^2 up to 5000 m^2 (Level 2)	Developments where members of the public will be present (but not resident) Emergency action may be difficult to coordinate
	Exclusions		
		DT2.4 x1 Development with less than 250 m^2 total floor space (Level 1)	Minimal increase in numbers at risk
		DT2.4 x2 Development with more than 5000 m^2 total floor space (Level 3)	Substantial increase in numbers at risk
DT2.5 Outdoor Use by Public	Food and drink: food festivals, picnic areas Retail: outdoor markets, car boot sales, funfairs	Principally an outdoor development for use by the general public i.e. developments where	Developments where members of the public will be present (but

Development Type	Examples	Development Detail and Size	Justification
	Community and adult education: open-air theatres and exhibitions Assembly and leisure: coach or bus or railway stations, park and ride interchange, ferry terminals, sports stadia, sports fields or pitches, funfairs, theme parks, viewing stands, marinas, playing fields, children's play areas, BMX or go kart tracks, country parks, nature reserves, picnic sites, marquees	people will predominantly be outdoors and not more than 100 people will gather at the facility at any one time (Level 2)	not resident) either indoors or outdoors Emergency action may be difficult to coordinate
	Exclusions		
	Outdoor markets, car boot sales, funfairs picnic area, park and ride interchange, viewing stands, marquees	DT2.5 x1 Predominantly open-air developments likely to attract the general public in numbers greater than 100 people but up to 1000 at any one time (Level 3)	Substantial increase in numbers at risk and more vulnerable due to being outside
	Theme parks, funfairs, large sports stadia and events, open air markets, outdoor concerts, pop festivals	DT2.5 x2 Predominantly open-air developments likely to attract the general public in numbers greater than 1000 people at any one time (Level 4)	Very substantial increase in numbers at risk, more vulnerable due to being outside Emergency action may be difficult to coordinate

12.3 Development Type Table 3: Developments for Use by Vulnerable People

Development Type	Examples	Development Detail and Size	Justification
DT3.1 Institutional Accommodation and Education	Hospitals, convalescent homes, nursing homes, old people's homes with warden on site or 'on call', sheltered housing, nurseries, crèches, schools and academies for children up to school leaving age	Institutional, educational and special accommodation for vulnerable people or that provides a protective environment (Level 3)	Places providing an element of care or protection Because of age, infirmity or state of health the occupants may be especially vulnerable to injury from hazardous events Emergency action and evacuation may be very difficult
	Exclusions		
	Hospitals, convalescent homes, nursing homes, old people's homes, sheltered housing	DT3.1 x1 24-hour care where the site on the planning application being developed is larger than 0.25 hectare (Level 4)	Substantial increase in numbers of vulnerable people at risk
	Schools, nurseries, crèches	DT3.1 x2 Day care where the site on the planning application being developed is larger than 1.4 hectare (Level 4)	Substantial increase in numbers of vulnerable people at risk
DT3.2 Prisons	Prisons, remand centres	Secure accommodation for those sentenced by court, or awaiting trial, etc. (Level 3)	Places providing detention Emergency action and evacuation may be very difficult

12.4 Development Type Table 4: Very Large and Sensitive Developments

Development Type	Examples	Development Detail and Size	Justification
Note: all Level 4 developments are by exception from Level 2 or 3 and are reproduced in this table for convenient reference			
DT4.1 Institutional Accommodation	Hospitals, convalescent homes, nursing homes, old people's homes, sheltered housing	Large developments of institutional and special accommodation for vulnerable people (or that provide a protective environment) where 24-hour care is provided and where the site on the planning application being developed is larger than 0.25 hectare (Level 4)	Places providing an element of care or protection Because of age or state of health the occupants may be especially vulnerable to injury from hazardous events Emergency action and evacuation may be very difficult The risk to an individual may be small but there is a larger societal concern
	Nurseries, crèches, schools for children up to school leaving age	Large developments of institutional and special accommodation for vulnerable people (or that provide a protective environment) where day care (not 24-hour care) is provided and where the site on the planning application being developed is larger than 1.4 hectare (Level 4)	Places providing an element of care or protection Because the occupants may be especially vulnerable to injury from hazardous events Emergency action and evacuation may be very difficult The risk to an individual may be small but there is a larger societal concern
DT4.2 Very Large Outdoor Use by Public	Theme parks, large sports stadia and events, open air markets, outdoor concerts, pop festivals	Predominantly open-air developments where there could be more than 1000 people present (Level 4)	People in the open air may be more exposed to toxic fumes and thermal radiation than if they were in buildings Large numbers make emergency action and evacuation difficult The risk to an individual may be small but there is a larger societal concern

13 APPENDIX D: INCIDENT SCENARIOS

13.1 Liquids Fuels Storage

13.1.1 Storage Tank Catastrophic Failure

Failure of each tank into the major bund. The area of the pool was 1.5 x the major bund area.

Probability of catastrophic failure of tank:		$5x10^{-6}$ events per year	
Probability of ignition:	ULP	0.065 per event	
	Diesel	0.0043 per event	
	Jet A-1	0.0043 per event	
Probability of flash fire:	ULP	0.6 per event	
	Diesel	0 per event	
	Jet A-1	0 per event	
Probability of vapour cloud explosion:		ULP	0.4 per event
		Diesel	0 per event
		Jet A-1	0 per event

13.1.2 Storage Tank - Major Leak

Failure of each tank into the major bund. The area of the pool was equal to the area of the major bund.

Probability of catastrophic failure of tank:		$3x10^{-5}$ events per year	
Probability of ignition:	ULP	0.065 per event	
	Diesel	0.0043 per event	
	Jet A-1	0.0043 per event	
Probability of flash fire:	ULP	0.4 per event	
	Diesel	0 per event	
	Jet A-1	0 per event	
Probability of vapour cloud explosion:		ULP	0.4 per event
		Diesel	0 per event
		Jet A-1	0 per event

13.1.3 Overfill of Storage Tank

Failure of each tank into the minor tank bund. The area of the pool was equal to the area of the minor bund.
Probability of overfill: 1x 10^{-2} events per year - this is derived from level control and level switches each of SIL-1 failure

Probability of ignition:	ULP	0.065 per event
	Diesel	0.0043 per event
	Jet A-1	0.0043 per event
Probability of flash fire:	ULP	0.6 per event
	Diesel	0 per event
	Jet A-1	0 per event
Probability of vapour cloud explosion:	ULP	0.4 per event
	Diesel	0 per event
	Jet A-1	0 per event

13.1.4 Storage Tank Pump Bay

Pump failure to maximum area of 1200 m^2.
Probability of pump failure: 1x10^{-4} events per year

Probability of ignition:	ULP	0.065 per event
	Diesel	0.0043 per event
	Jet A-1	0.0043 per event
Probability of flash fire:	ULP	0.6 per event
	Diesel	0 per event
	Jet A-1	0 per event
Probability of vapour cloud explosion:	ULP	0.4 per event
	Diesel	0 per event
	Jet A-1	0 per event

13.1.5 Tank Top Fires

Area of release:	Tank diameter	
Height of fire:	Tank height	
Probability of failure:	ULP	$3x10^{-5}$ events per year
Probability of failure:	Diesel	1 events per year
Probability of ignition:	ULP	0.065 per event
	Diesel	0.0043 per event
	Jet A-1	0.0043 per event

13.1.6 Tank Explosion

Explosive mass in tank:	ULP	Volume below the landed internal floating roof at the lower flammable limit
	Diesel/Jet-A1	0
Probability of failure	Failure to follow maintenance procedures when testing tanks every 5 years ($1x10^{-3}$ events/year divided by 5 years)	
Probability of explosion:	0.4	

13.1.7 Road Tanker Loading

Probability of release of entire contents:	$1x10^{-5}$ events per year
Operating hours per day:	24
Time to fill road tanker:	1 hour
Maximum capacity of rail tanker:	50 m^3
Probability of tanker arm rupture:	$3x10^{-8}$ /hour
Probability of tanker arm failure:	$3x10^{-7}$ /hour

13.2 LPG

13.2.1 Vessel

Catastrophic tank failure probability:	5×10^{-7} events per year
Severe tank leak probability:	5×10^{-7} events per year
Probability of BLEVE:	0.7 per event
Probability of flash fire;	0.6 per event
Probability of vapour cloud explosion:	0.4

13.2.2 Road Tanker Loading

Probability of release of entire contents: 1×10^{-7} events per year
Operating hours per day: 24
Time to fill road tanker: 1 hour
Maximum capacity of road tanker: 50 m^3
Probability of tanker arm rupture: 3×10^{-8} /hour
Probability of tanker arm failure: 3×10^{-7} /hour

14 APPENDIX E: BUNCEFIELD RECOMMENDATIONS

14.1 Buncefield Report Recommendation 1

The Competent Authority and operators of Buncefield-type sites should develop and agree a common methodology to determine safety integrity level (SIL) (Link to SIL Info) requirements for overfill prevention systems in line with the principals set out in Part 3 of BS EN 61511 resource centre link. This methodology should take into account of:

1. The existence of nearby sensitive resources or populations;
2. The nature and intensity of depot operations;
3. Realistic reliability expectations for tank gauging systems;
4. The extent/rigour of operator monitoring.

Application of the methodology should be clearly demonstrated in the COMAH safety report submitted to the Competent Authority for each applicable site. Existing safety reports will need to be reviewed to ensure this methodology is adopted.

14.2 Buncefield Report Recommendation 2

Operators of Buncefield-type sites should, as a priority, review and amend as necessary their management systems for maintenance of equipment and systems to ensure their continuing integrity in operation. This should include, but not be limited to reviews of the following:

1. The arrangements and procedures for periodic proof testing of storage tank overfill prevention systems to minimise the likelihood of any failure that could result in loss of containment; any revisions identified pursuant to this review should be put into immediate effect;
2. The procedures for implementing changes to equipment and systems to ensure any such changes do not impair the effectiveness of equipment and systems in preventing loss of containment or in providing emergency response.

14.3 Buncefield Report Recommendation 3

Operators of Buncefield-type sites should protect against loss of containment of petrol and other highly flammable liquids by fitting a high integrity, automatic operating overfill prevention system (or a number of such systems, as appropriate) that is physically and electrically separate and independent from the tank gauging system.

Such systems should meet the requirements of Part 1 of BS EN 61511 resource centre link for the required safety integrity level main website link, as determined by the agreed methodology (see Recommendation 1). Where independent automatic overfill prevention systems are already provided, their efficacy and reliability should be reappraised in line with the principles of Part 1 of BS EN 61511 resource centre link and for the required safety integrity level, as determined by the agreed methodology (see Recommendation 1).

14.4 Buncefield Report Recommendation 4

The overfill prevention system (comprising means of level detection, logic/control equipment and independent means of flow control) should be engineered, operated and maintained to achieve and maintain an appropriate level of safety integrity in accordance with the requirements of the recognised industry standard for ‘safety instrumented systems’, Part 1 of BS EN 61511 resource centre link.

14.5 Buncefield Report Recommendation 5

All elements of an overfill prevention system should be proof tested in accordance with the validated arrangements and procedures sufficiently frequently to ensure the specified safety integrity level is maintained in practice in accordance with the requirements of Part 1 of BS EN 61511 resource centre link.

14.6 Buncefield Report Recommendation 6

The sector should put in place arrangements to ensure the receiving site (as opposed to the transmitting location) has ultimate control of tank filling. The receiving site should be able to safely terminate or divert a transfer (to prevent loss of containment or other dangerous conditions) without depending on the actions of a remote third party, or on the availability of communications to a remote location. These arrangements will need to consider upstream implications for the pipeline network, other facilities on the system, and refineries.

14.7 Buncefield Report Recommendation 7

In conjunction with Recommendation 6, the sector and the Competent Authority should undertake a review of the adequacy of existing safety arrangements, including communications, employed by those responsible for pipeline transfers of fuel. This work should be aligned with implementing. Recommendations 19 and 20 on high reliability organisations to ensure major hazard risk controls address the management of critical organisational interfaces.

14.8 Buncefield Report Recommendation 8

The sector, including its supply chain of equipment manufacturers and suppliers, should review and report without delay on the scope to develop improved components and systems, including but not limited to the following:

1. Alternative means of ultimate high-level detection for overfill prevention that do not rely on components internal to the storage tank, with the emphasis on ease of inspection, testing, reliability and maintenance;
2. Increased dependability of tank level gauging systems through improved; AND,
3. Validation of measurements and trends, allowing warning of faults and through using modern sensors with increased diagnostic capability and systems to control and log override actions.

14.9 Buncefield Report Recommendation 9

Operators of Buncefield-type sites should introduce arrangements for the systematic maintenance of records to allow a review of all product movements together with the operation of the overfill prevention systems and any associated facilities. The arrangements should be fit for their design purpose and include, but not be limited to, the following factors:

1. The records should be in a form that is readily accessible by third parties without the need for specialist assistance;
2. The records should be available both on site and at a different location;
3. The records should be available to allow periodic review of the effectiveness of control measures by the operator and the Competent Authority, as well as for root cause analysis should there be an incident; AND,
4. A minimum period of retention of one year.

14.10 Buncefield Report Recommendation 10

The sector should agree with the Competent Authority on a system of leading and lagging performance indicators for process safety performance. This system should be in line with HSE's recently published guidance on developing process safety indicators HSG254.

14.11 Buncefield Report Recommendation 11

Operators of Buncefield-type sites should review the classification of places within COMAH sites where explosive atmospheres may occur and their selection of equipment and protective systems (as required by the Dangerous Substances and Explosive Atmospheres Regulations 2002 (LINK TO DSEAR ATEX PAGE main website). This review should take into account the likelihood of undetected loss of containment and the possible extent of an explosive atmosphere following such an undetected loss of containment. Operators in the wider fuel and chemicals industries should also consider such a review, to take account of events at Buncefield.

14.12 Buncefield Report Recommendation 12

Following on from Recommendation 11, operators of Buncefield-type sites should evaluate the siting and/or suitable protection of emergency response facilities such as firefighting pumps, lagoons or manual emergency switches.

14.13 Buncefield Report Recommendation 13

Operators of Buncefield-type sites should employ measures to detect hazardous conditions arising from loss of primary containment, including the presence of high levels of flammable vapours in secondary containment. Operators should without delay undertake an evaluation to identify suitable and appropriate measures. This evaluation should include, but not be limited to, consideration of the following:

1. Installing flammable gas detection in bunds containing vessels or tanks into which large quantities of highly flammable liquids or vapour may be released;
2. The relationship between the gas detection system and the overfill prevention system. Detecting high levels of vapour in secondary containment is an early indication of loss of containment and so should initiate action, for example through the overfill prevention system, to limit the extent of any further loss;
3. Installing CCTV equipment to assist operators with early detection of abnormal conditions. Operators cannot routinely monitor large numbers of passive screens, but equipment is available that detects and responds to changes in conditions and alerts operators to these changes.

14.14 Buncefield Report Recommendation 14

Operators of new Buncefield-type sites or those making major modifications to existing sites (such as installing a new storage tank) should introduce further measures including, but not limited to, preventing the formation of flammable vapour in the event of tank overflow. Consideration should be given to modifications of tank top design and to the safe rerouting of overflowing liquids.

14.15 Buncefield Report Recommendation 15

The sector should begin to develop guidance without delay to incorporate the latest knowledge on preventing loss of primary containment and on inhibiting escalation if loss occurs. This is likely to require the sector to collaborate with the professional institutions and trade associations.

14.16 Buncefield Report Recommendation 16

Operators of existing sites, if their risk assessments show it is not practicable to introduce measures to the same extent as for new ones, should introduce measures as close to those recommended by Recommendation 14 as is reasonably practicable. The outcomes of the assessment should be incorporated into the safety report submitted to the Competent Authority.

14.17 Buncefield Report Recommendation 17

The Competent Authority and the sector should jointly review existing standards for secondary and tertiary containment with a view to the Competent Authority producing revised guidance by the end of 2007.

The review should include, but not be limited to the following:

1. Developing a minimum level of performance specification of secondary containment (typically this will be bunding);
2. Developing suitable means for assessing risk so as to prioritise the programme of engineering work in response to the new specification;
3. Formally specifying standards to be achieved so that they may be insisted upon in the event of lack of progress with improvements;
4. Improving firewater management and the installed capability to transfer contaminated liquids to a place where they present no environmental risk in the event of loss of secondary containment and fires;
5. Providing greater assurance of tertiary containment measures to prevent escape of liquids from site and threatening a major accident to the environment.

14.18 Buncefield Report Recommendation 18

Revised standards should be applied in full to new build sites and to new partial installations. On existing sites, it may not be practicable to fully upgrade bunding and site drainage. Where this is so operators should develop and agree with the Competent Authority risk-based plans for phased upgrading as close to new plant standards as is reasonably practicable.

14.19 Buncefield Report Recommendation 19

The sector should work with the Competent Authority to prepare guidance and/or standards on how to achieve a high reliability industry through placing emphasis on the assurance of human and organisational factors in design, operation, maintenance and testing. Of particular importance are:

1. Understanding and defining the role and responsibilities of the control room operators (including in automated systems) in ensuring safe transfer processes;
2. Providing suitable information and system interfaces for front line staff to enable them to reliably detect, diagnose and respond to potential incidents;
3. Training, experience and competence assurance of staff for safety critical and environmental protection activities
4. Defining appropriate workload, staffing levels and working conditions for front line personnel;
5. Ensuring robust communications management within and between sites and contractors and with operators of distribution systems and transmitting sites (such as refineries);
6. Prequalification auditing and operational monitoring of contractors' capabilities to supply, support and maintain high integrity equipment;
7. Providing effective standardised procedures for key activities in maintenance, testing and operations;
8. Clarifying arrangements for monitoring and supervision of control room staff;
9. Effectively managing changes that impact on people, processes and equipment.

14.20 Buncefield Report Recommendation 20

The sector should ensure that the resulting guidance and/or standards is/are implemented fully throughout the sector, including where necessary with the refining and distribution sectors. The Competent Authority should check that this is done.

14.21 Buncefield Report Recommendation 21

The sector should put in place arrangements to ensure that good practice in these areas, incorporating experience from other high hazard sectors, is shared openly between organisations.

14.22 Buncefield Report Recommendation 22

The Competent Authority should ensure that safety reports submitted under the COMAH Regulations contain information to demonstrate that good practice in human and organisational design, operation, maintenance and testing is implemented as rigorously as for control and environmental protection engineering systems.

14.23 Buncefield Report Recommendation 23

The sector should set up arrangements to collate incident data on high potential incidents including overfilling, equipment failure, spills, and alarm system defects, evaluate trends, and communicate information on risks, their related solutions and control measures to the industry.

14.24 Buncefield Report Recommendation 24

The arrangements set up to meet Recommendation 23 should include, but not be limited to, the following:

1. Thorough investigation of root causes of failures and malfunctions of safety and environmental protection critical elements during testing or maintenance, or in service;
2. Developing incident databases that can be shared across the entire sector, subject to data protection and other legal requirements;
3. Collaboration between the workforce and its representatives, duty holders and regulators to ensure lessons are learned from incidents, and best practices are shared.

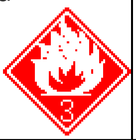
14.25 Buncefield Report Recommendation 25

In particular, the sector should draw together current knowledge of major hazard events, failure histories of safety and environmental protection critical elements and developments in new knowledge and innovation to continuously improve the control of risks. This should take advantage of the experience of other high hazard sectors such as chemical processing, offshore oil and gas operations, nuclear processing and railways.

Source: BUNCEFIELD MAJOR INCIDENT INVESTIGATIONS BOARD (2007). *Recommendations on the Design and Operation of Fuel Storage Sites.* [report]. Available at: Buncefield Investigation Website. http://www.buncefieldinvestigation.gov.uk/reports/index.htm (Accessed 5 February 2012).

15 APPENDIX F: MATERIAL SAFETY DATA SHEETS

15.1 Diesel Fuel No. 2

Fuels, Diesel, No. 2 Diesel oil No. 2 Gasoil - unspecified ICSC # 1561 	CAS # 68476-34-6 RTECS UN # 1202 EC # 649-227-00-2 October 26, 2004 Validated

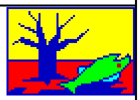
TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Water spray, alcohol-resistant foam, dry powder, carbon dioxide.
EXPLOSION	Above 52°C explosive vapour/air mixtures may be formed.	Above 52°C use a closed system, ventilation, and explosion-proof electrical equipment.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE			
•INHALATION	Dizziness. Headache. Nausea.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Dry skin. Redness.	Protective gloves.	Rinse and then wash skin with water and soap.
•EYES	Redness. Pain.	Safety goggles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	(See Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING

Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Personal protection: filter respirator for organic gases and vapours.	Well closed.	Note: H Xn symbol R: 40 S: 2-36/37 UN Hazard Class: 3 UN Packing Group: III

ICSC: 1561	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** BROWN SLIGHTLY VISCOUS LIQUID WITH CHARACTERISTIC ODOUR. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** **OCCUPATIONAL EXPOSURE LIMITS:** TLV: 100 ppm as TWA; (skin); A3; (ACGIH 2004).	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol. **INHALATION RISK:** A harmful contamination of the air will not or will only very slowly be reached on evaporation of this substance at 20°C. **EFFECTS OF SHORT-TERM EXPOSURE:** The substance is irritating to the eyes , the skin and the respiratory tract . The substance may cause effects on the central nervous system. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**

		The liquid defats the skin.
PHYSICAL PROPERTIES	Boiling point: 282-338°C Melting point: -30 - -18°C Density: 0.87 - 0.95 g/cm^3 Solubility in water, g/100 ml at 20°C: 0.0005 Flash point: 52°C c.c.	Auto-ignition temperature: 254-285°C Explosive limits, vol% in air: 0.6 - 6.5 Octanol/water partition coefficient as log Pow: > 3.3
ENVIRONMENTAL DATA	(https://www.cdc.gov/niosh/images/13.gif) The substance is harmful to aquatic organisms.	

NOTES

Additives to Diesel fuel in winter may change physical and toxicological properties of the substance. This card does not address Diesel exhaust.

Transport Emergency Card: TEC (R)-30S1202

NFPA Code: H0; F2; R0;

ADDITIONAL INFORMATION

ICSC: 1561	**DIESEL FUEL No. 2**

(C) IPCS, CEC, 1994

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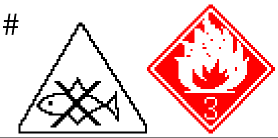
15.2 Gasoline

ICSC: 1400

Benzin
ICSC # 1400



CAS # 86290-81-5
RTECS # DE3550000
UN # 1203
EC # 649-378-00-4
October 18, 2001 Validated

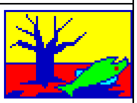
TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE			
•INHALATION	Confusion. Cough. Dizziness. Drowsiness. Dullness. Headache.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	MAY BE ABSORBED! Dry skin. Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES	Redness. Pain.	Safety spectacles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Nausea. Vomiting. (See Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Remove all ignition sources. Cover the spilled material with dry earth, sand or non-combustible material. Do NOT wash away into	Fireproof.	Marine pollutant. Note: H, P T symbol R: 45-65 S: 53-45

sewer. Do NOT let this chemical enter the environment. Personal protection: self-contained breathing apparatus.		UN Hazard Class: 3 UN Packing Group: I
ICSC: 1400	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.	

GASOLINE

ICSC: 1400

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** MOBILE LIQUID **PHYSICAL DANGERS:** The vapour is heavier than air and may travel along the ground; distant ignition possible. The vapour mixes well with air, explosive mixtures are easily formed. As a result of flow, agitation, etc., electrostatic charges can be generated. **CHEMICAL DANGERS:** **OCCUPATIONAL EXPOSURE LIMITS:** TLV: 300 ppm as TWA, 500 ppm as STEL; A3 (confirmed animal carcinogen with unknown relevance to humans); (ACGIH 2004).	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its vapour, through the skin and by ingestion. **INHALATION RISK:** A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C. **EFFECTS OF SHORT-TERM EXPOSURE:** The substance is irritating to the eyes, the skin and the respiratory tract. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. The substance may cause effects on the central nervous system. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** The liquid defats the skin. The substance may have effects on the central nervous system and liver. This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 20-200°C Relative density (water = 1): 0.70 - 0.80 Solubility in water, g/100 ml: none Relative vapour density (air = 1): 3 - 4	Flash point: <-21°C Auto-ignition temperature: about 250°C Explosive limits, vol% in air: 1.3-7.1 Octanol/water partition coefficient as log Pow: 2-7
ENVIRONMENTAL DATA	The substance is harmful to aquatic organisms. 	

N O T E S

Depending on the degree of exposure, periodic medical examination is suggested. The product may contain additives which may alter the health and environmental effects. Card has been partly updated in April 2005. See section Physical properties.

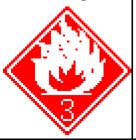
NFPA Code: H1; F3; R0;
Transport Emergency Card: TEC (R)-30S1203

ADDITIONAL INFORMATION

ICSC: 1400 GASOLINE

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

15.3 Paraffin

Kerosine Light petroleum Lamp oil Fuel oil no°1 ICSC # 0663  	CAS # 8008-20-6 RTECS # OA5500000 UN # 1223 EC # 649-404-00-4 November 26, 1998 Validated

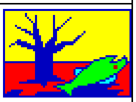
TYPES OF HAZARD/ EXPOSURE	**ACUTE HAZARDS/ SYMPTOMS**	**PREVENTION**	**FIRST AID/ FIRE FIGHTING**
FIRE	Flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Above 37°C explosive vapour/air mixtures may be formed.	Above 37°C use a closed system, ventilation, and explosion-proof electrical equipment. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT GENERATION OF MISTS!	
•INHALATION	Confusion. Cough. Dizziness. Headache. Sore throat. Unconsciousness.	Ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
•SKIN	Dry skin. Roughness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
•EYES	Redness.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Diarrhoea. Nausea. Vomiting.	Do not eat, drink, or smoke during work.	Do NOT induce vomiting. Rest. Refer for medical attention.

SPILLAGE DISPOSAL	**STORAGE**	**PACKAGING & LABELLING**
Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment. (Extra personal	Fireproof. Separated from strong oxidants. Cool.	Note: H Xn symbol R: 65 S: 2-23-24-62

protection: self-contained breathing apparatus).		UN Hazard Class: 3 UN Packing Group: III

ICSC: 0663	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

PARAFFIN	**ICSC: 0663**

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** LOW VISCOSITY LIQUID WITH CHARACTERISTIC ODOUR. **PHYSICAL DANGERS:** As a result of flow, agitation, etc., electrostatic charges can be generated. **CHEMICAL DANGERS:** Reacts with oxidants. **OCCUPATIONAL EXPOSURE LIMITS:** TLV: 200 mg/m³ (P) as total hydrocarbon vapour. Skin A3 (confirmed animal carcinogen with unknown relevance to humans); (ACGIH 2006). OSHA PEL: none NIOSH REL: TWA 100 mg/m³ NIOSH IDLH: N.D. See: IDLH INDEX	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its vapour and by ingestion. **INHALATION RISK:** No indication can be given about the rate in which a harmful concentration in the air is reached on evaporation of this substance at 20°C. **EFFECTS OF SHORT-TERM EXPOSURE:** The substance slightly irritates the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the nervous system. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** The liquid defats the skin.
PHYSICAL PROPERTIES	Boiling point: 150-300°C Melting point: -20°C Relative density (water = 1): 0.8 Solubility in water: none	Relative vapour density (air = 1): 4.5 Flash point: 37-65°C Auto-ignition temperature: 220°C Explosive limits, vol% in air: 0.7-5
ENVIRONMENTAL DATA	The substance is harmful to aquatic organisms.	

N O T E S

Physical properties vary, depending on the composition. Ingestion of paraffin (lamp oil) is a major cause of accidental poisoning in children. Card has been partly updated in October 2006. See section: Occupational Exposure Limits.

Transport Emergency Card: TEC (R)-551
NFPA Code: H 0; F 2; R 0;

ADDITIONAL INFORMATION

ICSC: 0663 PARAFFIN
(C) IPCS, CEC, 1994

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

Page last reviewed: July 22, 2015
Page last updated: July 1, 2014
Content source:
National Institute for Occupational Safety and Health

15.4 Propane/LPG

ICSC: 0319

n-Propane C_3H_8 / $CH_3CH_2CH_3$ Molecular mass: 44.1 (cylinder) (liquefied) ICSC # 0319 	CAS # 74-98-6 RTECS # TX2275000 UN # 1978 EC # 601-003-00-5 November 27, 2003 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Extremely flammable.	NO open flames, NO sparks, and NO smoking.	Shut off supply; if not possible and no risk to surroundings, let the fire burn itself out; in other cases extinguish with powder, carbon dioxide.
EXPLOSION	Gas/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent build-up of electrostatic charges (e.g., by grounding) if in liquid state. Use non-sparking hand tools.	In case of fire: keep cylinder cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE			
•INHALATION	Drowsiness. Unconsciousness.	Closed system and ventilation.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
•SKIN	ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves. Protective clothing.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Refer for medical attention.
•EYES	ON CONTACT WITH LIQUID: FROSTBITE.	Face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION			1/4

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Personal protection: self-contained breathing apparatus. Evacuate danger area! Consult an expert! Remove all ignition sources. Ventilation. NEVER direct water jet on liquid.	Fireproof. Cool.	F+ symbol R: 12 S: 2-9-16 UN Hazard Class: 2.1

ICSC: 0319	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0319

PROPANE IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE** ODOURLESS, COLOURLESS COMPRESSED LIQUEFIED GAS. **PHYSICAL DANGERS:** The gas is heavier than air and may travel along the ground; distant ignition possible, and may accumulate in low ceiling spaces causing deficiency of oxygen. As a result of flow, agitation, etc., electrostatic charges can be generated. **CHEMICAL DANGERS:** **OCCUPATIONAL EXPOSURE LIMITS:** TLV: (Aliphatic hydrocarbon gases) 1000 ppm as TWA; (ACGIH 2005). MAK: 1000 ppm, 1800 mg/m3; Peak limitation category: II(4); Pregnancy risk group: D; (DFG 2006). OSHA PEL: TWA 1000 ppm (1800 mg/m3) NIOSH REL: TWA 1000 ppm (1800 mg/m3) NIOSH IDLH: 2100 ppm 10%LEL See: 74986	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation. **INHALATION RISK:** On loss of containment this liquid evaporates very quickly displacing the air and causing a serious risk of suffocation when in confined areas. **EFFECTS OF SHORT-TERM EXPOSURE:** Rapid evaporation of the liquid may cause frostbite. The substance may cause effects on the central nervous system. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**
PHYSICAL PROPERTIES	Boiling point: -42°C Melting point: -189.7°C Relative density (water = 1): 0.5 Solubility in water, g/100 ml at 20°C: 0.007 Vapour pressure, kPa at 20°C: 840	Relative vapour density (air = 1): 1.6 Flash point: -104°C Auto-ignition temperature: 450°C Explosive limits, vol% in air: 2.1-9.5 Octanol/water partition coefficient as log Pow: 2.36
ENVIRONMENTAL DATA		

NOTES

Check oxygen content before entering area. Turn leaking cylinder with the leak up to prevent escape of gas in liquid state. High concentrations in the air cause a deficiency

Transport Emergency Card: TEC (R)-20S1978

NFPA Code: H1; F4; R0 Card has been partially updated in July 2007: see Occupational Exposure Limits.

ADDITIONAL INFORMATION

ICSC: 0319

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Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

Content source: National Institute for Occupational Safety and Health (https://www.cdc.gov/NIOSH/)

15.5 Carbon Black Oil / Heavy Furnace Oil

SAFETY DATA SHEET

SECTION 1	PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: HAFO(CSO) TANK BOTTOMS (see Section 16 for specific products covered)
Product Description: Petroleum Hydrocarbons
Product Code: 709043-00
Intended Use: Refinery process stream

COMPANY IDENTIFICATION

Supplier: **EXXONMOBIL OIL CORPORATION**
22777 Springwoods Village Parkway
Spring, TX. 77389 USA

24 Hour Health Emergency	609-737-4411
Transportation Emergency Phone	800-424-9300 or 703-527-3887 CHEMTREC
Product Technical Information	800-662-4525
MSDS Internet Address	http://www.exxon.com, http://www.mobil.com

SECTION 2	HAZARDS IDENTIFICATION

This material is hazardous according to regulatory guidelines (see (M)SDS Section 15).

CLASSIFICATION:

Flammable liquid: Category 4.
Acute inhalation toxicant: Category 4. Carcinogen: Category 1B. Reproductive toxicant (developmental): Category 2. Specific target organ toxicant (repeated exposure): Category 2.

LABEL:
Pictogram:

Signal Word: Danger

Hazard Statements:
H227: Combustible liquid. H332: Harmful if inhaled. H350: May cause cancer. H361: Suspected of damaging the unborn child. H373: May cause damage to organs through prolonged or repeated exposure. Blood, Liver, Thymus

Precautionary Statements:
P201: Obtain special instructions before use. P202: Do not handle until all safety precautions have been read and understood. P210: Keep away from flames and hot surfaces. -- No smoking. P260: Do not breathe mist / vapours. P271: Use only outdoors or in a well-ventilated area. P273: Avoid release to the environment. P280: Wear

protective gloves/protective clothing/eye protection/face protection.P304 + P340: IF INHALED: Remove person to fresh air and keep comfortable for breathing. P308 + P313: IF exposed or concerned: Get medical advice/ attention. P312: Call a POISON CENTER or doctor/physician if you feel unwell. P370 + P378: In case of fire: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish. P391: Collect spillage.P403 + P235: Store in a well-ventilated place. Keep cool. P405: Store locked up.P501: Dispose of contents and container in accordance with local regulations.

Contains: CLARIFIED OILS (PETROLEUM), CATALYTIC CRACKED

Other hazard information:

HAZARD NOT OTHERWISE CLASSIFIED (HNOC): None as defined under 29 CFR 1910.1200.

PHYSICAL / CHEMICAL HAZARDS

Thermal burn hazard - contact with hot material may cause thermal burns. Material can accumulate static charges which may cause an ignition. Material can release vapors that readily form flammable mixtures. Vapor accumulation could flash and/or explode if ignited. Combustible.

HEALTH HAZARDS

High-pressure injection under skin may cause serious damage. Under conditions of poor personal hygiene and prolonged repeated contact, some polycyclic aromatic compounds (PACs) have been suspected as a cause of skin cancer in humans. Hydrogen sulfide, a highly toxic gas, is expected to be present. Signs and symptoms of overexposure to hydrogen sulfide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odor does not provide a reliable indicator of the presence of hazardous levels in the atmosphere. May be irritating to the eyes, nose, throat, and lungs. Repeated exposure may cause skin dryness or cracking.

ENVIRONMENTAL HAZARDS

Expected to be very toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

NFPA Hazard ID:	Health:	2	Flammability:	2	Reactivity:	0
HMIS Hazard ID:	Health:	2*	Flammability:	2	Reactivity:	0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a complex substance.

Hazardous Substance(s) or Complex Substance(s) required for disclosure

Name	CAS#	Concentration*	GHS Hazard Codes
CLARIFIED OILS (PETROLEUM), CATALYTIC CRACKED	64741-62-4	< 100%	H332, H350(1B), H361(D), H373, H400(M factor 1), H410(M factor 1)

Hazardous Constituent(s) Contained in Complex Substance(s) required for disclosure

Name	CAS#	Concentration*	GHS Hazard Codes
HYDROGEN SULFIDE	7783-06-4	< 0.1%	H220, H280, H330(2), H400(M factor 1)
POLYNUCLEAR AROMATIC HYDROCARBONS		> 0.1%	H317, H340(1B), H350(1B), H360(1B)(D), H360(1B)(F), H400(M factor 1), H410(M factor 1)

* All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

As per paragraph (i) of 29 CFR 1910.1200, formulation is considered a trade secret and specific chemical identity and exact percentage (concentration) of composition may have been withheld. Specific chemical identity and exact percentage composition will be provided to health professionals, employees, or designated representatives in accordance with applicable provisions of paragraph (i).

SECTION 4 FIRST AID MEASURES

INHALATION

Immediately remove from further exposure. Get immediate medical assistance. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. Give supplemental oxygen, if available. If breathing has stopped, assist ventilation with a mechanical device.

SKIN CONTACT

Remove contaminated clothing. Dry wipe exposed skin and cleanse with waterless hand cleaner and follow by washing thoroughly with soap and water. For those providing assistance, avoid further skin contact to yourself or others. Wear impervious gloves. Launder contaminated clothing separately before reuse. Discard contaminated articles that cannot be laundered. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury. For hot product: Immediately immerse in or flush affected area with large amounts of cold water to dissipate heat. Cover with clean cotton sheeting or gauze and get prompt medical attention.

EYE CONTACT

Flush thoroughly with water for at least 15 minutes. Get medical assistance.

INGESTION

Seek immediate medical attention.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Combustible. The product can form flammable mixtures and can burn only when heated above the flash point. Storage tank headspace may contain flammable atmosphere. Exposure to fire can generate toxic fumes. Hazardous material. Firefighters should consider protective equipment indicated in Section 8.

Hazardous Combustion Products: Sulfur oxides, Aldehydes, Incomplete combustion products, Smoke, Fume, Oxides of carbon, Hydrogen sulfide

FLAMMABILITY PROPERTIES

Flash Point [Method]: >90°C (194°F) [ASTM D-93]
Flammable Limits (Approximate volume % in air): LEL: 0.5 UEL: 7.0
Autoignition Temperature: >250°C (482°F)

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. US regulations require reporting releases of this material to the environment which exceed the applicable reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

PROTECTIVE MEASURES

Avoid contact with spilled material. Warn or evacuate occupants in surrounding and downwind areas if required due to toxicity or flammability of the material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders.

For emergency responders: Respiratory protection: half-face or full-face respirator with filter(s) for organic vapor and, when applicable, H2S, or Self Contained Breathing Apparatus (SCBA) can be used depending on the size of spill and potential level of exposure. If the exposure cannot be completely characterized or an oxygen deficient atmosphere is possible or anticipated, SCBA is recommended. Work gloves that are resistant to aromatic hydrocarbons are recommended. Note: gloves made of polyvinyl acetate (PVA) are not water-resistant and are not suitable for emergency use. Chemical goggles are recommended if splashes or contact with eyes is possible. Small spills: normal antistatic work clothes are usually adequate. Large spills: full body suit of chemical resistant, antistatic material is recommended.

SPILL MANAGEMENT

Land Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do it without risk. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Prevent entry into waterways, sewer, basements or confined areas. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Large Spills: Water spray may reduce vapor; but may not prevent ignition in closed spaces. Small Spills: Absorb

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with earth, sand or other non-combustible material and transfer to containers for later disposal. If liquid is too viscous for pumping, scrape it up with shovels into a suitable container for recycle or disposal. Recover by pumping or with suitable absorbent.

Water Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants. Eliminate sources of ignition.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Avoid all personal contact. Potentially toxic/irritating fumes/vapors may be evolved from heated or agitated material. Harmful amounts of H_2S may be present. The toxic and olfactory (sense of smell) fatigue properties of hydrogen sulfide require that air monitoring alarms and respiratory protection be used where the concentration might be expected to reach a harmful level, such as in an enclosed space, heated transport vessel, or in a spill or leak situation.

Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source). When the material is handled in bulk, an electrical spark could ignite any flammable vapors from liquids or residues that may be present (e.g., during switch-loading operations). Use proper bonding and/or ground procedures. However, bonding and grounds may not eliminate the hazard from static accumulation. Consult local applicable standards for guidance. Additional references include American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practice on Static Electricity) or CENELEC CLC/TR 50404 (Electrostatics - Code of practice for the avoidance of hazards due to static electricity).

Static Accumulator: This material is a static accumulator. A liquid is typically considered a nonconductive, static accumulator if its conductivity is below 100 pS/m (100x10E-12 Siemens per meter) and is considered a semiconductive, static accumulator if its conductivity is below 10,000 pS/m. Whether a liquid is nonconductive or semiconductive, the precautions are the same. A number of factors, for example liquid temperature, presence of contaminants, anti-static additives and filtration can greatly influence the conductivity of a liquid.

STORAGE

The container choice, for example storage vessel, may effect static accumulation and dissipation. Keep container closed. Handle containers with care. Open slowly in order to control possible pressure release. Store in a cool, well-ventilated area. Keep away from incompatible materials. Storage containers should be grounded and bonded. Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

Exposure limits/standards (Note: Exposure limits are not additive)

Substance Name	Form	Limit / Standard			NOTE	Source
CLARIFIED OILS (PETROLEUM), CATALYTIC CRACKED [benzene solubles]	Total oil mist	TWA	0.1 mg/m3		Skin	ExxonMobil
HYDROGEN SULFIDE		Ceiling	20 ppm		N/A	OSHA Z2
HYDROGEN SULFIDE		Maximum concentration	50 ppm		N/A	OSHA Z2
HYDROGEN SULFIDE		STEL	14 mg/m3	10 ppm	N/A	ExxonMobil
HYDROGEN SULFIDE		TWA	7 mg/m3	5 ppm	N/A	ExxonMobil
HYDROGEN SULFIDE		STEL	5 ppm		N/A	ACGIH
HYDROGEN SULFIDE		TWA	1 ppm		N/A	ACGIH

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

No biological limits allocated.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

Use explosion-proof ventilation equipment to stay below exposure limits.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

Positive-pressure, air-supplied respirator in areas where H2S vapors may accumulate is recommended.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

Chemical resistant gloves are recommended. If product is hot, thermally protective, chemical resistant gloves are recommended. If contact with forearms is likely, wear gauntlet style gloves.

Eye Protection: If contact with material is likely, chemical goggles are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:
Chemical/oil resistant clothing is recommended. If product is hot, thermally protective, chemical resistant apron and long sleeves are recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS
Comply with applicable environmental regulations limiting discharge to air, water and soil. Protect the environment by applying appropriate control measures to prevent or limit emissions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Note: Physical and chemical properties are provided for safety, health and environmental considerations only and may not fully represent product specifications.

GENERAL INFORMATION
Physical State: Liquid
Form: Viscous
Color: Black
Odor: Petroleum/Solvent
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION
Relative Density (at 15 °C): > 1
Flammability (Solid, Gas): N/A
Flash Point [Method]: >90°C (194°F) [ASTM D-93]
Flammable Limits (Approximate volume % in air): LEL: 0.5 UEL: 7.0
Autoignition Temperature: >250°C (482°F)
Boiling Point / Range: > 350°C (662°F)
Decomposition Temperature: N/D
Vapor Density (Air = 1): > 0.9 at 101 kPa
Vapor Pressure: < 0.133 kPa (1 mm Hg) at 20 °C
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): N/D
Solubility in Water: Negligible
Viscosity: >20.5 cSt (20.5 mm2/sec) at 40 °C
Oxidizing Properties: See Hazards Identification Section.

OTHER INFORMATION
Freezing Point: N/D
Melting Point: N/A

SECTION 10 STABILITY AND REACTIVITY

REACTIVITY: See sub-sections below.

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat.

MATERIALS TO AVOID: Halogens, Alkalies, Strong oxidizers, Strong Acids

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

Hazard Class	Conclusion / Remarks
Inhalation	
Acute Toxicity: (Rat) 4 hour(s) LC50 4100 mg/m3 (Aerosol)	Moderately toxic. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 403
Irritation: No end point data for material.	Negligible hazard at ambient/normal handling temperatures.
Ingestion	
Acute Toxicity (Rat): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 401
Skin	
Acute Toxicity (Rabbit): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 402
Skin Corrosion/Irritation (Rabbit): Data available.	May dry the skin leading to discomfort and dermatitis. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 404
Eye	
Serious Eye Damage/Irritation (Rabbit): Data available.	May cause mild, short-lasting discomfort to eyes. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 405
Sensitization	
Respiratory Sensitization: No end point data for material.	Not expected to be a respiratory sensitizer.
Skin Sensitization: Data available.	Not expected to be a skin sensitizer. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 406
Aspiration: Data available.	Not expected to be an aspiration hazard. Based on physico-chemical properties of the material.
Germ Cell Mutagenicity: Data available.	Not expected to be a germ cell mutagen. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 474 475 476
Carcinogenicity: Data available.	Caused cancer in laboratory animals. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 451
Reproductive Toxicity: Data available.	Caused damage to the fetus in laboratory animals, but the relevance to humans is uncertain. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD

	Guideline 414 416
Lactation: No end point data for material.	Not expected to cause harm to breast-fed children.
Specific Target Organ Toxicity (STOT)	
Single Exposure: No end point data for material.	Not expected to cause organ damage from a single exposure.
Repeated Exposure: Data available.	Concentrated, prolonged or deliberate exposure may cause organ damage. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 411

TOXICITY FOR SUBSTANCES

NAME	ACUTE TOXICITY
HYDROGEN SULFIDE	Inhalation Lethality: 4 hour(s) LC50 444 ppm (Gas) (Rat)

OTHER INFORMATION

For the product itself:

Target Organs Repeated Exposure: Blood, Liver, Thymus

Contains:

HYDROGEN SULFIDE : Chronic health effects due to repeated exposures to low levels of H2S have not been established. High level (700 ppm) acute exposure can result in sudden death. High concentrations will lead to cardiopulmonary arrest due to nervous system toxicity and pulmonary edema. Lower levels (150 ppm) may overwhelm sense of smell, eliminating warning of exposure. Symptoms of overexposure to H2S include headache, fatigue, insomnia, irritability, and gastrointestinal problems. Repeated exposures to approximately 25 ppm will irritate mucous membranes and the respiratory system and have been implicated in some eye damage.

The following ingredients are cited on the lists below:

Chemical Name	CAS Number	List Citations
CLARIFIED OILS (PETROLEUM), CATALYTIC CRACKED	64741-62-4	5

--REGULATORY LISTS SEARCHED--

1 = NTP CARC	3 = IARC 1	5 = IARC 2B
2 = NTP SUS	4 = IARC 2A	6 = OSHA CARC

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Expected to be very toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

MOBILITY

Majority of components -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

Majority of components -- Low potential to migrate through soil.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Material -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

Majority of components -- Has the potential to bioaccumulate, however metabolism or physical properties may reduce the bioconcentration or limit bioavailability.

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrositivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (DOT)

Proper Shipping Name: HYDROCARBONS, LIQUID, N.O.S. (Clarified oils (petroleum), catalytic cracked)
Hazard Class & Division: COMBUSTIBLE LIQUID
ID Number: 3295
Packing Group: III
ERG Number: 128

Label(s): NONE
Transport Document Name: UN3295, HYDROCARBONS, LIQUID, N.O.S. (Clarified oils (petroleum), catalytic cracked), COMBUSTIBLE LIQUID, PG III

Footnote: This material is not regulated under 49 CFR in a container of 119 gallon capacity or less when transported solely by land, as long as the material is not a hazardous waste, a marine pollutant, or specifically listed as a hazardous substance.

LAND (TDG): Not Regulated for Land Transport

SEA (IMDG)
Proper Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Clarified oils (petroleum), catalytic cracked)
Hazard Class & Division: 9
EMS Number: F-A, S-F
UN Number: 3082
Packing Group: III
Marine Pollutant: Yes
Label(s): 9
Transport Document Name: UN3082, ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S. (Clarified oils (petroleum), catalytic cracked), 9, PG III, MARINE POLLUTANT

AIR (IATA)
Proper Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S. (Clarified oils (petroleum), catalytic cracked)
Hazard Class & Division: 9
UN Number: 3082
Packing Group: III
Label(s) / Mark(s): 9, EHS
Transport Document Name: UN3082, ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S. (Clarified oils (petroleum), catalytic cracked), 9, PG III

SECTION 15 REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: This material is considered hazardous in accordance with OSHA HazCom 2012, 29 CFR 1910.1200.

Listed or exempt from listing/notification on the following chemical inventories: AICS, DSL, ENCS, IECSC, KECI, TSCA

EPCRA SECTION 302: This material contains no extremely hazardous substances.

CERCLA: This material is not subject to any special reporting under the requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Contact local authorities to determine if other reporting requirements apply.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: Fire. Immediate Health. Delayed Health.

SARA (313) TOXIC RELEASE INVENTORY:

Chemical Name	CAS Number	Typical Value
POLYNUCLEAR AROMATIC HYDROCARBONS		> 0.1%

The following ingredients are cited on the lists below:

Chemical Name	CAS Number	List Citations
CLARIFIED OILS (PETROLEUM), CATALYTIC CRACKED	64741-62-4	10
HYDROGEN SULFIDE	7783-06-4	1, 4
POLYNUCLEAR AROMATIC HYDROCARBONS		18

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16 OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):
H220: Extremely flammable gas; Flammable Gas, Cat 1
H280: Contains gas under pressure; may explode if heated; Pressurized Gas
H330(2): Fatal if inhaled; Acute Tox Inh, Cat 2
H332: Harmful if inhaled; Acute Tox Inh, Cat 4
H350(1B): May cause cancer; Carcinogenicity, Cat 1B
H361(D): Suspected of damaging the unborn child; Repro Tox, Cat 2 (Develop)
H373: May cause damage to organs through prolonged or repeated exposure; Target Organ, Repeated, Cat 2
H400: Very toxic to aquatic life; Acute Env Tox, Cat 1
H410: Very toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 1

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
Updates made in accordance with implementation of GHS requirements.

THIS MSDS COVERS THE FOLLOWING MATERIALS: BRRF: Clarified Oil Tank Bottoms | BRRF: Clarified Slurry oil tank bottoms | BRRF: HAFO(CSO) Tank Bottoms

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Internal Use Only
MHC: 0B, 0B, 2, 0, 1, 0 PPEC: AH, E

DGN: 7115934XUS (1020000)

ODIS ID: 500 Sample ID 18585

Supplier: PetroSA in Mosselbay, SA

ORION ENGINEERED CARBONS

Feedstock ID

DASHBOARD
BEST GUESS
REQUEST SAMPLE
RUN PREDICTION
INPUT ANALYSIS
SEARCH
BLEND/TANK MANAGEMENT
REPORTS
ADMIN
HELP

ANALYSIS DATA INPUT

Type	Feedstock
ID*	500 (Advance Search)
Purchase Order	
Feedstock Type	Fluid Catalytic Cracking (1%)
Analysis ID	18584
Date of Analysis	2018-12-18
Sampling Date	2018-08-20 03:00
Sample Requester	Link, Sascha
Sample Priority	1 - Urgent
Sample Comments	
Lab Name*	Orion lab Kalscheuren
Summary	

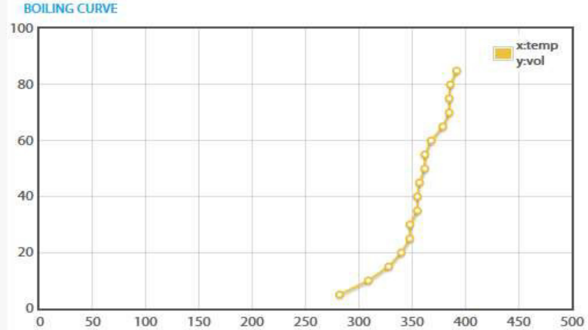
Feedstock Properties	Method	Unit	Value	Entered Confidence Interval	SI Value	Remarks
Density	ASTM D 4052	kg/l	0,917		0,917 kg/l	0,917/0,917
Carbon mass fraction (waf)	Elemental Ana	%	86,2	0,023	86,2 % (±0,023)	
Hydrogen mass fraction (waf)	Elemental Ana	%	11,916	0,033	11,92 % (±0,033	
Nitrogen mass fraction (waf)	Elemental Ana	%	0,046	0,005	0,046 % (±0,005	
Sulphur mass fraction (waf)	Elemental Ana	%	1,133	0,014	1,13 % (±0,014)	
Oxygen mass fraction (waf)	Elemental Ana	%	0,704	0,051	0,7 % (±0,051)	

Water mass fraction	☑	ASTM D 95	%	0,048	0,001	0,048 % (±0,001)	0,048/0,048/0,049
Ash mass fraction	☑	ASTM D 482	%	0,25	0,016	0,25 % (±0,016)	0,26/0,24
Conradson coking residue	☑	ASTM D 4530	%	7,62	0,022	7,62 % (±0,022)	7,61/7,63
Molecular weight	☑	ASTM D 2503	g/mol	389,8	7,37	390 g/mol (±7,37	383,6/396,6/389,4
Gross calorific value of oil	☑	ASTM D 4809	kJ/kg	44301	105,197	44300 kJ/kg (±1C	44273/44393/44238
Reactivity k	☐	OEC Reactivity	m^3/m				
Reactivity Ea	☐	OEC Reactivity	kJ/mo				
Crystallization start temp.	☐	DIN EN 13991	°C				
Flashpoint	☑	ASTM D 93B	°C	113		113 °C	
Paraffine (mass fraction)	☑	DSOP/OEC 9.	%				
Asphaltenes	☑	OEC Oil Analy	%	1,33	1	1 % (±1)	1,39/0,73
Toluene insolubles	☑	OEC Oil Analy	%	0,35	0	0,35 %	0,37/0,34
Quinoline insolubles	☑	DIN 51921	%	0,25	0	0,25 %	0,48/0,01

Aromatic Carbon C	☑	(Unknown)	-			0,153 -	
Aromatic Carbon CH	☑	(Unknown)	-			0,04 -	
Oliphinic Carbon CH	☑	(Unknown)	-			0 -	
Paraffinic Carbon CH2	☑	DSOP/OEC 9.	-			0,808 -	
Phenolic Oxygen	☑	(Unknown)	-			0,006 -	
Sulfur Group	☑	OEC Schinkel	-			0,005 -	
Nitrogen group	☑	OEC Schinkel	-			0,001 -	
Alpha	☐	OEC Schinkel	-	0,1		0,1 -	
Gamma	☐	OEC Schinkel	-	0,89		0,89 -	
Err_HO	☐	OEC Schinkel	-			-0,013 -	
Err_RHO	☐	OEC Schinkel	-			0,103 -	

Dynamic Viscosity 98 °C @ 50 1/s	☐	ASTM D 445	mPa*	9,549		9,549 mPa*s	
Flow consistency index (Ostwald de Waele) @ 98°C	☐	OEC Schinkel	mPas	8,867		8,867 mPas^n	
Flow behavior index (Ostwald de Waele) @ 98°C	☐	OEC Schinkel	-	1,02		1,02 -	
Kinematic viscosity at 98 °C @ 50 1/s	☑	ASTM D 445	cSt	10,413		10,413 cSt	
Dynamic Viscosity 50 °C @ 50 1/s	☐	ASTM D 445	mPa*	48,196		48,196 mPa*s	
Flow consistency index (Ostwald de Waele) @ 50°C	☐	OEC Schinkel	mPas	52,081		52,081 mPas^n	
Flow behavior index (Ostwald de Waele) @ 50°C	☐	OEC Schinkel	-	0,981		0,981 -	
Kinematic viscosity at 50 °C @ 50 1/s	☑	ASTM D 445	cSt	52,558		52,558 cSt	
Dynamic Viscosity @ 50 1/s Param A	☐	OEC Schinkel	mPa*	10,034		10,034 mPa*s	
Dynamic Viscosity @ 50 1/s Param B	☐	OEC Schinkel	K	1025,2		1025,2 K	
Dynamic Viscosity @ 50 1/s Param C	☐	OEC Schinkel	K	-167,96		-167,96 K	
Dynamic Viscosity @ 50 1/s Param Xo	☐	OEC Schinkel	K				
Sieve residue (5 µm)	☐	OEC Internal	ppm				
Sieve residue (10 µm)	☐	DSOP/OEC 9.	ppm				
Sieve residue (25 µm)	☑	DSOP/OEC 9.	ppm	220	59	220 ppm (±59)	190/250
Sieve residue (45 µm)	☐	DSOP/OEC 9.	ppm	15	29	20 ppm (±29)	2/30

BOILING CURVE



DISTILLATION(C)

From last full analysis ☐

Add Value

Delete All

Temperature (°C)	Distillate (Vol%)
282	5
309	10
328	15
340	20

13.8.2 Ecological Assessments

AQUATIC AND TERRESTRIAL BIODIVERSITY ASSESSMENT

Provision of Landside Structures and Infrastructure to the proposed Bulk Liquid Storage and Handling Facility in the Port of Ngqura within the Coega IDZ, Nelson Mandela Bay Municipality

Report prepared for:

CSIR – Environmental Management Services

P O Box 17001

Congella, Durban, 4013

South Africa

Report prepared by:

Dr Brian Colloty

1 Rossini Road

Port Elizabeth

6001

July 2013

Specialist Expertise:

Dr. Brian Colloty: Scherman Colloty and Associates

QUALIFICATIONS

B. Sc. [Natural Sciences] - University of Port Elizabeth (1994).
B. Sc. Honours [Zoology] - University of Port Elizabeth (1995).
M.Sc. [Botany] - University of Port Elizabeth (1996) - The Structure and Status of the Keiskamma River.
Ph.D. [Botany] - The botanical importance rating of estuaries in the Ciskei and Transkei region. Funded by the Water Research Commission. University of Port Elizabeth (2000).

PROFESSIONAL MEMBERSHIPS

Member of the South African Association of Aquatic Scientists (2005 – present)
Member of Southern African Institute of Ecologists and Environmental Scientists (SAIEES)
Certified Professional Natural Scientist – SACNASP (Ecologist - 400268/07)
Certified Environmental Assessment Practitioner (EAPSA)

Dr. Colloty has conducted several Water Use Licence Applications and estuarine and freshwater specialist studies for EIAs. These include existing EIAs in the Coega IDZ as well as various wind farm EIAs in the Eastern Cape.

EXECUTIVE SUMMARY

Transnet SOC Limited are proposing to construct a series of landside structures and infrastructure to service the proposed Bulk Liquid Storage and Handling Facility in Zone 8 of the Coega Industrial Development Zone and Port of Ngqura, as well as other future developments along the east bank property of the Port of Ngqura. The proposed project will entail the construction of the following components:

- An Entrance Facility;
- An Access Road from the entrance facility to the tank farm and onwards to the berth in the Port of Ngqura;
- Water, Stormwater, Sewer Pipelines and Infrastructure constructed within the road reserve;
- Fuel Reserve and Service Road for the proposed OTGC Bulk Liquid Pipelines;
- Fuel Reserve for Proposed Tank Farm Users;
- Boundary Fencing;
- Electrical Substations; and
- Additional fuel reserve and the widening of a section of the abovementioned fuel reserve for the Bulk Liquid pipelines.

Scherman Colloty and Associates were appointed by the CSIR (Environmental Assessment Practitioner) on behalf of Transnet to carry out a Biodiversity Assessment to assess the impacts of the proposed project on the surrounding Biodiversity, including Terrestrial and Aquatic Ecology. In general a variety of habitats were observed, which ranged from degraded as well as very sensitive terrestrial habitats. The Coega Estuary was found to be in a transformed state near the proposed works, and is largely unnatural, while the drainage line is mostly natural. The findings of the specialist study are outlined below.

The overall study concluded that with suitable mitigation the landside structures and infrastructure would have a limited (LOW) impact on the surrounding terrestrial and aquatic environments should the following be incorporated into the design or considered:

- All engineering options within Open Space Management Plan (Revision 9) area 1.1 and 1.1a should be kept to a minimum as well as any infrastructure proposed within the Algoa Dune Strandveld.
- Boundary Fence: It is understood that Transnet are currently assessing three different routing options for the fence line. Transnet need to take into consideration several factors when selecting the fence line option. These factors include technical, financial and environmental implications of each fence line, as well as the future expansion plans for the Port of Ngqura. Fence line Option 1 follows the existing Port Boundary towards the shoreline. Fence line Option 2 will travel adjacent to the Access Road. This option will have implications for the future development of the Port such that it will divide the east bank of the Port. Although Fence line Option 3 follows a track in a partly degraded area, it is in close proximity to a *Syncarpha recurvata* population and as such is the least preferred option from an ecological point of view. Should this option be required, then the *Syncarpha* population should be cordoned off prior to the construction process and considered a No-Go area.
- The Subsequent Environmental Impact Report for the Port of Ngqura carried out by Coastal and Environmental Services in 2000 (CES, 2000), explains that "slopes exceeding a 1:3 gradient should ideally not be developed but where development does take place the slopes must be stabilised and rehabilitated" (CES, 2000, page 83). In the case of this project, areas with slopes of 1:3 or greater are unavoidable as a result of the access road. As a result, it is recommended that suitable stabilizing structures and erosion prevention controls be implemented.
- All mitigations stated in this report need to be implemented.

- The relevant permits for the protected plant species need to be obtained in hand prior to construction and, where possible, all rescued plants must be retained in a suitable nursery. It is understood that Transnet will be establishing a suitable site within the Port of Ngqura where species can be relocated to and appropriately maintained.

The Contractor should also refer to the detailed Transnet Capital Projects Construction Environmental Management Plan and Standard Environmental Specifications. It is understood that Transnet will also develop a project specific environmental specification for this proposed landside structures and infrastructure project based on the outcomes of this and the other specialist studies. Therefore it is recommended that the specification deals with the following in depth and will meet or exceed the CDC/IDZ specifications as well as any conditions contained in the 2002 Record of Decision (RoD):

- A plant rescue and protection plan, which allows for the transplantation of conservation important species from areas to be transformed. Particular species include:
    - *Aloe striata*
    - *Haworthia translucens*
    - *Cyrtanthus clavatus*
    - *Cyrtanthus spiralis*
    - *Bergeranthus addoensis*
    - *Bergeranthus longisepalus*
    - *Bergeranthus scapiger*
    - *Trichodiadema bulbosum*
    - *Cotyledon orbiculata var. flanaganii*
    - *Euphorbia globosa*
- A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation phases, including timeframes for restoration, which must indicate rehabilitation within the shortest possible time after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery of natural habitats.
- An alien invasive management plan to be implemented during construction and operation phases. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.
- Any works within the proposed development that may encroach on the Coega Estuary, must account for the reinstatement of the channel to its former size and capacity. Should any diversions occur, then these must be limited to a short period, prior to the reinstatement of the channel.

CONTENTS

TABLES AND FIGURES

ABBREVIATION

CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DWA	National Department of Water Affairs
DWAF	National Department of Water Affairs and Forestry (now DWA)
ECBCP	Eastern Cape Biodiversity Conservation Plan
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
GIS	Geographic Information System
IDZ	Industrial Development Zone
NFEPA	National Freshwater Ecosystem Priority Areas (CSIR)
NMBM	Nelson Mandela Bay Municipality
OSMP	Open Space Management Plan
PES	Present Ecological State Score
PNCO	Provincial Nature Conservation Ordinance
RDB	Red Data Book of the Internal Union for the Conservation of Nature or IUCN
SABIF	South African Biodiversity Information Facility housed by SANBI
SANBI	South African National Biodiversity Institute
SC&A	Scherman Colloty & Associates
SRK	SRK Consulting South Africa (Pty) Ltd
SSC	Species of Special Concern

AQUATIC AND TERRESTRIAL BIODIVERSITY ASSESSMENT

1.1 INTRODUCTION AND METHODOLOGY

1.1.1 Introduction

Scherman Colloty & Associates cc (SC&A) was appointed by the CSIR as an independent specialist to evaluate the aquatic and terrestrial ecological aspects of the proposed landside structures and infrastructure development proposed by Transnet SOC Limited to service the proposed Bulk Liquid Storage and Handling Facility. This study follows on results obtained in a survey of the regional literature and observations made during short site visits conducted in September 2012 and April 2013.

Several important national and provincial conservation plans were also reviewed, with the results of those studies being included, together with an assessment of the potential impact of the project on the Coega Open Space Management Plan (OSMP – Revision 9).

This Transnet project will thus incorporate the following aspects related to the development of the proposed Tank Farm, which will require the following infrastructure:

- A new entrance facility on the east bank of the Coega River towards the north of the Port of Ngqura (including offices and security buildings);
- An access road from the new entrance to the Tank Farm, and from the tank farm to the berths (including proposed A-series berths);
- Water, sewer and stormwater pipelines alongside the access road;
- A fuel reserve for bulk liquid pipelines from the tank farm to the berth (including a gravel service road);
- Fuel Reserve for Proposed Tank Farm Users;
- Fencing around the east bank boundary of the Port (including intruder detection, security fencing, lighting and a service road);
- New substations and a transformer and standby generator; and
- An additional fuel reserve extending from the port boundary in the north east to the tank farm, as well as the widening of a section of the abovementioned fuel reserve for the bulk liquid pipelines from 10 m to 30 m.

1.1.2 Scope and Objectives

The scope and objectives of this study are to provide the following:

- A description of the current state of the environment (vegetation and fauna) against, which impacts can be identified and measured.
- A description of species composition and conservation status in terms of protected, endangered or vulnerable floral and faunal species or vegetation types.
- This description will include species which are likely to occur within, traverse across or forage within the proposed project area, as well as species which may not necessarily occur on site, but which are likely to be impacted upon as a result of the proposed development.
- A description of the current state of vegetation on site (i.e. natural, transformed, disturbed etc.).

- An indication of the irreplaceability value of vegetation types present on site with particular reference to open space planning and the possibility of habitat fragmentation.
- A description of the presence and extent of alien invasive vegetation species on site.
- A detailed list of species of special concern (flora and fauna).
- An assessment of potential direct, indirect and cumulative impacts identified, and how these would affect the vegetation and fauna.
- A disclosure of any gaps in information or assumptions made.
- Recommendations for mitigation measures to minimise impacts identified.
- An outline of additional management guidelines.
- An Environmental Management Programme (EMPr).

1.1.3 Terms of References

Water bodies

- A desktop aquatic assessment of the study area. This will cover the development footprint in relation to available information on the wetland ecosystems (including streams and rivers) within the region.
- A map demarcating the relevant local drainage areas and catchments of the respective water bodies and any potential wetland areas within a 500m radius of the study area. This will demonstrate, from a holistic point of view the connectivity between the site and the surrounding regions, i.e. the zone of influence.
- The determination of the ecological state of any water bodies, estimating their biodiversity, conservation and ecosystem function importance with regard to ecosystem services. SC&A is presently assessing the Present Ecological State (PES) for all rivers and known wetland areas in the Eastern Cape as part of a 2 year Water Research Commission funded study and is thus developing the latest PES methods in collaboration with the Department of Water Affairs.
- Recommend buffer zones and No-go areas around any delineated water bodies based on the relevant legislation (e.g. Eastern Cape Biodiversity Conservation Plan & NMBM Draft Bioregional Plan) or best practice. SC&A also has access to geographic information that forms part of the latest National Freshwater Ecosystems Priority Areas (2011) conducted by the CSIR.
- Highlight potential impacts and assess these during the Basic Assessment Process using the supplied methodology.
- Provide mitigations regarding project related impacts, including engineering services that could negatively affect demarcated wetland areas.
- Recommend specific actions that could enhance the aquatic functioning in the areas, allowing the potential for a positive contribution by the project.
- Provide geo-referenced GIS shape files of the water bodies.

Terrestrial Ecology

A desktop and literature review of the area under investigation has been conducted to collate as much information as possible prior to any detailed fieldwork. The purpose of the desktop assessment is to rank relevant areas according to their ecological sensitivity and to identify areas of least ecological risk (to be assessed during the Basic Assessment process).

Water Use Licence Applications

The proposed layout and project actions were for any potential aspects that may require a Water Use License from the Department of Water Affairs (DWA). Typical water uses would include those listed in Section 21 and 37 of the National Water Act (Act 37 of 1998) and include:

- Section 21 (a): abstractive use of water for construction (if required).

- Section 21 (b): Storage. Any person or body storing water for any purpose in excess of 10 000 cubic meters or where the water area at full supply level exceeds 1 hectare in total on land owned or occupied by that person or body and not in possession of a permit or permission, e.g. the filter basins or reclamation or stormwater detention ponds.
- Section 21 (c) and (i) use, i.e. water course crossings by, roads, pipelines or additional infrastructure.
- Discharge of waste or water containing waste in terms of section the following activities:
  - Section 21(f), when discharging waste or water containing waste into a water resource through a pipe, canal or other conduit.
  - Section 21(g) – disposing of waste in a manner which may detrimentally impact on a water resource.

Note that the current Section 21 (c) and (i) General Authorisations (GAs) do *not* apply to the use of water within a **500m radius** from the boundary of any wetland or estuary. Should construction within these boundaries be considered, *licensing* and not registration will have to take place.

The WULA forms do require a certain amount of detail; however, the supporting documentation (e.g. DW781 questionnaire) requires a significant amount of information related to the engineering design, impact assessment, mitigations and the environmental management programme. Proof of public participation is also needed.

Once the number of applications has been determined and the Basic Assessment documents have been completed, the Water Use License Applications would be submitted to the DWA regional Office.

1.1.4 Approach and Methodology

During the field survey the location and extent of any sensitive aquatic and terrestrial areas earmarked were ground-truthed. Fieldwork was limited to visual sightings by means of transect walks and plot-based sampling, while particular attention was also paid to the occurrence of Red Data species with known distributions in the region.

Terrestrial and aquatic vegetation units were sampled by means of the following techniques as per each site:

- Data collection was plot-based and in the form of vegetation samples within selected reference areas to categorise the various vegetation units.
- Results from the data analysis provide a description of the dominant and typical species occurring on the site(s), and include:
  - Threatened, endemic or rare species, with an indication of the relative functionality and conservation importance of the specific community in the area under investigation;
  - Invasive or exotic species present in the area;
  - The functional and conservation importance of all communities in the area of investigation; and
  - Delineate the functional water bodies based on the methods & standards described in the above section.

Mammals were sampled by means of the following techniques:

- Fieldwork included visual sightings by means of transect walks to evaluate the presence of mammal taxa. During the site visit, specific attention was given to signs (droppings, burrows, vocalisations, etc.) of taxa and the presence of suitable habitat;
- A full list of species observed and expected to occur has been compiled; and
- Specific reference has been made to the occurrence of Red Data species.

Birds were sampled by means of the following techniques:

- Bird data was collected by means of point counts. Data from the point counts was then analysed to determine typical or dominant species as well as residing assemblages; and

- A full list of species observed and expected to occur has been included. Specific reference is made to the occurrence of Red Data species.

Herpetofauna (reptiles & amphibians) were sampled by means of the following techniques:
- Visual observations;
- Active searching techniques; and
- Vocalisations (for amphibians).

Additional information of faunal community residing on the area of investigation was sourced from distributional data/records (both recent and historical), relevant literature, the private sector and other atlas projects. Habitat areas (based on the species compositions of the vegetation analysis, topography and soil study) were ranked into high, medium or low classes in terms of their significance based on the Ecological Sensitivity and Conservation Importance. A sensitivity and habitat map (including buffer zones if applicable) was produced based on the above information.

1.1.5 Assumptions and Limitations

In order to obtain a comprehensive understanding of the dynamics of both the flora and fauna of both the terrestrial and aquatic communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints these long-term studies are not feasible and are mostly based on instantaneous sampling.

Therefore, due to the scope of the work presented in this report, a detailed investigation of all, or part of, the proposed site was not possible. It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

Furthermore, additional information may come to light during a later stage of the process or development. This company, the consultants and/or specialist investigators do not accept any responsibility for conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from the surveys or requests made to them at the time of this report.

It is important to note that this specialist assessment was based on the extent and footprint of this specific Landside Structures and Infrastructure project in relation to the Open Space areas (Revision 9). The recommendations made in this report have not been made in view of any other proposed developments and services that are currently being implemented.

1.1.6 Source of Information

Relevant literature for e.g. South African Biodiversity Information Facility (SABIF, which includes the PRECIS plant distribution database), South African Bird & Herpetological Atlas Projects, relevant Red Data books, provincial ordinances and all systematic bioregional / conservation plans, were also consulted. Particular attention was paid to the CBA 1 & 2 areas shown in the Eastern Cape Biodiversity Conservation Plan or ECBCP and important areas identified in the Draft Bioregional Plan for Nelson Mandela Bay (SRK Consulting, 2010).

Particular attention was paid to the requirements of the Coega Industrial Development Zone (IDZ) Record of Decision with regard the Coega Open Space Management Plan (Revision 9).

SC&A also accessed the geographic information that forms part of the latest National Freshwater Ecosystems Priority Areas (2011) Atlas being finalised by the CSIR.

1.2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO BIODIVERSITY IMPACTS

The project will see the construction and installation of various structures, which are in the majority, linear in form. These include roads, fences, various pipelines and office infrastructure. This would thus result in the clearing of the surrounding vegetation, but also introduce aspects such as fragmentation of habitats and changes in hydrological regimes (hard surfaces and stormwater management). It must be noted that although the storm water infrastructure will largely be within the road reserve storm water outlets may be located outside the road reserve to ensure discharge into natural drainage lines.

Although it is anticipated that these impacts would be on a local scale, it is however important to assess these within the context, that a number of rare and critically endangered plant and animal species occur within the study area.

1.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The site is located within Zone 8 of the Coega IDZ, adjacent to the Coega Estuary and the Algoa Bay coastline. While the proposed Tank Farm is aligned with the designated Coega Open Space Management Plan (OSMP Revision 9), several of the supporting services and infrastructure described in this study, may impact on the remaining Bontveld and Bontveld corridors within this zone. Figure 5 of this report illustrates the layout of the proposed project in relation to Revision 9 of the Coega OSMP. This figure clearly indicates where the Coega Open Space will be crossed by the proposed project.

The site is characterised by coastal plains, undulating coastal platforms, most with calcrete outcrops and valley sides associated with the Coega River (Figure 1). In general, soils on the plateau are better developed where the topography slopes towards the drainage line.

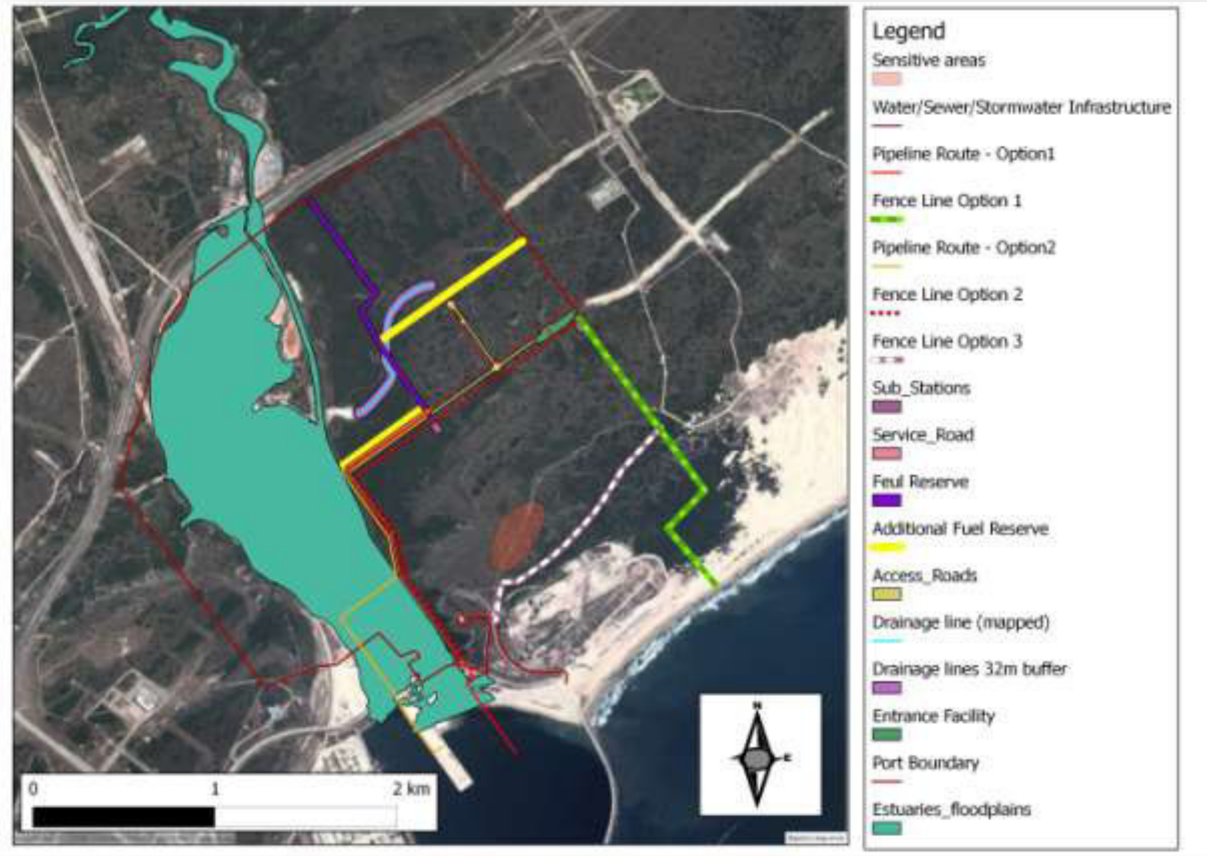


Figure 1: Locality map indicating the proposed layouts for the landside infrastructure

1.3.1 Terrestrial environment

Flora

The study area is located within the Albany Thicket Biome, as defined by Mucina and Rutherford (2006). The tank farm and associated access roads, fences, pipelines and water-related infrastructure traverse five vegetation types (Figure 2), namely:

1. Algoa Dune Strandveld (AZ 5);
2. Cape Estuarine Saltmarshes (AZe 2);
3. Cape Seashore Vegetation (AZd 3);
4. Coega Bontveld (AT 7); and
5. Sundays Thicket (AT 6).

These vegetation types are all listed as Least Threatened (Mucina and Rutherford, 2006).

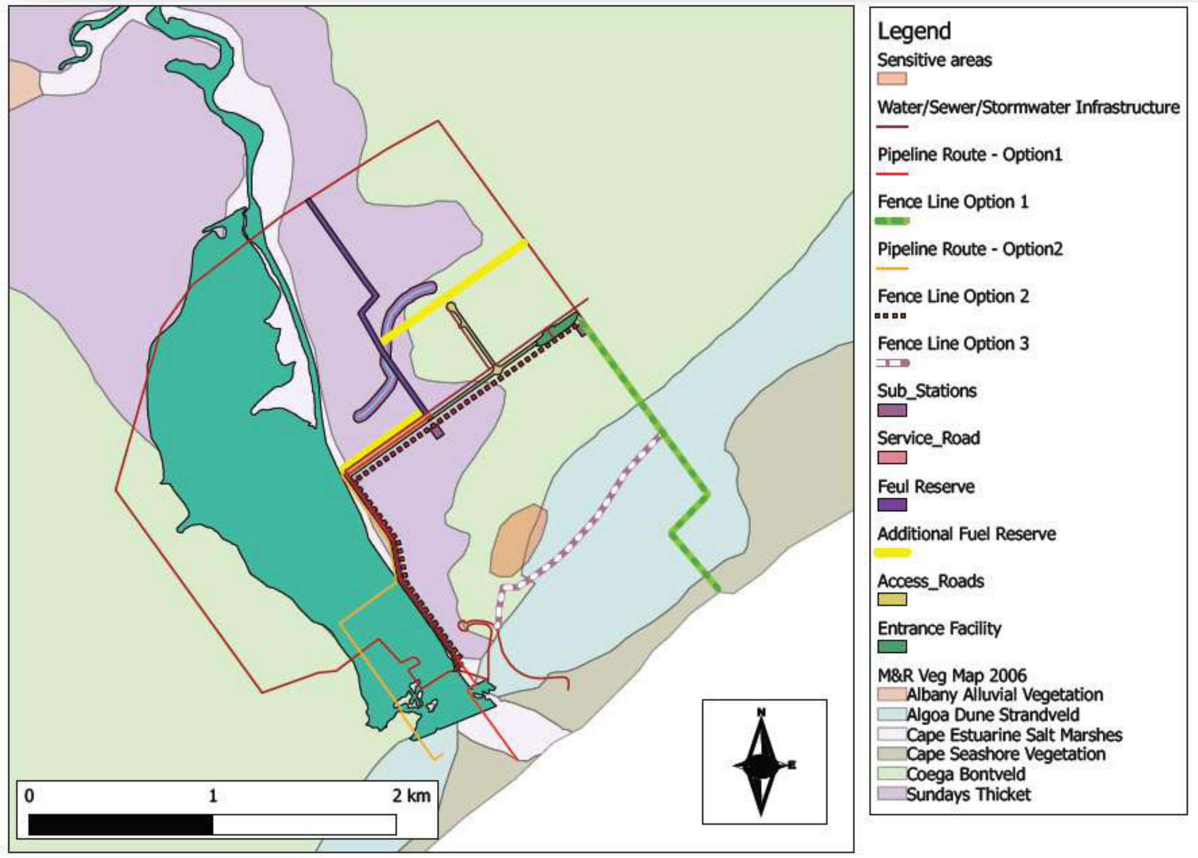


Figure 2: The spatial position of the associated infrastructure in relation to the regional vegetation types as defined by Mucina and Rutherford (2006).

According to the Nelson Mandela Bay Municipality Conservation Assessment and Plant or NMBM CAP (Stewart and Reeves, 2010), which is a more recent and fine-scale bioregional conservation assessment and plan for the study area, the access roads, fences, pipelines and water-related infrastructure traverse seven vegetation types (Figure 3). The vegetation types are:

1. Algoa Dune Thicket;
2. Coega Estuary;
3. Coega Estuary Floodplain;
4. Colchester Strandveld;
5. Grass Ridge Bontveld;
6. Sandy Beach; and
7. Sundays Valley Thicket.

These vegetation types are listed as Critically Endangered (Coega Estuary, Coega Estuary Floodplain); Vulnerable (Algoa Dune Thicket, Colchester Strandveld, Grass Ridge Bontveld, Sundays Valley Thicket), and Least Threatened (Sandy Beach) in the NMBM CAP document (Stewart and Reeves 2010). None of the estuary related areas as shown in the spatial data will be encroached by this project, i.e. no impacts will occur within the Coega Estuary and Coega Estuary Floodplain vegetation units as indicated in Figure 3.

These units do not fall within the project footprint, however as discussed in Section 1.3.3 of this report, a portion of the proposed road reserve may encroach on the Coega River channel. It is important to reiterate that the proposed encroachment does not fall within the Coega Estuary and Coega Estuary Floodplain vegetation units as indicated in Figure 3.

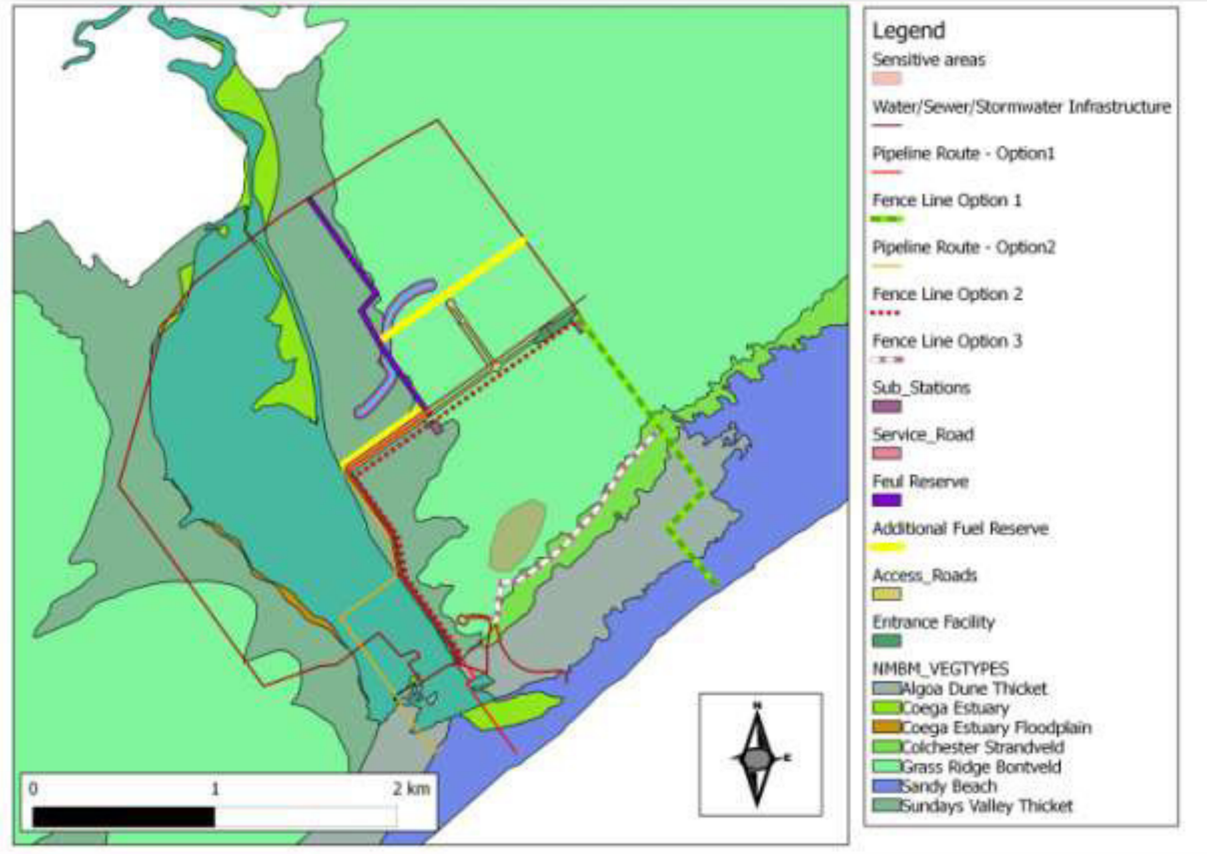


Figure 3: The spatial position of the associated infrastructure in relation to the regional vegetation types as defined by Stewart and Reeves (2010)

Sundays Valley Thicket (Mucina and Rutherford's (2006) Sundays Thicket), as seen in small valleys, along the proposed northern fence and along the eastern boundary of the Coega Estuary (Cerebos Saltworks), consists of solid, impenetrable stands of spinescent trees, shrubs and succulents, particularly *Portulacaria afra* (Spekboom), entangled in woody, succulent and spinescent lianas. It occurs on deep, red loamy to clayey soil and is dominated by *Aloe africana*, *Euclea undulata*, *Euphorbia ledienii* and *Schotia afra*.

Grass Ridge Bontveld (Mucina and Rutherford's (2006) Coega Bontveld), as seen in flat to gently sloping plains in most of the study area, occurs on deeper, calcareous, gravelly, paleo-dune sands towards the southern fence (Plate 1), where it becomes Algoa Dune Thicket vegetation towards the ocean (Plate 2). Algoa Dune Thicket is dominated by *Chrysanthemoides monilifera*, *Pterocelastrus tricuspidatus*, *Olea exasperata* and *Sideroxylon inerme*.

Grass Ridge Bontveld also occurs on shallower, gravelly clayey soil inland towards the Coega Estuary and Sundays Valley Thicket vegetation (Plate 3 and Plate 4). Grass Ridge Bontveld vegetation, restricted to the karst landscape created in the underlying limestone, consists of scattered, low bushclumps of Sundays Valley Thicket species, in a matrix of open grassland which contains species characteristic of Fynbos, Grassland and Succulent Karoo vegetation types. Bushclumps are dominated by *Aloe africana*, *Chrysanthemoides monilifera, Colpoon compressum*, *Euclea undulata*, *Pterocelastrus tricuspidatus* and *Sideroxylon inerme*. The grassy matrix in Grass Ridge Bontveld is dominated by *Cynodon dactylon*, *Eustachys paspaloides*, *Themeda triandra*, *Ficinia truncata*, *Acmadenia obtusata*, *Disparago ericoides*, *Euryops ericifolius*, *Gazania krebsiana*, *Gibbaria scabra*, *Jamesbrittenia microphylla*, *Lobostemon trigonus*, *Monsonia emarginata*, *Nylandtia spinosa*, *Osteospermum imbricatum* and *Pteronia incana*.

Plate 1: Grass Ridge Bontveld in the high, level areas towards the southern fence on gravelly, calcareous sandy soil.

Plate 2: Grass Ridge Bontveld and Algoa Dune Thicket towards the ocean.

Plate 3: Grass Ridge Bontveld in the lower, sloping areas towards the Coega Estuary and Sundays Valley Thicket on gravelly, clayey soil.

Plate 4: Grass Ridge Bontveld in the lower, sloping areas towards the Coega Estuary and Sundays Valley Thicket on gravelly, clayey soil.

The plant species of conservation concern (SCCs) and protected plant species – observed primarily within Algoa Dune Thicket, Grass Ridge Bontveld and Sundays Valley Thicket vegetation (Stewart and Reeves 2010) in the study area – are listed in Table 1. The most noteworthy SCCs are Port Elizabeth / Uitenhage endemics, namely *Agathosma gonaquensis* (Critically Endangered), *Cyrtanthus spiralis* (Endangered), *Euryops ericifolius* (Endangered), *Syncarpha recurvata* (Endangered) and *Rhombophyllum rhomboideum* (Endangered). A particularly large population of *Syncarpha recurvata* was observed during this assessment and is indicated as a highly sensitive habitat in all Figures in this report. This species occurs on calcrete outcrops, where these have been disturbed. Furthermore little is known on how to rehabilitate these areas, as this species cannot be transplanted or regrown ex situ.

Table 1: Plant species of conservation concern and protected plants found in the study area (SANBI, 2012; Provincial Nature Conservation Ordinance (PNCO), 1974; National Forest Act (NFA, 1998)).

Family	Species	Threat status (SANBI 2012)	Protected status (PNCO 1974, NFA 1998)	Life form
AMARYLLIDACEAE	*Boophone disticha* (L.f.) Herb.	Declining	Protected	Geophyte
AMARYLLIDACEAE	*Cyrtanthus spiralis* Burch. ex Ker Gawl.	EN	Protected	Geophyte
AMARYLLIDACEAE	*Haemanthus coccineus* L.	LC	Protected	Geophyte
APOCYNACEAE	*Pachypodium bispinosum* (L.f.) A.DC.	LC	Protected	Succulent
ASPHODELACEAE	*Aloe africana* Mill.	LC	Protected	Succulent
ASPHODELACEAE	*Aloe humilis* (L.) Mill.	LC	Protected	Succulent
ASTERACEAE	*Euryops ericifolius* (Bél.) B.Nord.	EN		Dwarf shrub
ASTERACEAE	*Syncarpha recurvata* (L.f.) B.Nord.	EN		Shrub
CRASSULACEAE	*Crassula perfoliata* L. var. *coccinea* (Sweet) G.D.Rowley	LC	Protected	Succulent
CRASSULACEAE	*Crassula perfoliata* L. var. *minor* (Haw.) G.D.Rowley	LC	Protected	Succulent
EUPHORBIACEAE	*Clutia daphnoides* Lam.	LC	Protected	Shrub
EUPHORBIACEAE	*Euphorbia clava* Jacq.	LC	Protected	Succulent
EUPHORBIACEAE	*Euphorbia fimbriata* Scop.	LC	Protected	Succulent
EUPHORBIACEAE	*Euphorbia gorgonis* A.Berger	LC	Protected	Succulent
EUPHORBIACEAE	*Euphorbia ledienii* A.Berger var. *ledienii*	LC	Protected	Succulent
EUPHORBIACEAE	*Euphorbia meloformis* Aiton subsp. *meloformis*	NT	Protected	Succulent
EUPHORBIACEAE	*Euphorbia rhombifolia* Boiss.	LC	Protected	Succulent
FABACEAE	*Indigofera tomentosa* Eckl. & Zeyh.	NT		Herb
GERANIACEAE	*Pelargonium reniforme* Curtis subsp. *reniforme*	DDD		Dwarf shrub, geophyte
IRIDACEAE	*Babiana sambucina* (Jacq.) Ker Gawl. subsp. *sambucina*	LC	Protected	Geophyte
IRIDACEAE	*Freesia corymbosa* (Burm.f.) N.E.Br.	LC	Protected	Geophyte
IRIDACEAE	*Tritonia gladiolaris* (Lam.) Goldblatt & J.C.Manning	LC	Protected	Geophyte
MESEMBRYANTHEMACEAE	*Aptenia haeckeliana* (A.Berger) Bittrich ex Gerbaulet	LC	Protected	Succulent
MESEMBRYANTHEMACEAE	*Delosperma echinatum* (Lam.) Schwantes	LC	Protected	Succulent
MESEMBRYANTHEMACEAE	*Glottiphyllum longum* (Haw.) N.E.Br.	LC	Protected	Succulent
MESEMBRYANTHEMACEAE	*Rhombophyllum rhomboideum* (Salm-Dyck) Schwantes	EN	Protected	Succulent
MESEMBRYANTHEMACEAE	*Ruschia cymbifolia* (Haw.) L.Bolus	LC	Protected	Succulent
ORCHIDACEAE	*Acrolophia capensis* (P.J.Bergius) Fourc.	LC	Protected	Geophyte
RUTACEAE	*Agathosma gonaquensis* Eckl. & Zeyh.	CR		Dwarf shrub
RUTACEAE	*Agathosma stenopetala* (Steud.) Steud.	VU		Dwarf shrub
SAPOTACEAE	*Sideroxylon inerme* L. subsp. *inerme*	LC	Protected (NFA)	Tree

Fauna

The faunal assessment was largely desktop, based on known distribution records, past assessments and expertise, supported by field observations. Table 2 lists the relevant faunal groups, their likelihood of occurring within the study area, together with their associated habitat and conservation status. The majority of species listed as well as observed with a conservation status were found in association with wetlands, rocky outcrops and the thicket / Bontveld vegetation types. The majority of these species were listed by the Provincial Nature Conservation Ordinance (PNCO).

Table 2: List of species recorded or likely to occur in the general study area, together with the conservation status. Where RDB = Red Data Book category SSC = Species of Special Concern, U = likely presence but unconfirmed Y = present and observed on site during assessment

Taxon	Common Name	RDB/SSC	Presence [x]
Amphibians			
Amietophrynus pardalis	Eastern Leopard Toad	PNCO, IUCN LC	U
Amietophrynus rangeri	Raucous Toad	PNCO, IUCN LC	U
Breviceps adspersus pentheri	Penther's Rain Frog	PNCO, IUCN LC	U
Cacosternum boettgeri	Common caco	PNCO, IUCN LC	U
Cacosternum nanum	Bronze Caco	PNCO, IUCN LC	U
Hyperolius marmoratus	Painted Reed Frog	PNCO, IUCN LC	U
Kassina senegalensis	Bubbling Kassina	PNCO, IUCN LC	Y
Semnodactylus wealii	Rattling Frog	PNCO, IUCN LC	U
Strongylopus fasciatus	Striped Stream Frog	PNCO, IUCN LC	U
Strongylopus grayii	Clicking Stream Frog	PNCO, IUCN LC	U
Tomopterna delalandii	Cape Sand Frog	PNCO, IUCN LC	U
Vandijkophrynus angusticeps	Cape sand Toad	PNCO, IUCN LC	U
Xenopus laevis	Common Platanna	PNCO, IUCN LC	U
Reptiles			
Acontias gracilicauda	Thin tailed legless skink	PNCO, IUCN LC	U
Acontias lineicauda	Algoa legless skink	PNCO, IUCN NT	U
Acontias meleagris orientalis	Eastern legless skink	PNCO, IUCNLC	U
Acontias percivali tasmani	Tasman's legless skink	PNCO, IUCN LC	Y
Agama atra	Southern rock agama	PNCO, IUCN LC	Y
Aspidelapse lubricus	Cape coral snake	PNCO, IUCN LC	U
Bitis arientans	Puff adder	PNCO, IUCN LC	Y (road fatality)
Bradypodion ventrale	Southern Dwarf Chameleon	PNCO, IUCN LC, CITIES 2	U
Causus rhombeatus	Night adder	PNCO, IUCN LC	U
Chersina angulata	**Angulate tortoise**	**PNCO, IUCN LC, CITIES 2**	**Y**
Cordylus cordylus	**Cape girdled lizard**	**PNCO, IUCN LC, CITIES 2**	**Y**
Cordylus tasmani	Tasman's girdled lizard	CITIES 2 ,PNCO, IUCN VU	U
Crotaphopeltis hotamboeia	Herald snake	PNCO, IUCN LC	Y
Dasypeltis scabra	Rhombic egg eater	PNCO, IUCN LC	U
Dispholidus typus	Boomslang	PNCO, IUCN LC	U
Duberria lutrix	Slug eater	PNCO, IUCN LC	Y
Gerrhosaurus flavigularis	Yellow throated plated lizard	PNCO, IUCN LC	Y
Hemachatus haemachatus	Rinkhals	PNCO, IUCN LC	U
Hemidactylus mabouia	Tropical house gecko	PNCO, IUCN LC	Y
Homopus areolatus	**Parrot-beaked padloper**	**PNCO, IUCN LC, CITIES 2**	**Y (Shell only)**
Homorolapse lacteus	Harlequin snake	PNCO, IUCN LC	U
Lamprophis aurora	Aurora house snake	PNCO, IUCN LC	U
Lamprophis capensis	Brown house snake	PNCO, IUCN LC	U
Lamprophis fuscus	Yellow bellied house snake	PNCO, IUCN NT	U
Lamprophis inornatus	Olive house snake	PNCO, IUCN LC	U
Leptotyphlops nigricans	Black thread snake	PNCO, IUCN LC	U

Taxon	Common Name	RDB/SSC	Presence [x]
Lycodonomorphus rufulus	Brown water snake	PNCO, IUCN LC	U
Lycophidion capense	Cape wolf snake	PNCO, IUCN LC	U
Lygodactylus capensis	Cape dwarf gecko	PNCO, IUCN LC	Y
Naja nivea	Cape cobra	PNCO, IUCN LC	U
Nucras intertexta	Spotted Sandveld Lizard	PNCO	U
Nucras lalandii	Delalandes sandveld lizard	PNCO, IUCN LC	U
Pachydactylus maculatus	Spotted thick toed gecko	PNCO, IUCN LC	Y
Pedioplanis pulchella	Pulchell's sand lizard	PNCO, IUCN LC	U
Pelomedusa subrufa	Marsh terrapin	PNCO, IUCN LC	Y (especially transformed pans / dams)
Philothamnus hoplogaster	Green water snake	PNCO, IUCN LC	U
Philothamnus natalensis occidentalus	Natal green snake	PNCO, IUCN LC	U
Philothamnus semivariegatus	Spotted bush snake	PNCO, IUCN LC	U
Prosymna sundevallii	Sundevalle's shovel snout	PNCO, IUCN LC	U
Psammophis crucifer	Crossed –marked sand snake	PNCO, IUCN LC	U
Psammophis notostictus	Karroo whip snake	PNCO, IUCN LC	U
Psammophylax rhombeatus	Rhombic skaapsteker	PNCO, IUCN LC	U
Pseudaspis cana	Mole snake	PNCO, IUCN LC	U
Pseudocordylus m. microlepidotus	Cape crag lizard	PNCO, IUCN LC	U
Rhinotyphlops lalandei	Delalande's beaked blind snake	PNCO, IUCN LC	U
Scelotes anguineus	Algoa dwarf burrowing skink	PNCO, IUCN LC, Endemic	U
Scelotes caffer	Cape dwarf burrowing skink	PNCO, IUCN LC	U
Stigmochelys pardalis	**Leopard Tortoise**	**PNCO, IUCN LC CITIES 2**	**Y**
Tetradactylus fitzsimonsi	Fitzsimon's long tailed seps	PNCO, IUCN VU	U
Tetradactylus seps	Short legged seps	PNCO, IUCN LC	U
Trachylepis capensis	Cape skink	PNCO, IUCN LC	Y
Trachylepis homalcephala	Red sided skink	PNCO, IUCN LC	Y
Trachylepis varia varie	Variable skink	PNCO, IUCN LC	Y
Varanus albigularis	Rock Monitor	PNCO, IUCN LC CITIES 2	U
Varanus niloticus	Water Monitor	PNCO, IUCN LC CITIES 2	U
Mammals			
Amblysomus corriae	Fynbos golden mole	PNCO, IUCN NT	U
Amblysomus hittentotus	**Hottentot Golden Mole**	**PNCO, IUCN DD**	**Y**
Aonyx capensis	African clawless otter	PNCO, IUCN LC	U
Atilax paludinosus	Marsh mongoose	PNCO, IUCN LC	U
Caracal caracal	Caracal	PNCO, IUCN LC	U
Cercopithecus pygerythrus	Vervet monkey	PNCO, IUCN LC	Y
Chlorotalpa duthieae	Duthie's golden mole	PNCO, IUCN LC	U
Crocidura cyanea	Reddish-Grey Musk Shrew	PNCO, IUCN DD	U
Crocidura flavescens	Greater red musk shrew	PNCO, IUCN LC	U
Cryptomys hottentotus	African mole rat	PNCO, IUCN LC	Y
Cynictis penicillata	Yellow mongoose	PNCO, IUCN LC	Y
Dendromus melanotis	Grey climbing mouse	PNCO, IUCN LC	U
Dendromus mesomelas	Brant's climbing mouse	PNCO, IUCN LC	U
Felis cattus	Domestic cat	Alien	Y
Felis silvestris	African wild cat	PNCO, IUCN LC	U
Galerella pulverulenta	Cape grey mongoose	PNCO, IUCN LC	Y
Genetta genetta	Small spotted genet	PNCO, IUCN LC	U
Genetta tigrina	Large spotted genet	PNCO, IUCN LC	U
Georychus capensis	Cape mole rat	PNCO, IUCN LC	U
Graphiurus murinus	Woodland dormouse	PNCO, IUCN LC	U
Graphiurus ocularis	Spectacled dormouse	PNCO, IUCN LC	U
Herpestes ichneumon	Large grey mongoose	PNCO, IUCN LC	U
Hystrix africaeaustralis	Cape porcupine	PNCO, IUCN LC	Y
Ictonyx striatus	Striped pole cat	PNCO, IUCN LC	U
Lepus saxatilis	Scrub hare	PNCO, IUCN LC	Y

Taxon	Common Name	RDB/SSC	Presence x
Macroscelides proboscideus	Round eared elephant shrew	PNCO, IUCN LC	U
Mastomys natalensis	Natal multimammate mouse	PNCO, IUCN LC	U
Mellivora capensis	Honey badger	PNCO, IUCN CITES 3 NT	U
Micaelamys namaquensis	Namaqua rock mouse	LC	U
Mus minutoides	Pygmy mouse	LC	U
Mus musculus	House mouse	Alien	U
Myosorex varius	Forest Shrew	PNCO, IUCN DD	U
Neoromicia capensis	Cape serotine bat	PNCO, IUCN LC	U
Nycteris thebaica	Egyptian slit faced bat	PNCO, IUCN LC	U
Orycteropus afer	Aardvark	PNCO, IUCN LC	Y
Otocyon megalotis	Bat eared fox	PNCO, IUCN LC	U
Otomys irroratus	Vlei rat	PNCO, IUCN LC	Y
Otomys unisulcatus	Bush vlei rat	PNCO, IUCN LC	U
Panthera pardus	Leopard	PNCO, IUCN LC	U
Papio cynocephalus ursinus	Chacma baboon	PNCO, IUCN LC	U
Philantomba monticola	Blue duiker	PNCO, IUCN CITES2 VU	U
Poecilogale albinucha	African striped weasel	PNCO, IUCN VU	U
Potamochoerus larvatus	Bush pig	PNCO, IUCN LC	Y
Raphicerus campestris	Steenbok	PNCO, IUCNLC	U
Raphicerus melanotis	Grysbok	PNCO, IUCNLC	Y
Rattus rattus	House rat	PNCO, IUCN LC	U
Rhabdomys pumilio	Four striped grass mouse	PNCO, IUCN LC	Y
Saccostomus campestris	Pouched mouse	PNCO, IUCNLC	U
Suncus infinitesimus	Least dwarf shrew	PNCO, IUCN E	U
Sylvicapra grimmia	Common duiker	PNCO, IUCN LC	Y
Tragelaphus scriptus	Bush buck	PNCO, IUCN LC	Y
Vulpes chama	Cape Fox	PNCO, IUCN LC	U

1.3.2 Birds

According to the South African Bird Atlas Project (SABAP1) (Harrison *et al.*, 1997), an average of 145 bird species have been recorded from the quarter degree grid cells (QDGC) that overlaps with the study site. However, recent data suggests that the diversity of habitat types prevalent on the study sites is more likely to sustain approximately 184 species (www.sabap2.adu.org.za). However, Table 3 lists birds, together with their known habitats and respective conservation status as recorded by Dr Paul Martin (the independent Environmental Control Officer of the Coega IDZ and Port of Ngqura). The table highlights the presence of 73 bird species, with conservation concern of the 220 species that have been recorded by Dr Martin in the past 5 – 6 years.

Table 3: A list of Red Data species that could occur on the study sites (according to Harrison et al., 1997; Barnes, 2000).

Indicated are: conservation status, habitat preference, whether the species was observed. Conservation status: **E** = endangered, **V** = vulnerable, **NT** = near-threatened, **P** = protected, **Ra** = raptor or owl, **B** = Listed in Appendix II of the Bonn Convention, **WA** = listed in Annexure 2 of the African-Eurasian Waterbird Agreement, RL = IUCN Red List; SA = South African Red Data Book (Barnes 2000), DEA = Threatened and Protected Species Regulations (DEAT 2007).

Common Name	Scientific Name	Conservation Status	Habitat
African Black Oystercatcher	*Haematopus moquini*	**NT** (RL,SA); **WA**	Beach
African Marsh-Harrier	*Circus ranivorus*	**V** (SA); **Ra**	Wetland
African Penguin	*Spheniscus demersus*	**E** (RL); **V** (SA); **B; WA**	Marine
African Sacred Ibis	*Threskiornis aethiopicus*	**WA**	Wetland
African Spoonbill	*Platalea alba*	**B; WA**	Wetland
Barn Owl	*Tyto alba*	**Ra**	Bontveld; Terrestrial
Black Harrier	*Circus maurus*	**V** (RL); **NT** (SA); **Ra**	Bontveld
Black Sparrowhawk	*Accipiter melanoleucus*	**Ra**	Thicket
Black-headed Heron	*Ardea melanocephala*	**WA**	Terrestrial

Common Name	**Scientific Name**	**Conservation Status**	**Habitat**
Black-necked Grebe	*Podiceps nigricollis*	**WA**	Saltpan
Black-shouldered Kite	*Elanus caeruleus*	**Ra**	Terrestrial
Black-winged Stilt	*Himantopus himantopus*	**WA**	Saltpans; Wetland
Blue Crane	*Anthropoides paradiseus*	**V** (RL,SA); **WA**	Bontveld; Grassland
Booted Eagle	*Hieraaetus pennatus*	**Ra**	Bontveld; Terrestrial
Cape Cormorant	*Phalacrocorax capensis*	**NT** (RL,SA); **WA**	Marine; Saltpan
Cape Gannet	*Morus capensis*	**V (**RL,SA); **WA**	Marine
Cape Teal	*Anas capensis*	**WA**	Saltpans
Caspian Tern	*Sterna caspia*	**NT** (SA); **B**; **WA**	Saltpans; Coastal
Cattle Egret	*Bubulcus ibis*	**WA**	Grassland
Chestnut-banded Plover	*Charadrius pallidus*	**NT** (RL,SA); **WA**	Saltpans
Common Greenshank	*Tringa nebularia*	**B; WA**	Saltpans; Coega Mouth
Common Moorhen	*Gallinula chloropus*	**WA**	Fresh water
Common Ringed Plover	*Charadrius hiaticula*	**B; WA**	Saltpans
Common Tern	*Sterna hirundo*	**B; WA**	Saltpans; Coastal
Common Whimbrel	*Numenius phaeopus*	**B; WA**	Saltpans; Coega Mouth
Crowned Lapwing	*Vanellus coronatus*	**WA**	Bontveld; Grassland
Curlew Sandpiper	*Calidris ferruginea*	**B; WA**	Saltpans
Damara Tern	*Sterna balaenarum*	**E** (SA); **NT** (RL); **B**; **WA**	Coastal
Denham's Bustard	*Neotis denhami*	**V** (SA); **NT** (RL)	Bontveld; Grassland
Egyptian Goose	*Alopochen aegyptiaca*	**WA**	Wetland
Greater Flamingo	*Phoenicopterus ruber*	**NT** (SA); **B**; **WA**	Saltpan
Grey Heron	*Ardea cinerea*	**WA**	Saltpan; Coega River
Grey Plover	*Pluvialis squatarola*	**B; WA**	Saltpans; Coega Mouth
Grey-headed Gull	*Chroicocephalus cirrocephalus*	**WA**	Saltpans; Coega Mouth
Half-collared Kingfisher	*Alcedo semitorquata*	**NT (**SA)	Coega River
Hartlaub's Gull	*Chroicocephalus hartlaubii*	**WA**	Saltpans; Coega Mouth
Jackal Buzzard	*Buteo rufofuscus*	**Ra**	Bontveld; Terrestrial
Kelp Gull	*Larus dominicanus*	**WA**	Saltpans; Coastal
Kittlitz's Plover	*Charadrius pecuarius*	**WA**	Saltpans
Knysna Woodpecker	*Campethera notata*	**NT** (RL,SA)	Thicket
Lanner Falcon	*Falco biarmicus*	**NT** (SA); **Ra**	Terrestrial; Saltpan
Lesser Flamingo	*Phoenicopterus minor*	**NT** (RL,SA); **B**; **WA**	Saltpan
Little Egret	*Egretta garzetta*	**WA**	Saltpan; Coega Mouth
Little Grebe	*Tachybaptus ruficollis*	**WA**	Saltpan; Coega River
Little Stint	*Calidris minuta*	**B; WA**	Saltpans
Little Tern	*Sterna albifrons*	**B; WA**	Saltpans; Coastal
Marsh Sandpiper	*Tringa stagnatilis*	**B; WA**	Saltpans
Martial Eagle	*Polemaetus bellicosus*	**V** (SA); **NT** (RL); **Ra**	Bontveld; Terrestrial
Osprey	*Pandion haliaetus*	**B; Ra**	Saltpans; Coastal
Peregrine Falcon	*Falco peregrinus*	**NT** (SA); **B**; **Ra**	Terrestrial; Saltpan
Pied Avocet	*Recurvirostra avosetta*	**B; WA**	Saltpans
Purple Heron	*Ardea purpurea*	**WA**	Coega River
Red-billed Teal	*Anas erythrorhyncha*	**WA**	Fresh water
Red-knobbed Coot	*Fulica cristata*	**WA**	Fresh water
Rock Kestrel	*Falco rupicolis*	**Ra**	Terrestrial
Roseate Tern	*Sterna dougallii*	**E** (SA); **WA**	Coega Mouth
Ruddy Turnstone	*Arenaria interpres*	**B; WA**	Saltpans; Beach
Ruff	*Philomachus pugnax*	**B; WA**	Saltpans
Sanderling	*Calidris alba*	**B; WA**	Saltpans; Beach
Sandwich Tern	*Thalasseus sandvicensis*	**B; WA**	Saltpans; Coastal
Secretarybird	*Sagittarius serpentarius*	**V** (RL); **NT** (SA); **Ra**	Bontveld; Grassland
South African Shelduck	*Tadorna cana*	**WA**	Wetland
Southern Pale Chanting Goshawk	*Melierax canorus*	**Ra**	Bontveld; Thicket
Spotted Eagle-Owl	*Bubo africanus*	**Ra**	Thicket; Terrestrial
Spur-winged Goose	*Plectropterus gambensis*	**WA**	Overfly
Steppe Buzzard	*Buteo (buteo) vulpinus*	**Ra**	Bontveld; Terrestrial
Swift Tern	*Thalasseus bergii*	**B; WA**	Saltpans; Marine
Three-banded Plover	*Charadrius tricollaris*	**WA**	Wetland
White Stork	*Ciconia ciconia*	**B; WA**	Overfly
White-breasted Cormorant	*Phalacrocorax (carbo) lucidus*	**WA**	Wetland
Yellow-billed Duck	*Anas undulata*	**WA**	Fresh water
Yellow-billed Kite	*Milvus [migrans] aegyptius*	**Ra**	Terrestrial

1.3.3 Aquatic environment

Two aquatic systems were observed on site with the relevant delineations shown in Figure 4. The observed water bodies could be divided into two broad groups, namely watercourses (a drainage line) and the Coega Estuary.

Due to the dense thicket vegetation, the drainage line did not show a distinct channel, and was thus delineated based on available topographical data, hydrophilic plant occurrence and 1:50 000 mapping data. Figure 4 shows the delineated drainage line with a 32m buffer. The impact of crossing this drainage line is addressed in Sections 1.6.6 and 1.6.7 of this report.

Due to the lack of aquatic vegetation and any flows within this system, standard Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) scoring systems could not be applied. However this system forms an important corridor between the upper Bontveld areas of the site and the estuary and any infrastructure crossing these areas, would require a Water Use License Application (Section 21 c & i). The need for a Water Use Licence was confirmed by the Department of Water Affairs (refer to Appendix B of this report) on 3 May 2013. The Department of Water Affairs confirmed that the current Water Use Licence for the Coega Estuary (Portion 11 of farm Coegas River Mouth 303) (Licence Number: 28066994 and File Number B191/2/1230/1, date 13 April 2005), cannot be used if the proposed crossing of the drainage line was not included in the licence. The current Water Use Licence issued to Transnet specifically authorises water uses 21 (c) and (i) of the National Water Act (Act 36 of 1998) for the Coega Estuary, and hence does not include the proposed drainage line crossing. Hence, a new water use licence is required. This process will be initiated with a pre-application meeting with the Department of Water Affairs.

Several wetlands have also been indicated in the National Wetland Inventory (Nel *et al.*, 2011) dataset (Figure 4). However those which could be impacted on by the project are man-made or artificial systems, associated with the salt works. These were not assessed in terms of PES or EIS as the proposed infrastructure would thus not require any wetland related Water Use License Applications (i.e. 500m from a wetland boundary), i.e. there are no wetland areas other than the estuary within the development footprint. Estuaries are not considered under the National Water Act, and as such would not require a Water Use License should any development take place within these areas.

Figure 4 also indicates the present estuary delineation, produced by the CSIR as part of a national delineation assessment of all estuaries (CSIR, 2011). This delineation was based on the locality of the 5m contour and would thus capture all area inundated during spring high tides. This is also indicated in Figure 2.

The Coega Estuary has been regarded as a transformed system due to the presence of the salt works and the development of the port. The system is now constrained to a narrow channel from the river mouth to the N2 Bridge and shows little tidal variation due to this restricted connection between the marine and riverine environments. A portion of the proposed project (i.e. road reserve) may encroach on the channel, thus narrowing the system.

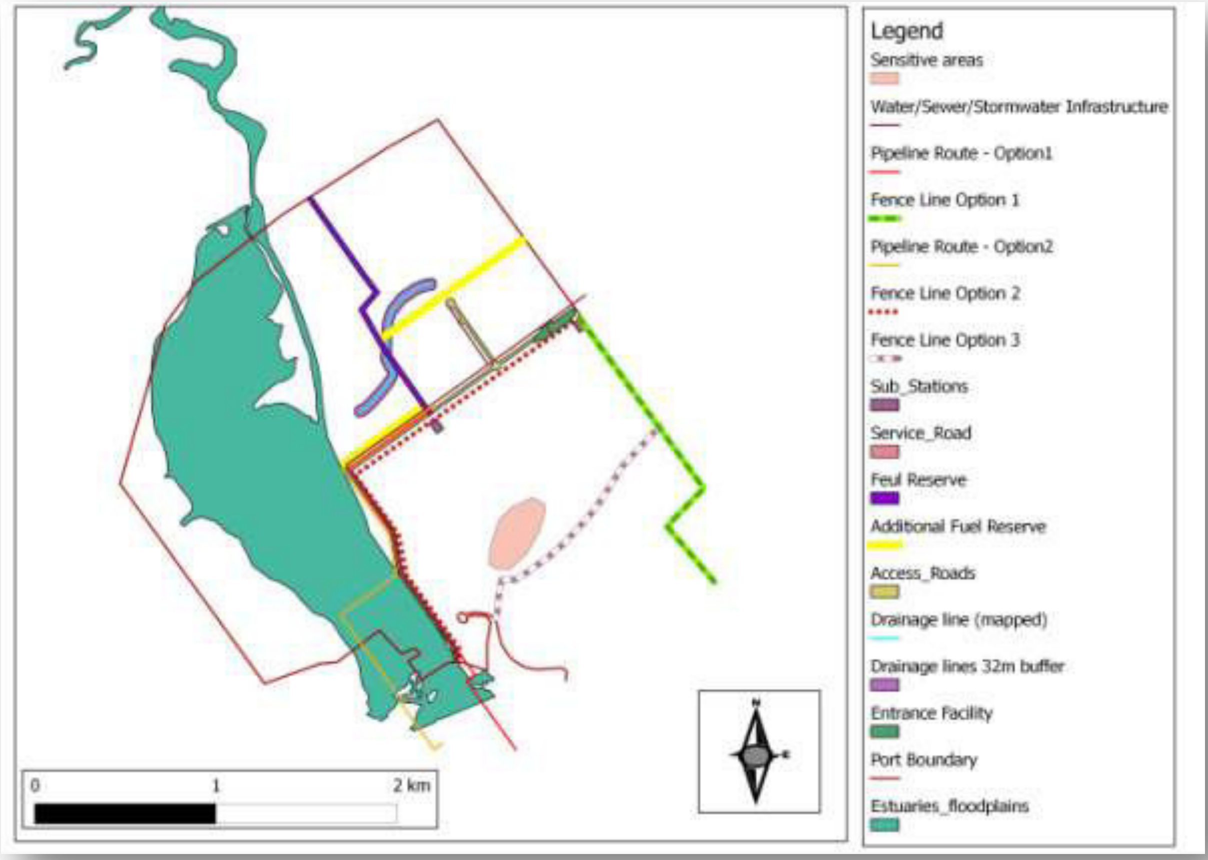


Figure 4: Observed water bodies within the study area and 32m buffers where required (note sensitive area shown is a terrestrial habitat)

1.4 IDENTIFICATION OF KEY ISSUES

For the purposes of this assessment and to adequately assess the potential impacts, the key issues have been divided in the terrestrial and aquatic environments. These are based on the habitats that would be available and the species that would frequent them.

1.4.1 Terrestrial Environment

The following key issues have been identified:

1. Loss of vegetation habitat and a reduction or changes to ecological processes and functioning as a result of construction (i.e. Open Space areas);
2. Loss of species of special concern and SSC habitat as a result of construction;
3. Increased risk of alien plant invasion in disturbed areas;
4. Increase animal road mortality; and
5. Permanent barriers to animal movement.

1.4.2 Aquatic environment

The following key issues have been identified:

1. Diversion and increased velocity of surface water flows – Changes to the hydrological regime and increased potential for erosion;

2. Diversion and increased velocity of surface water flows – reduction in permeable surfaces; and
3. Impact of changes to water quality.

1.4.3 Comments raised by I&APs

The following comments were raised by I&APs during the 40-day review of the Background Information Document.

Comment	Commenter	Response
Boundary Fence Design: One of the mitigation recommendations in the original EIR is that fencing should allow for the passage of small and medium sized mammals and that all forms of mesh fencing should be avoided. The present design of the Port fence complies with this requirement while meeting ISPS requirements	Dr Paul Martin of the Coega Development Corporation	This has been incorporated as a direct recommendation into this report.
Thicket on the Eastern Banks of the Coega River: Obviously the servitudes / road down the eastern bank of the Coega River are of great concern, especially as it appears cutting a considerable distance into the existing steep eastern bank is required and part of the existing OSMP area will be affected. Mitigation recommendations in the original EIR include: All slopes exceeding 1:3 gradient should ideally not be developed but where development does take place the slopes must be stabilised and rehabilitated. Development in the dense Mesic Succulent Thicket habitat on the steep slopes on both banks of the Coega River should be avoided. The RoD requires that viable corridors must be maintained between habitats to allow migration of animals (the servitude between the tank farm and Coega River will interfere with a corridor along the eastern bank of the Coega River	Dr Paul Martin of the Coega Development Corporation	This has been incorporated as a direct recommendation into this report.
I have recently submitted an avifauna report to Annick Walsdorff (CSIR) providing full details of avifauna on the Coega Saltpans, lower Coega River and Port of Ngqura that is very relevant to this project and should be taken cognisance of	Dr Paul Martin of the Coega Development Corporation	The major findings of that report has been included in this report, especially with regard updating the number of species of birds being observed in the study area.

Refer to Appendix E of the Final Basic Assessment Report for comments that were raised by I&APs (relating to impacts on terrestrial and aquatic ecology) during the 40-day review of the Draft Basic Assessment Report. Responses to these comments have also been provided in Appendix E, as part of the Comments and Responses Report.

1.5 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

Locally the South African Constitution, seven (7) Acts and one (1) international treaty allow for the protection of natural vegetation, rivers and water courses. These ecosystems are thus protected from the destruction or in the case of aquatic systems from pollution by the following:

- Section 24 of The Constitution of the Republic of South Africa;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act, 2004 (Act 10 of 2004);
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);
- Nature and Environmental Conservation Ordinance (No. 19 of 1974);
- National Forest Act (No. 84 of 1998); and
- National Heritage Resources Act (No. 25 of 1999).

Most of the plant species listed in Table 1 will thus require permits from the Provincial authorities or the Department of Agriculture, Fisheries and Forestry (one tree species).

Apart from NEMA, the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) will also apply to this project. The CARA has categorised a large number of invasive plants together with associated obligations of the land owner. A number of Category 1 & 3 plants were found, thus the contractors and Transnet (during the operational phase) should take precautions to minimise the spread of these species. This should be done through proper stockpile management (topsoil) and suitable rehabilitation of disturbed areas after construction.

In accordance with GN R.544 Activity 26 (Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)) several listed activities were assessed. In particular an amendment of the National Environmental Management: Biodiversity Act or NEM:BA (Act No 10 of 2004) that has now been promulgated, lists 225 threatened ecosystems based on vegetation type (Vegmap 2006). Some of these do occur within the region. Should a vegetation type or ecosystem be listed, actions in terms of NEM:BA are triggered, however **NONE** of these listed vegetation types occur within the study area.

The existing Transnet Water Use License does not include the proposed drainage line crossing, therefore a new Water Use License is required (refer to Appendix B of this report for confirmation of this from the Department of Water Affairs). This report will be used as per the relevant submissions to the Department of Water Affairs in terms the registration/licensing (as required) for Section 21 c & i water uses with regard any of the infrastructure crossing the drainage line.

With regards to development within 500m of the Coega Estuary, a wetland, no WULA would be required as this is considered part of the intertidal zone (marine) and thus does not fall within the Department of Water Affairs' jurisdiction.

1.5.1 Provincial legislation and policy

Natural vegetation

With regards to protected flora, the Eastern Cape Provincial Nature and Environmental Conservation Ordinance (Ordinance 19 of 1974) (PNCO) includes a list of protected flora. Any plants found within the sites have been described in this report. Should any species that are listed in the ordinance be found on site then the relevant permits should be obtained by the proponent for their relocation or destruction, as required. Specific localities were not identified due to the time constraints of the study, but all the species observed and requiring permits are shown in Table 1.

Aquatic ecosystems

Various guidelines on suitable development have been issued in a number of the provinces. Currently there are no accepted aquatic buffer distances provided by the provincial authorities. Until such a system is developed, it is recommended that a 32m for rivers and water courses be adhered to and has been common practice in other parts of the Nelson Mandela Bay Municipality (refer to Figure 4).

1.6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

During this investigation it was found that the greatest number of impacts would occur within the terrestrial environment and to a limited degree in the aquatic or the drainage line areas. Potential issues could also arise from the construction in and near to the Coega Estuary and these impacts were also assessed. It should be noted that all the impacts will have a direct impact on the environment. Indirect impacts were mostly found in the aquatic environment, which result in downstream impacts on the river system.

With regards to the decommissioning phase, this was not assessed as the impacts would remain the same as those shown in the operational phase. This is due to the lack of irreversibility of the impacts due to the nature of the soils and vegetation having a low rehabilitation potential. Although the potential for rehabilitation is low, it is recommended that a rehabilitation plan is compiled and implemented during the decommissioning phase in order to ensure that disturbed areas are rehabilitated (to some extent) post-decommissioning.

1.6.1 Loss of vegetation and Open Space Management habitat

Nature of the impact

The project and in particular the fences, pipelines (or the required fuel reserves), substations and roads will require the clearing of vegetation. It is anticipated that the area cleared would be wider than the structure required, especially with regard any lay down areas required for site offices or storage during the construction period.

The impact would largely be uniform for all the alternatives, with the exception of areas associated with Fence Line option 3 as this would pass nearby sensitive vegetation types, which contain Species of Special Concern. These areas also form part of the Coega OSMP (Revision 9) (1.1 & 1.1a) as shown in Figure 5 below and are indicated as Critical Biodiversity Areas in the NMBM CAP (Figure 6).

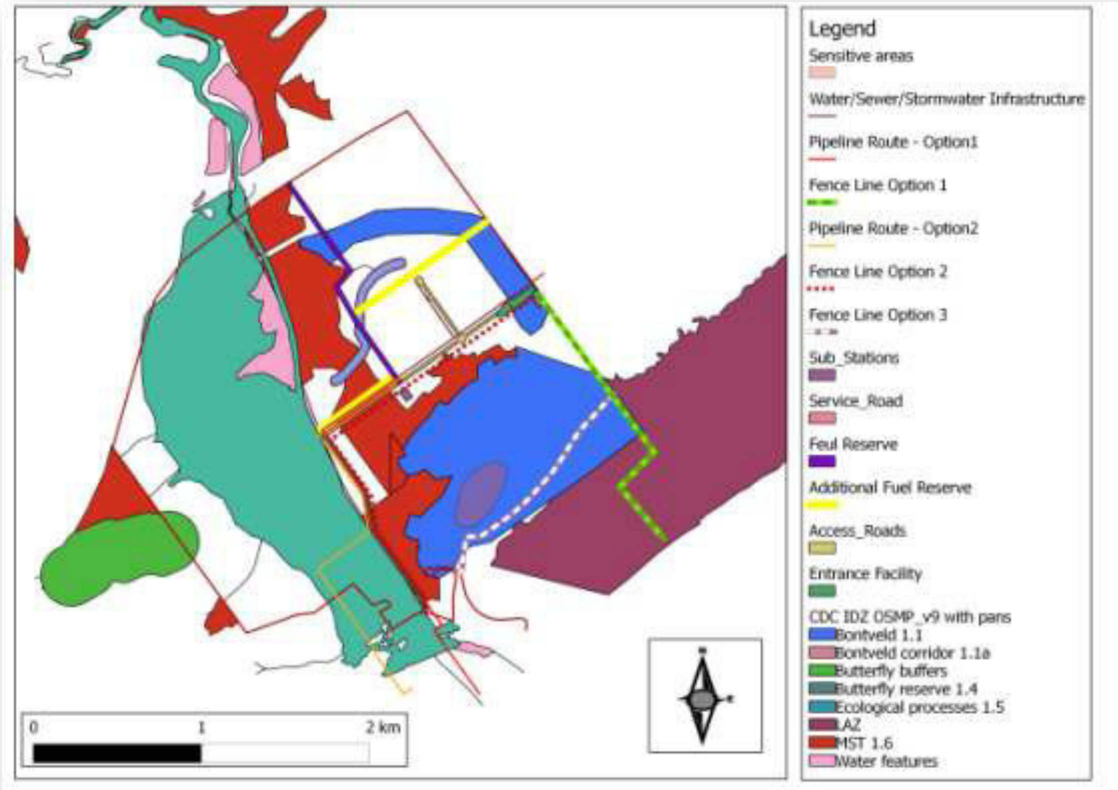


Figure 5: The spatial extent of the proposed infrastructure layout in relation to the Coega OSMP Revision 9

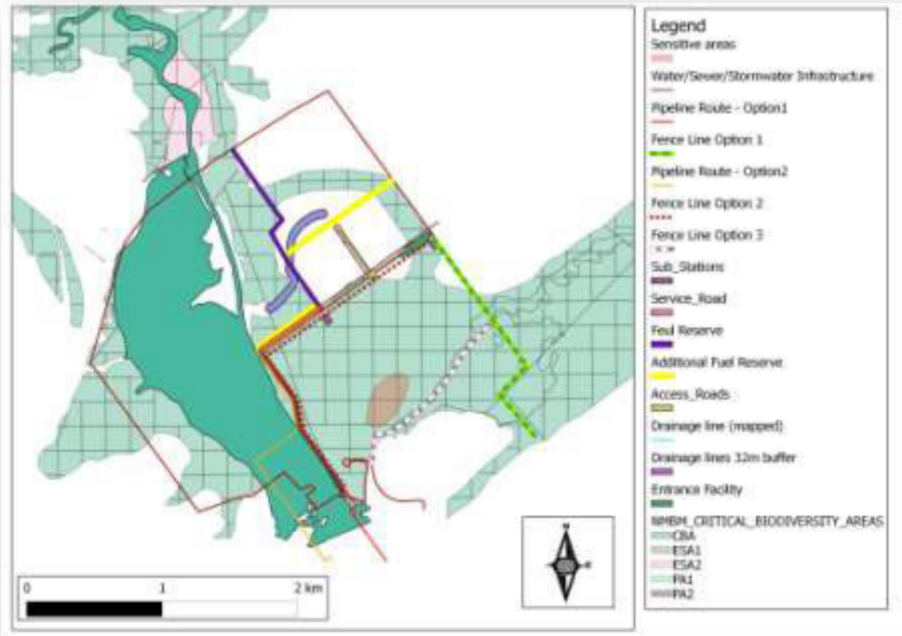


Figure 6: The spatial extent of the proposed infrastructure layout in relation to the NMBM Conservation Action Plan (Critical Biodiversity Areas)

Significance of impacts without mitigation

The construction phase would have the greatest impact on the surrounding vegetation. This will result in the disturbance of the vegetation and soils along the entire routes or footprints. The overall significance of the impact would be rated as **HIGH** (negative) should any of the Algoa Dune Strandveld or Open Space areas be impacted upon (Table 4 and Figure 5). The inclusion of the additional fuel reserve and widening of the fuel reserve (for the Bulk Liquid pipelines) to the west will increase the footprint thus reducing connectivity between the open spaces areas. The road reserve may also impact or rather encroach on the present canalised section of the Coega Estuary.

The operational phase of the project would also have limited impact on the surrounding vegetation once the plants are allowed to re-establish themselves; with the overall impact would be **LOW** (Table 5) regardless of the options.

Proposed mitigation:

- All options within OSMP area 1.1 and 1.1a should be kept to a minimum as well as any infrastructure proposed within the Algoa Dune Strandveld (Construction and Operational Phase). Refer to Figure 5 which indicates where the OSMP is traversed by the proposed project.
- Boundary Fence: It is understood that Transnet are currently assessing three different routing options for the fence line. Transnet need to take into consideration several factors when selecting the fence line option. These factors include technical, financial and environmental implications of each fence line option, as well as the future expansion plans for the Port of Ngqura. Fence line Option 1 follows the existing Port Boundary towards the shoreline. Fence line Option 2 will travel adjacent to the Access Road. This option will have implications for the future development of the Port such that it will divide the east bank of the Port. Fence line Option 3 follows a track in a partly degraded area. This latter option should be considered very carefully due to it close proximity to the *Syncarpha recurvata* populations indicated in this report and is such the least preferred option from an ecological point of view. Should this option be required, then the *Syncarpha* population should be cordoned off prior to the construction process and considered a No-Go area. Provided the *Syncarpha* population is treated as a no-go area the impact of Fence line Option 3 will be minimal.
- Clearing of vegetation should be kept to a minimum, keeping the width and length of the earthworks to a minimum (Construction phase).
- Re-vegetation as part of a rehabilitation plan is always advocated, however due to the low annual rainfall (normal conditions), this may not be practical. It is suggested that the shallow topsoil layer be stockpiled separately from the subsoil layers. All stockpiles should not exceed a maximum of 2 m in height and be properly maintained in accordance with the Transnet Standard Environmental Specifications. When the construction has been completed, the topsoil layers, which contain seed and vegetative material, should be reinstated last thus allowing plants to rapidly re-colonise the bare soil areas (Construction Phase). Monitoring should be undertaken on bare soil areas for erosion (e.g. rilling) and suitable mechanisms to abate erosion in line with the Transnet Construction EMP. During the operational phase, it is recommended that maintenance of rehabilitated areas is undertaken in accordance with the rehabilitation and landscaping plan, as well as the project specific environmental specification that will be prepared for this proposed landside structures and infrastructure project based on this and the other specialist studies conducted for this project.
- Alien plant regrowth should also be monitored, and any such species should be removed during the construction and operational phases in line with the relevant Transnet environmental specifications and the Transnet Alien Vegetation Management Plan for the Port of Ngqura.
- After construction the Coega Estuary channel, where impacted upon must be reinstated and where possible diversions should be limited for short periods. The new channel must

accommodate current flows (low flow and floods), i.e. simulate the current hydrological regime.

Significance of impact with mitigation

With the above mitigation measures in place, the impact on the vegetation would remain localised, with natural re-vegetation happening within a short time period, resulting in a low risk and **Low** impact significance (construction and operation phases Table 4 & 5).

1.6.2 Loss of species of special concern and their habitats

Nature of the impact

A large number of protected plants and their habitats were observed during this study. Fence Line option 3 passes nearby sensitive vegetation types, which contain Species of Special Concern. These areas also form part of the Coega OSMP (1.1 & 1.1a) and are indicated as Critical Biodiversity Areas in the NMBM CAP (Figure 6).

Significance of impacts without mitigation

The construction phase would have the greatest impact on the surrounding vegetation. This will result in the disturbance of the vegetation and soils along the entire routes or footprints. The overall significance of the impact would be rated as **HIGH** (negative) should any of the Algoa Dune Strandveld or Open Space areas be impacted upon (Table 4).

The operational phase of the project would also have limited impact on the surrounding vegetation once the plants are allowed to re-establish themselves; with the overall impact would be **LOW** (Table 5) regardless of the options.

Proposed mitigation:

- All options within OSMP area 1.1 and 1.1a should be kept to a minimum as well as any infrastructure proposed within the Algoa Dune Strandveld. Refer to Figure 5 which indicates where the OSMP is traversed by the proposed project.
- Clearing of vegetation should be kept to a minimum, keeping the width and length of the earthworks to a minimum (Construction Phase).
- Table 1 indicates the species that will require permits prior to removal or destruction prior to construction commencing. These species, where possible, should then be relocated to the suitable nursery being established by Transnet for use in other parts of the IDZ.

Significance of impact with mitigation

With the above mitigation measures in place, the impact on the vegetation would remain localised, with natural re-vegetation happening within a short time period, resulting in a low risk and **Low** impact significance (construction and operations Table 4 & 5).

1.6.3 Increased risk of alien plant invasion

Nature of the impact

A few small areas contain alien plants, and these are mostly limited to disturbed areas along all of the present farm tracks and the actual Tank Farm site.

Significance of impacts without mitigation

The resultant disturbance of the vegetation and soils along the entire route during the construction phase would allow for the further spread of alien plants if not curtailed. However due to the present state of the vegetation the potential impact would be **HIGH** (negative) considering the regional importance of the terrestrial plant species found in the construction and operational phases (Table 4 & 5).

Proposed mitigation:

- Clearing of vegetation should be kept to a minimum, keeping the width and length of the earth works to a minimum (Construction Phase).
- Re-vegetation as part of a rehabilitation plan is always advocated, however due to the low annual rainfall (normal conditions), this may not be practical. It is suggested that the shallow topsoil layer be stockpiled separately from the subsoil layers. All stockpiles should not exceed a maximum of 2 m in height and be properly maintained in accordance with the Transnet Standard Environmental Specifications. When the construction has been completed, the topsoil layers, which contain seed and vegetative material, should be reinstated last thus allowing plants to rapidly re-colonise the bare soil areas (Construction Phase). Monitoring should be undertaken on bare soil areas for erosion (e.g. rilling) and suitable mechanisms to abate erosion in line with the Transnet Construction EMP. During the operational phase, it is recommended that maintenance of rehabilitated areas is undertaken in accordance with the rehabilitation and landscaping plan, as well as the project specific environmental specification that will be prepared for this proposed landside structures and infrastructure project based on this and the other specialist studies conducted for this project.
- It is understood that Transnet currently holds an Alien Vegetation Management Plan for the Port of Ngqura, which needs to be implemented for the proposed project. This plan must be updated if required. The plan needs to include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.

Significance of impact with mitigation

With the above mitigation measures in place, the impact on the vegetation would remain localised, with natural re-vegetation happening within a short time period, resulting in a low risk and **LOW** impact significance in the construction and operational phases (Table 4 & 5). This is also based on the fact that during the operational phase on-going clearing and maintenance practices will be employed by the management of the IDZ and Port of Ngqura.

1.6.4 Increased animal road mortality

Nature of the impact

Frequent truck/vehicle road activity will result in mortality of animals that cross. In the case of this study area mammals and reptiles would be the most frequent road kills, for reasons that include searching for food, basking during the day, “moon basking” which occurs when reptiles lie on roads at night to absorb warmth from the road surface, or merely to cross to the other side. The risk to amphibians would be lower in the study area due to the lack of available habitat, which limits the need for migration events usually seen in the breeding season.

Significance of impacts without mitigation

The significance of the impacts due to the potential species occurring in the region, the diversity of habitats and food sources that are still relatively intact increases the potential for road kills. Without mitigation, the impact would be rated as **MEDIUM** (Table 4 & 5).

Proposed mitigation

Mitigation with respect to minimising these incidents is minimal and not always practical. Therefore awareness should be created during the staff induction programme. Staff should be made aware of the general speed limits as well the potential animals that may cross and how to react in these situations.

Furthermore it is suggested that mountable kerbing be used, which allows for the movement of animals across any roads, especially the smaller species of rodent, tortoises, snakes and lizards.

Significance of impact with mitigation

With mitigation, the impact would be rated as **LOW** (Table 4 & 5).

1.6.5 Permanent barriers to animal movement

Nature of the impact

The installation of the boundary fencing would pose as a barrier the animals that move within the area. This would obviously restrict those species that are not able to move through the fencing such as the medium sized mammals.

Significance of impacts without mitigation

This impact would only have significance in the operational phase, and should only mesh type fencing be used, then the impact would have a **MEDIUM** rating (Table 5). This is based on the low number of medium sized animals found in the area.

Proposed mitigation:

As recommended in the original Coega IDZ Environmental Impact Report, boundary fencing should allow for the passage of small and medium sized mammals and all forms of mesh fencing should be avoided. The present design of the Port fence complies with this requirement while meeting ISPS requirements. The fence design should also allow for migration of tortoises, and thus tortoise holes must be provided as per current Port fence design.

Furthermore it is suggested that mountable kerbing be used, which allows for the movement of animals across any roads, especially the smaller species of rodent, tortoises, snakes and lizards.

Significance of impact with mitigation

This impact would be reduced to **LOW** (Table 5), based on the low number of medium sized animals found in the area.

1.6.6 Diversion and increased velocity of surface water flows – Changes to the hydrological regime and increased potential for erosion

Nature of the impact

Due to the nature of the proposed project this would be an operational phase impact, limited to once the roads in particular, stormwater management features, erosion protection structures have been constructed. These structures could interfere with natural run-off patterns, diverting flows and increasing the velocity of surface water flows. This then has the potential to increase the potential for erosion as natural vegetation would be lost in the study area, while increasing sedimentation of downstream areas, once flows subside. This will be of specific concern where the proposed fuel reserves will cross the drainage line located to the north west of the tank farm area.

Significance of impacts without mitigation

The un-vegetated soils within the study area are moderately susceptible to erosion when subjected to high flows (high volumes and velocities), and head-cuts can readily form within the water courses. These create bed and bank instability within the aquatic ecosystems and consequent sedimentation of downstream areas. Should surface water flows be diverted, changes in regional hydrological patterns could also occur, i.e. lead to the drying out of certain areas.

Due to the nature of the study area hydrology, its present state and the present impacts, the negative impact, although permanent would be localised and probably result in a low intensity impact. Thus the overall significance of the impact would be rated as **MEDIUM** (Table 6 & 7) in the operations phase.

Proposed mitigation:

It is understood that there is an existing Storm Water Management Plan in place. Transnet need to ensure that this plan is updated to cater for this proposed project development. Gabion structures and rocks should be used where appropriate. It is recommended that stormwater and any runoff generated by the hard surfaces should be discharged into energy dissipation structures, where required. These could be used to enhance the sense of place, if they are planted with indigenous vegetation. These energy dissipation structures should be placed in a manner that flows are managed prior to being discharged back into the natural water courses, thus not only preventing erosion, but also supporting the maintenance of natural base flows within these systems, i.e. hydrological regime (water quantity and quality) is maintained. The crossing point should also not trap any run-off, thereby creating inundated areas, but allow for free flowing water courses. The stormwater structures and infrastructure should be maintained on a regular basis.

The Subsequent Environmental Impact Report for the Port of Ngqura explains that “slopes exceeding a 1:3 gradient should ideally not be developed but were development does take place the slopes must be stabilised and rehabilitated” (CES, 2000, page 83). In the case of this project, areas with slopes of 1:3 or greater are unavoidable as a result of the proposed access road. As a result, it is recommended that suitable stabilizing structures and erosion prevention controls be implemented during the operational phase.

Significance of impact with mitigation

Although permanent changes to the local hydrological regime are probable, the intensity of negative impact in the operational phase would be Low, thus the overall significance of this impact would be **LOW** (operations phase) as the annual volumes of run-off that support any large riparian systems is low (Table 6 & 7).

1.6.7 Diversion and increased velocity of surface water flows – reduction in permeable surfaces

Nature of the impact

Road construction involves the creation of hard surfaces, which usually includes the provision of stormwater drainage and the removal of vegetation. This will divert further flows away from one water body, while increasing flow velocities of run-off into another during the operational phase. This impact is closely linked to the previous impact, but the reduction in permeable surfaces does require a separate assessment due to the need for surface water to permeate into shallow, as well as deeper groundwater systems. This will be of particular concern where the proposed fuel reserves will cross the drainage line located to the north west of the tank farm area.

Significance of impacts without mitigation

The soils within the study area are susceptible to erosion when subjected to high flows (high volumes and velocities), with head-cuts readily forming within the water courses. This creates bed and bank instability of the aquatic ecosystems and consequent sedimentation of downstream areas. Should surface water flows be diverted, changes in regional hydrological patterns could also occur, i.e. lead to the drying out of certain areas. The drying out of areas also reduces the potential for surface water to recharge shallow and deep groundwater systems which serves as a long term source of water for the larger river system riparian systems.

Due to the nature of the study area hydrology and its present state and the surrounding impacts, the negative impact, although permanent would be localised and probably result in a low intensity impact. Thus the overall significance of the impact would be rated as **MEDIUM** operations phase (Table 7).

Proposed mitigation

It is understood that there is an existing Storm Water Management Plan in place. Transnet need to ensure that this plan is updated to cater for this proposed project development. Gabion structures and rocks should be used where appropriate. It is recommended that stormwater and any runoff generated by the hard surfaces should be discharged into energy dissipation structures, where required. These could be used to enhance the sense of place, if they are planted with indigenous vegetation. These energy dissipation structures should be placed in a manner that flows are managed prior to being discharged back into the natural water courses, thus not only preventing erosion, but also supporting the maintenance of natural base flows within these systems, i.e. hydrological regime (water quantity and quality) is maintained. The stormwater structures and infrastructure should be maintained on a regular basis.

Significance of impact with mitigation

Although permanent changes to the local hydrological regime are probable, the intensity of negative impact in the operational phase would be Low, thus the overall significance of this impact would be **LOW**. This impact is also partially reversible should the roads and related infrastructure be decommissioned, i.e. changes to local soil structure and surrounding vegetation would still be apparent in the long term (Table 7).

1.6.8 Impact of changes to water quality

Nature of the impact

The Coega Development Corporation initiated a surface water and groundwater monitoring programme for the Coega River system in 2000. For purposes of this study, it is assumed due to the activities in the study area, that the aquatic systems may already contain high levels of nitrates, phosphates and organic matter, but would not exceed any allowable limits.

During construction various materials, such as sediments, diesel, oils and cement, will pose a threat to the continued functioning of the instream and adjacent vegetated areas, if by chance it is dispersed via surface run-off, or are allowed to permeate into the groundwater. The potential negative changes to water quality during the operational phase would be limited to sedimentation and erosion related issues assessed in Section 1.6.6 as well as pollution arising from hydrocarbon spillages as assessed below. These negative impacts would persist into the medium term.

Significance of impacts without mitigation

Changes to water quality (surface and groundwater) impact on the functioning of plants and other instream biota. This impact without mitigation would have a **MEDIUM** significance, as excessive pollution will also impact on instream conditions due the introduction of toxins. Potential toxins include the following:

- Grout and concrete – these products contain cement which increases the pH (basic) of surfaces waters impairs the metabolism and breathing physiology of aquatic organisms
- Hydrocarbons (shutter oil, other lubricants, grease and fuels) – The persistent impact of these pollutants is varied, but can enact negatively on metabolic pathways, cellular structures (plant and animal), respiration and gene stability (heavy metals)

Proposed mitigation

- Fuels used for construction and chemicals used for road surfacing must be stored safely on site and surrounded by bunds. Chemical storage containers must be regularly inspected so that any leaks are detected early (Construction Phase).
- Littering and contamination of water sources during construction must be prevented by effective construction camp management (Construction Phase).
- Emergency plans must be in place in case of spillages onto road surfaces and water courses (Construction and Operational Phase).
- All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised (Construction Phase).
- Stockpiles must be located away from river channels i.e. greater than 32m or outside of the 1:100 floodline whichever is greater (Construction Phase). Refer to Figure 4 which illustrates the 32m buffer of the drainage line, as well as the delineation of the Coega Estuary.
- The construction camp and necessary ablution facilities meant for construction workers must be beyond the 32m buffer described previously and shown in Figure 4 (Construction Phase).
- Erosion and sedimentation into water bodies must be minimised through the effective stabilisation (such as silt traps, gabions and Reno mattresses or similar suitable stabilising structures) and the re-vegetation of any disturbed areas (Operational Phase).
- Install silt traps, sumps and oil separators as part of the Stormwater Management System, where required (Operational Phase).

Significance of impact with mitigation

Should the construction site and the works be managed properly, the negative impacts would remain localised and in the short-term. This would result in an overall significance of **LOW** as the introduction of any pollutants would be limited with mitigation (Table 6 & 7).

Table 4: Impact assessment summary table for the Construction Phase on the terrestrial environment

Construction Phase										
Direct Impacts										
Impact Description	**Mitigation**	**Spatial Extent**	**Intensity**	**Duration**	**Reversibility**	**Irreplaceability**	**Probability**	**Significance & Status**		**Confidence**
								Without Mitigation	**With Mitigation**	
Loss of vegetation and OSMP areas	See Section 1.6.1	Regional	High	Long Term	Low	High	Probable	High Negative	Low Negative	High
Loss of SSC and their habitats	See Section 1.6.2	National	High	Long Term	Low	High	Probable	High Negative	Low Negative	High
Increased risk of alien plant invasion	See Section 1.6.3	Local	Medium	Long Term	Low	High	Probable	High Negative	Low Negative	High
Increased animal road mortality	See Section 1.6.4	Local	Medium	Long Term	Low	Low	Probable	Medium Negative	Low Negative	High
Permanent barriers to animal movement	See Section 1.6.5	N/A								

Table 5: Impact assessment summary table for the Operational Phase on the terrestrial environment

Operational Phase										
Direct Impacts										
Impact Description	**Mitigation**	**Spatial Extent**	**Intensity**	**Duration**	**Reversibility**	**Irreplaceability**	**Probability**	**Significance & Status**		**Confidence**
								Without Mitigation	**With Mitigation**	
Loss of vegetation and OSMP areas	See Section 1.6.1	Regional	Low	Long Term	Low	High	Probable	Low Negative	Low Negative	High
Loss of SSC and their habitats	See Section 1.6.2	National	Low	Long Term	Low	High	Probable	Low Negative	Low Negative	High
Increased risk of alien plant invasion	See Section 1.6.3	Local	Medium	Long Term	Low	High	Probable	High Negative	Low Negative	High
Increased animal road mortality	See Section 1.6.4	Local	Medium	Long Term	Low	Low	Probable	Medium Negative	Low Negative	High
Permanent barriers to animal movement	See Section 1.6.5	N/A								

Table 6: Impact assessment summary table for the Construction Phase on the aquatic environment

Construction Phase										
Direct Impacts										
Impact Description	**Mitigation**	**Spatial Extent**	**Intensity**	**Duration**	**Reversibility**	**Irreplaceability**	**Probability**	**Significance & Status**		**Confidence**
								Without Mitigation	**With Mitigation**	
Diversion and increased velocity of surface water flows – reduction in permeable surfaces	N/A as this would only result after construction has been completed									
Impact of changes to water quality	See Section 1.6.8	Local	Medium	Long Term	Medium	Low	Probable	Medium Negative	Low Negative	High

Table 7: Impact assessment summary table for the Operational Phase on the aquatic environment

Operational Phase										
Direct Impacts										
Impact Description	**Mitigation**	**Spatial Extent**	**Intensity**	**Duration**	**Reversibility**	**Irreplaceability**	**Probability**	**Significance & Status**		**Confidence**
								Without Mitigation	**With Mitigation**	
Diversion and increased velocity of surface water flows – Changes to the hydrological regime and increased potential for erosion	See Section 1.6.6	Local	Low	Long Term	Medium	Low	Probable	Medium Negative	Low Negative	High
Diversion and increased velocity of surface water flows – reduction in permeable surfaces	See Section 1.6.7	Local	Low	Short Term	Medium	Low	Probable	Medium Negative	Low Negative	High
Impact of changes to water quality	See Section 1.6.8	Local	Medium	Short Term	Medium	Low	Probable	Medium Negative	Low Negative	High

1.7 CONCLUSION

The overall study concluded that with suitable mitigation the landside structures and infrastructure would have a limited (LOW) impact on the surrounding terrestrial and aquatic environments should the following be incorporated into the design or considered:

- All engineering options within Open Space Management Plan area 1.1 and 1.1a (Revision 9) should be kept to a minimum as well as any infrastructure proposed within the Algoa Dune Strandveld. Refer to Figure 5 which indicates where the OSMP is traversed by the proposed project.
- Boundary Fence: It is understood that Transnet are currently assessing three different routing options for the fence line. Transnet need to take into consideration several factors when selecting the fence line option. These factors include technical, financial and environmental implications of each fence line, as well as the future expansion plans for the Port of Ngqura. Fence line Option 1 follows the existing Port Boundary towards the shoreline. Fence line Option 2 will travel adjacent to the Access Road. This option will have implications for the future development of the Port such that it will limit divide the east bank of the Port. Although Fence line Option 3 follows a track in a partly degraded area, it is in close proximity to a *Syncarpha recurvata* population and as such is the least preferred option from an ecological point of view. Should this option be required, then the *Syncarpha* population should be cordoned off prior to the construction process and considered a No-Go area.
- The Subsequent Environmental Impact Report for the Port of Ngqura explains that "slopes exceeding a 1:3 gradient should ideally not be developed but were development does take place the slopes must be stabilised and rehabilitated" (CES, 2000, page 83). In the case of this project, areas will slopes of 1:3 or greater are unavoidable as a result of the access road. As a result, it is recommended that suitable stabilizing structures and erosion prevention controls be implemented.
- All mitigations stated in this report need to be implemented.
- The relevant permits for the protected plant species need to be obtained in hand prior to construction and, where possible, all rescued plants must be retained in a suitable nursery. It is understood that Transnet will be establishing a suitable site within the Port of Ngqura where species can be relocated to and appropriately maintained.

The Contractor should also refer to the detailed Transnet Capital Projects Construction Environmental Management Plan and Standard Environmental Specifications. It is understood that Transnet will also develop a project specific environmental specification for this proposed landside structures and infrastructure project based on the outcomes of this and the other specialist studies conducted for the project. It is recommended that the specification deals with the following in depth:

- A plant rescue and protection plan, which allows for the transplantation of conservation important species from areas to be transformed. Particular species include:
  - *Aloe striata*
  - *Haworthia translucens*
  - *Cyrtanthus clavatus*
  - *Cyrtanthus spiralis*
  - *Bergeranthus addoensis*
  - *Bergeranthus longisepalus*
  - *Bergeranthus scapiger*
  - *Trichodiadema bulbosum*
  - *Cotyledon orbiculata var. flanaganii*
  - *Euphorbia globosa*
- A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation phases, including timeframes for restoration, which must indicate rehabilitation within the shortest possible time after completion of construction activities to reduce the

amount of habitat converted at any one time and to speed up the recovery of natural habitats.

- Staff, especially during the construction phase, should be informed that no trapping, snaring or feeding of any animal will be allowed. This can be incorporated into the staff induction and environmental awareness training.
- An alien invasive management plan to be implemented during construction and operation phases. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.
- Any works within the proposed development that may encroach on the Coega Estuary, must account for the reinstatement of the channel to its former size and capacity. Should any diversions occur, then these must be limited to a short period, prior to the reinstatement of the channel.

1.8 REFERENCES

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1.9 APPENDIX A

Full list of plant species, including species of conservation concern and protected species, observed in the study area during the site visit.

Family	Species	Threat status (SANBI 2012)	Protected status (PNCO 1974, NFA 1998)	Life form
ACANTHACEAE	*Barleria irritans* Nees	LC		Dwarf shrub
ACANTHACEAE	*Blepharis procumbens* (L.f.) Pers.	LC		Dwarf shrub
AIZOACEAE	*Aizoon rigidum* L.f.	LC		Succulent
AMARYLLIDACEAE	*Boophone disticha* (L.f.) Herb.	Declining	Protected	Geophyte
AMARYLLIDACEAE	*Cyrtanthus spiralis* Burch. ex Ker Gawl.	EN	Protected	Geophyte
AMARYLLIDACEAE	*Haemanthus coccineus* L.	LC	Protected	Geophyte
ANACARDIACEAE	*Searsia crenata* (Thunb.) Moffett	LC		Tree
APOCYNACEAE	*Pachypodium bispinosum* (L.f.) A.DC.	LC	Protected	Succulent
ARALIACEAE	*Cussonia thyrsiflora* Thunb.	LC		Shrub
ASPHODELACEAE	*Aloe africana* Mill.	LC	Protected	Succulent
ASPHODELACEAE	*Aloe humilis* (L.) Mill.	LC	Protected	Succulent
ASPHODELACEAE	*Bulbine frutescens* (L.) Willd.	LC		Succulent
ASPHODELACEAE	*Bulbine latifolia*	LC		Succulent
ASPHODELACEAE	*Bulbine narcissifolia* Salm-Dyck	LC		Succulent
ASPHODELACEAE	*Gasteria bicolor* Haw. var. *bicolor*	LC		Succulent
ASPHODELACEAE	*Trachyandra* sp.			Geophyte
ASTERACEAE	*Berkheya heterophylla*	LC		Herb
ASTERACEAE	*Chrysanthemoides monilifera*	LC		Shrub
ASTERACEAE	*Chrysocoma ciliata* L.	LC		Shrub
ASTERACEAE	*Cineraria lobata* L'Hér. subsp. *lobata*	LC		Dwarf shrub
ASTERACEAE	*Cotula sericea* L.f.	LC		Herb
ASTERACEAE	*Disparago ericoides* (P.J.Bergius) Gaertn.	LC		Dwarf shrub
ASTERACEAE	*Euryops algoensis* DC.	LC		Shrub
ASTERACEAE	*Euryops ericifolius* (Bél.) B.Nord.	EN		Dwarf shrub
ASTERACEAE	*Felicia filifolia*	LC		Shrub
ASTERACEAE	*Felicia hyssopifolia*	LC		Shrub
ASTERACEAE	*Gazania krebsiana*	LC		Herb
ASTERACEAE	*Gibbaria scabra* (Thunb.) Norl.	LC		Shrub
ASTERACEAE	*Helichrysum rosum*	LC		Dwarf shrub
ASTERACEAE	*Helichrysum teretifolium* (L.) D.Don	LC		Dwarf shrub
ASTERACEAE	*Metalasia aurea* D.Don	LC		Shrub
ASTERACEAE	*Osteospermum imbricatum*	LC		Shrub
ASTERACEAE	*Pteronia incana* (Burm.) DC.	LC		Shrub
ASTERACEAE	*Oedera genistifolia* (L.) Anderb. & K.Bremer	LC		Dwarf shrub
ASTERACEAE	*Relhania pungens*	LC		Dwarf shrub
ASTERACEAE	*Curio acaulis* (L.) P.V.Heath	NE		Succulent
ASTERACEAE	*Curio radicans* (L.) P.V.Heath	LC		Succulent
ASTERACEAE	*Senecio scaposus* DC. var. *scaposus*	LC		Succulent
ASTERACEAE	*Senecio junceus* (DC.) Harv.	LC		Succulent
ASTERACEAE	*Syncarpha recurvata* (L.f.) B.Nord.	EN		Shrub
BORAGINACEAE	*Lobostemon trigonus* (Thunb.) H.Buek	LC		Shrub
BRASSICACEAE	*Heliophila linearis* (Thunb.) DC. var. *linearis*	LC		Herb
CAMPANULACEAE	*Wahlenbergia* sp.			Dwarf shrub
CELASTRACEAE	*Lauridia tetragona* (L.f.) R.H.Archer	LC		Shrub

CELASTRACEAE	*Pterocelastrus tricuspidatus* (Lam.) Walp.	LC		Tree
CRASSULACEAE	*Cotyledon orbiculata*			Succulent
CRASSULACEAE	*Crassula capitella* Thunb. subsp. *thyrsiflora* (Thunb.) Toelken	LC		Succulent
CRASSULACEAE	*Crassula expansa*	LC		Succulent
CRASSULACEAE	*Crassula mesembryanthoides*	LC		Succulent
CRASSULACEAE	*Crassula muscosa*	LC		Succulent
CRASSULACEAE	*Crassula orbicularis* L.	LC		Succulent
CRASSULACEAE	*Crassula perfoliata* L. var. *coccinea* (Sweet) G.D.Rowley	LC	Protected	Succulent
CRASSULACEAE	*Crassula perfoliata* L. var. minor (Haw.) G.D.Rowley	LC	Protected	Succulent
CRASSULACEAE	*Crassula perforata* Thunb. subsp. *perforata*	LC		Succulent
CRASSULACEAE	*Crassula pubescens* Thunb. subsp. *rattrayi* (Schönland & Baker f.) Toelken	LC		Succulent
CRASSULACEAE	*Crassula subulata* L. var. *subulata*	LC		Succulent
CRASSULACEAE	*Crassula tetragona*	LC		Succulent
CRASSULACEAE	*Crassula vaginata* Eckl. & Zeyh. subsp. *vaginata*	LC		Succulent
CYPERACEAE	*Ficinia truncata* (Thunb.) Schrad.	LC		Graminoid
EBENACEAE	*Euclea undulata* Thunb.	LC		Tree
ERIOSPERMACEAE	*Eriospermum brevipes* Baker	LC		Geophyte
EUPHORBIACEAE	*Clutia daphnoides* Lam.	LC	Protected	Shrub
EUPHORBIACEAE	*Euphorbia clava* Jacq.	LC	Protected	Succulent
EUPHORBIACEAE	*Euphorbia fimbriata* Scop.	LC	Protected	Succulent
EUPHORBIACEAE	*Euphorbia gorgonis* A.Berger	LC	Protected	Succulent
EUPHORBIACEAE	*Euphorbia ledienii* A.Berger var. *ledienii*	LC	Protected	Succulent
EUPHORBIACEAE	*Euphorbia meloformis* Aiton subsp. *meloformis*	NT	Protected	Succulent
EUPHORBIACEAE	*Euphorbia rhombifolia* Boiss.	LC	Protected	Succulent
FABACEAE	*Argyrolobium* sp.			Dwarf shrub
FABACEAE	*Aspalathus* sp.			Shrub
FABACEAE	*Indigofera* sp.			Herb
FABACEAE	*Indigofera tomentosa* Eckl. & Zeyh.	NT		Herb
GERANIACEAE	*Monsonia emarginata* (L.f.) L'Hér.	LC		Herb
GERANIACEAE	*Pelargonium alchemilloides* (L.) L'Hér.	LC		Dwarf shrub
GERANIACEAE	*Pelargonium laxum* (Sweet) G.Don subsp. *laxum*	LC		Shrub, succulent
GERANIACEAE	*Pelargonium peltatum* (L.) L'Hér.	LC		Climber, succulent
GERANIACEAE	*Pelargonium reniforme* Curtis subsp. *reniforme*	DDD		Dwarf shrub, geophyte
HYACINTHACEAE	*Albuca schoenlandii* Baker	LC		Geophyte
HYACINTHACEAE	*Drimia anomala* (Baker) Baker	LC		Geophyte
HYACINTHACEAE	*Drimia elata* Jacq.	DDT		Geophyte
HYACINTHACEAE	*Ledebouria socialis* (Baker) Jessop	LC		Geophyte
HYPOXIDACEAE	*Hypoxis* sp.			Geophyte
HYPOXIDACEAE	*Hypoxis stellipilis* Ker Gawl.	LC		Geophyte
IRIDACEAE	*Babiana sambucina* (Jacq.) Ker Gawl. subsp. *sambucina*	LC	Protected	Geophyte
IRIDACEAE	*Freesia corymbosa* (Burm.f.) N.E.Br.	LC	Protected	Geophyte
IRIDACEAE	*Tritonia gladiolaris* (Lam.) Goldblatt & J.C.Manning	LC	Protected	Geophyte
LAMIACEAE	*Plectranthus madagascariensis* (Pers.) Benth. var. *madagascariensis*	LC		Herb, succulent
MALVACEAE	*Hermannia althaeoides* Link	LC		Dwarf shrub
MALVACEAE	*Hermannia diffusa* L.f.	LC		Dwarf shrub
MALVACEAE	*Hermannia salviifolia*	LC		Dwarf shrub
MESEMBRYANTHEMACEAE	*Delosperma echinatum* (Lam.) Schwantes	LC	Protected	Succulent

MESEMBRYANTHEMACEAE	*Glottiphyllum longum* (Haw.) N.E.Br.	LC	Protected	Succulent
MESEMBRYANTHEMACEAE	*Rhombophyllum rhomboideum* (Salm-Dyck) Schwantes	EN	Protected	Succulent
MESEMBRYANTHEMACEAE	*Ruschia cymbifolia* (Haw.) L.Bolus	LC	Protected	Succulent
MESEMBRYANTHEMACEAE	*Aptenia haeckeliana* (A.Berger) Bittrich ex Gerbaulet	LC	Protected	Succulent
OLEACEAE	*Olea exasperata* Jacq.	LC		Tree
ORCHIDACEAE	*Acrolophia capensis* (P.J.Bergius) Fourc.	LC	Protected	Geophyte
OROBANCHACEAE	*Hyobanche sanguinea* L.	LC		Herb, parasite
PLUMBAGINACEAE	*Limonium scabrum* (Thunb.) Kuntze var. *scabrum*	LC		Dwarf shrub
POACEAE	*Cynodon dactylon* (L.) Pers.	LC		Graminoid
POACEAE	*Eustachys paspaloides* (Vahl) Lanza & Mattei	LC		Graminoid
POACEAE	*Panicum maximum* Jacq.	LC		Graminoid
POACEAE	*Setaria sphacelata*	LC		Graminoid
POACEAE	*Stipagrostis zeyheri*	LC		Graminoid
POACEAE	*Themeda triandra* Forssk.	LC		Graminoid
POLYGALACEAE	*Nylandtia spinosa* (L.) Dumort.	LC		Shrub
POLYGALACEAE	*Polygala microlopha* DC. var. *microlopha*	LC		Dwarf shrub
PORTULACACEAE	*Adromischus cristatus*	LC		Succulent
PORTULACACEAE	*Portulacaria afra* Jacq.	LC		Succulent, tree
RHAMNACEAE	*Scutia myrtina* (Burm.f.) Kurz	LC		Tree
RUTACEAE	*Acmadenia obtusata* (Thunb.) Bartl. & H.L.Wendl.	LC		Dwarf shrub
RUTACEAE	*Agathosma apiculata* G.Mey.	LC		Dwarf shrub
RUTACEAE	*Agathosma gonaquensis* Eckl. & Zeyh.	CR		Dwarf shrub
RUTACEAE	*Agathosma stenopetala* (Steud.) Steud.	VU		Dwarf shrub
SANTALACEAE	*Thesium* sp.			Parsite, shrub
SAPOTACEAE	*Sideroxylon inerme* L. subsp. inerme	LC		Tree
SCROPHULARIACEAE	*Jamesbrittenia microphylla* (L.f.) Hilliard	LC		Dwarf shrub
THYMELACEAE	*Passerina corymbosa* Eckl. ex C.H.Wright	LC		Dwarf shrub
ZYGOPHYLLACEAE	*Zygophyllum maritimum* Eckl. & Zeyh.	LC		Dwarf shrub, scrambler

1.10 APPENDIX B

CORRESPONDENCE FROM DEPARTMENT OF WATER AFFAIRS

Page 1 of 4

Rohaida Abed - RE: Provision of Landside Structure and Infrastructure to service the Bulk Liquid Storage and Handling Facility in the Port of Ngqura within the Coega IDZ

From: Tshatshu Portrait <TshatshuP@dwa.gov.za>
To: "RAbed@csir.co.za" <RAbed@csir.co.za>
Date: 03/05/2013 09:00
Subject: RE: Provision of Landside Structure and Infrastructure to service the Bulk Liquid Storage and Handling Facility in the Port of Ngqura within the Coega IDZ
CC: Bloem Marisa <BloemM@dwa.gov.za>, "Galoshe Anda (PLZ)" <GalosheA@dwa.gov...

Good morning Rohaida

The pipeline across the drainage line for the above-mentioned proposed project will require new water use authorisation. An existing authorisation cannot be used if this activity was not covered or if the drainage line crossing was not included.

I hope you find this in order.

Kind regards,

Portrait

From: Bloem Marisa
Sent: 02 May 2013 01:20 PM
To: Tshatshu Portrait
Subject: FW: Provision of Landside Structure and Infrastructure to service the Bulk Liquid Storage and Handling Facility in the Port of Ngqura within the Coega IDZ

From: Bloem Marisa
Sent: Monday, March 11, 2013 2:32 PM
To: Tshatshu Portrait; Mgxwati Lungiswa (PLZ)
Subject: FW: Provision of Landside Structure and Infrastructure to service the Bulk Liquid Storage and Handling Facility in the Port of Ngqura within the Coega IDZ

Hi Portrait and Lungiswa

Please see comment from consultant regarding the above mentioned project and respond according.

Portrait, I am aware that your unit had no concerns but in relation to the question please respond if it is needed.

Regards

Marisa

From: Rohaida Abed [RAbed@csir.co.za]
Sent: Monday, March 11, 2013 2:14 PM
To: Bloem Marisa
Cc: Ismail Banoo; brian@itsnet.co.za; Sandy Wren
Subject: Re: Provision of Landside Structure and Infrastructure to service the Bulk Liquid Storage and Handling Facility in the Port of Ngqura within the Coega IDZ

Dear Marisa

I hope you are well. As you are aware, the CSIR were appointed by Eastern Cape Infrastructure Joint Venture on behalf of Transnet SOC Limited to carry out a Basic Assessment for the provision of Landside Structures and Infrastructure to service the proposed Oiltanking Grindrod Calulo (OTGC) Bulk Liquid Storage and Handling Facility in the Port of Ngqura. Public Process Consultants have been appointed to manage the Public Participation Process for the proposed project. The Draft Basic Assessment Report was released to the public and stakeholders for a 40-day comment period extending from 4 February 2013 to 15 March 2013.

Thank you for providing us with the attached comments (as referred to in the email below) for the proposed project.

As highlighted in the Draft Basic Assessment Report, the proposed project will include the provision of an approximately 30 m wide pipeline servitude for the proposed Tank Farm users. This 30 m wide servitude may also include a service road constructed within for pipeline maintenance purposes. For easy reference, I have extracted the relevant maps of the Pipeline Servitude for Tank Farm Users (depicted by the green (Map 1) and purple (Map 2) lines) and the coordinates of the servitude from the Draft BAR (please see attached).

The Biodiversity Assessment mentions the following in relation to the Aquatic Environment:
- Two aquatic systems were observed on site and these can be divided into two broad groups namely watercourses (a drainage line) and the Coega Estuary.
- Due to the dense thicket vegetation, the drainage line did not show a distinct channel, and was thus delineated based on available topographical data, hydrophilic plant occurrence and 1:50 000 mapping data.
- Any infrastructure crossing these areas, would require a Water Use License Application (Section 21 c & i) should these not be covered by the current Water Use License that is in place for the Port of Ngqura.

Transnet Ltd were granted a Water Use License for the Coega River (i.e. Portion 11 of farm Coegas River Mouth 303) (Licence Number: 28066994 and File Number B191/2/1230/1, date 13 April 2005). Based on this, we would appreciate your feedback on the following points:
- Does the proposed drainage line crossing (i.e. for the Pipeline Servitude for Tank Farm Users) fall within the conditions of Transnet's existing Water Use License?
- If yes, does this indicate that a new Water Use License Application will not be required for the proposed project?

We would greatly appreciate your assistance with the above.

Please do not hesitate to contact us if you have any queries or if require additional information.

Thank you and kind regards

Rohaida

CSIR Environmental Management Services
Tel: 031 242 2318

>>> Sandy Wren <sandy@publicprocess.co.za> 08/03/2013 17:48 >>>

From: "Bloem Marisa" <BloemM@dwa.gov.za>
To: "Sandy Wren" <sandy@publicprocess.co.za>
Subject: Provision of Landside Structure and Infrastructure to service the Bulk Liquid Storage and Handling Facility in the Port of Ngqura within the Coega IDZ

Good Day Sandy

Please find attached comments from the Technical Unit of the Department of Water Affairs for the above mentioned project.

Kind Regards

Marisa Bloem
Department of Water Affairs: Port Elizabeth
Water Use Authorization Section
Private Bag X6041
6000

Tel: 041 501 0717
Mobile: 083 232 9822
Fax2Email: 086 560 5042
bloemm@dwa.gov.za<mailto:bloemm@dwa.gov.za>

[Description: Picture1]

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13.8.3 Air Quality Impact Statement

PROPOSED CHANGES TO BAY TERMINALS TANK FARM COEGA IDZ

1 INTRODUCTION

Lethabo Air Quality Specialists (Pty) Ltd (LAQS) was appointed by Messrs Bay Terminals in 2018 to carry out an air quality impact (AQI) assessment on a proposed tank farm development in the Coega Industrial Development Zone (IDZ).

LAQS's findings were contained in its report "*Air Quality Impact Assessment prepared for Bay Terminals Tank Farm, Coega Industrial Development Zone, Port Elizabeth*" dated June 2018. The findings of the AQI assisted in the issuing of an atmospheric emissions license (AEL) for the tank farm.

Since the AEL was issued, changes to the composition of the fuel throughput are under evaluation as Messrs Orion Engineered Carbons (OEC) wishes to source the heavy oils used for the production of carbon black through the tank farm. This necessitates changes to the fuel pipeline and the application for environmental authorisation of these changes is being conducted by WSP's Cape Town offices.

As a change to the composition of the liquid fuels flowing through the tank farm could have an impact on emissions of VOCs, and the air quality in the area, WSP requested LAQS to determine the degree to which the changes would impact on emissions and air quality.

This report gives LAQS assessment of the potential impact that the proposed changes will have on air quality in the vicinity of the tank farm.

2 ORIGINAL OPERATIONS

The total throughput of all fuels through the proposed tank farm is 2 700 000 m^3 per annum. This annual volume was made up of the following components:

Fuel type	Percentage	Tank capacity m^3	Annual throughput, m^3
Unleaded petrol (ULP)	39.2	4 x 20 000	1 058 825
Diesel	39.2	4 x 20 000	1 058 825
Jet fuel	4.9	1 x 10 000	132 350
HFO	14.7	2 x 15 000	397 060
Paraffin	2.0	1 x 4000	52 940
Total annual throughput			2 700 000

3 PROPOSED CHANGES

OEC manufactures carbon black using heavy fuel oil (HFO) as a raw material. Their requirements are such that the demand for HFO will be higher than originally planned, necessitating larger HFO storage tanks at the tank farm.

With the total annual throughput remaining constant at 2 700 000 m^3, an increase in HFO throughput will be balanced by equal reductions in the annual ULP and diesel throughputs, resulting in the following capacities:

Fuel type	Percentage	Tank capacity m^3	Annual throughput, m^3
Unleaded petrol (ULP)	36.3	4 x 19 250	1 019 118
Diesel	39.2	4 x 19 250	1 019 118
Jet fuel	4.9	1 x 10 000	132 355
HFO	17.6	2 x 18 000	476 470
Paraffin	2.0	1 x 4000	52 940
Total annual throughput			2 700 000

The changes in the liquid fuel composition imply that the total annual emissions of VOCs will change as well.

4 EMISSIONS

While the changes in the liquid stream compositions may seem small, the effect that the proposed changes will have on VOC emissions are significant.

4.1 2018 EMISSIONS

VOC emissions from the storage and handling of organic liquids are best estimated through the application of emission factors and calculation steps published in the USEPA's AP-42. These factors and calculation steps are complex, but have been compiled by the USEPA in its TANKS emission estimation model. This model was used by LAQS in estimating emissions from the tank farm in 2018, yielding the following annual emissions for the fuels listed above:

--	Unleaded petrol	73.7 tons	99.2% of total VOCs
--	Diesel	0.55 tons	0.74% of total VOCs
--	Paraffin	0.004 tons	0.01% of total VOCs
--	Aviation (jet) fuel	0.05 tons	0.07% of total VOCs
--	Heavy furnace oil	0.004 tons	0.01% of total VOCs
--	**TOTAL EMISSIONS**	**74.3 tons**	

From these figures it can be seen that the VOC emissions are dominated by emissions from the handling and storage of ULP, primarily due to the substantially higher vapour pressure, and subsequent volatility, of petrol relative to the other fuels.

4.2 EMISSIONS AFTER PROPOSED CHANGES

Using the revised fuels throughputs as input data to the TANKS model resulted in the following annual emissions for the various fuels:

--	Unleaded petrol	62.6 tons	99.17% of total VOCs
--	Diesel	0.51 tons	0.74% of total VOCs
--	Paraffin	0.004 tons	0.01% of total VOCs
--	Aviation (jet) fuel	0.05 tons	0.08% of total VOCs
--	Heavy furnace oil	0.005 tons	0.01% of total VOCs
--	**TOTAL EMISSIONS**	**68.7 tons**	

The revised annual throughput of fuels will, therefore, result in a reduction of 5.53 tons of VOCs per annum, or 7.43% in total. This reduction is primarily due to a reduction in the throughput of ULP in the tank farm, with emissions from a lower diesel throughput playing a marginal role.

5 IMPACT ON AIR QUALITY

It must be noted that the only emissions that will change are those associated with the storage and handling of liquid fuels. The emissions estimated from the planned HFO-fired boiler on site will remain unchanged.

There is a linear relationship between emissions and ground-level concentrations of pollutants in the sense that a change in emissions will results in a change of equal proportion in ground-level concentrations, i.e. a change of, e.g., 5% in emissions will result in a change of 5% in ground-level concentrations.

The expected reduction of 7.43% in VOC emission will, therefore, result in a decrease of 7.43% in the ground-level concentrations estimated by LAWS in 2018. The estimated ground-level VOC concentrations given in 2018 and the revised values as a result of the reduction in emissions are given in the table below.

	2018	Revised
Maximum annual average concentration, $\mu g/m^3$	20.6	19.0
Where	300 m east of tank farm centre	
Maximum 95-percentile concentration, $\mu g/m^3$	118.5	109.7
Where	300 m east of tank farm centre	

Unfortunately there is no ambient air quality standard for VOCs with the result that no direct comparison against any standard is possible.

6 CONCLUSION AND RECOMMENDATION

Should the planned changes be implemented LAQS is of the opinion that total emissions of VOCs from the tank farm operations will be lower than those calculated in 2018. The reduction equals approximately 7.43% and is primarily due to the replacement of petrol by HFO, a much less volatile fuel.

The lower emissions will result in a concomitant reduction in ground-level concentrations of VOCs of the same order of magnitude, i.e. 7.43%.

The planned changes in individual fuel throughputs will not result in any increase in the total quantity of liquid fuels handled by the tank farm annually, but purely a partial substitution of one fuel type with another.

LAQS, therefore, does not regard the planned changes as a major variation in the process of storage and handling of fuels. In addition, the reduced emissions will result in a reduced impact on air quality in the region.

As a result LAQS recommends that the AEL issued to Bay Terminals remain in place, albeit with a slight change in fuel types if necessary, and that no revision of the environmental impact assessment of the tank farm and its operations will be required.

C H Albertyn, PrEng, CEng, QEP (Emeritus)

OFFICE OF THE DIRECTOR

ENVIRONMENTAL HEALTH SUB-DIRECTORATE

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Email:	gmhlonyane@mandelametro.gov.za	Website : www.nelsonmandela.gov.za

17 October 2019

Messrs Lethabo Air Quality Specialists (Pty) Ltd
P.O. Box 2174
Noorsekloof
6331

Attention: Mr. Chris Albertyn

Dear Sir

BAY TERMINALS GROUP TANK FARM, ZONE 7 COEGA INDUSTRIAL ZONE, PORT ELIZABETH

Reference is made to your correspondence dated 9 October 2019 with regards to the Provisional Atmospheric Emission Licence (PAEL) for the above mentioned company.

This letter serves to advise that the Nelson Mandela Bay Municipality accept the air quality assessment report submitted in support of the proposed changes for storage of petroleum products at Bay Terminals Group (Pty) Ltd.

Prior to the amendment of the PAEL to accommodate the proposed changes, kindly provide this office with a letter from Department of Economic Development Environmental Affairs and Tourism (DEDEAT) with regards to the current status quo of their Environmental Authorization.

Yours faithfully

DR MP. NODWELE
DEPUTY DIRECTOR: ENVIRONMENTAL HEALTH SUB-DIRECTORATE

13.9 Amended Construction Environmental Management Programme

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PROGRAMME (CEMPR)

BAY TERMINALS GROUP COEGA TANK FARM

DEDEAT Reference Number: ECm1/C/LN2/M/16-2018

Proponent:

Bay Terminals Group.

Report Compiled by:

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Project Reference:
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Report date:
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21803-21928_CEMPR_1

DOCUMENT PROGRESS

Distribution List

Date	Report Reference Number	Document Distribution	Number of Copies
17/09/2018	21803_CEMPR_0	Internal	Internal Review
October 2018	21803_CEMPR_1	EAP – EIA process	Hard copy; Pdf
November 2018	21803_CEMPR_2	Eastern Cape Department of Economic Development, Environment and Tourism (ECDEDEAT)	Hard copy; Pdf
November 2019	21803_21928-CEMPR-1	Eastern Cape Department of Economic Development, Environment and Tourism (ECDEDEAT)	Hard copy; Pdf
November 2019	21803_21928-CEMPR-1	Public Review	PDF

Amendments on Document

Date	Report Reference Number		Description of Amendment
November 2018	21803_CEMPR_1	21803_CEMPR_2	Minor amendments
November 2019	21803_CEMPR_2	21803_21928-CEMPR-1	Update to take into account Part 2 Amendments

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1 INTRODUCTION

1.1 Overview

Bay Terminals Group (BTG) responded to a tender advertised by Coega Development Corporation (CDC) for a bulk petrochemical fuel storage facility in Zone 7 of the Coega SEZ and were subsequently awarded this tender by CDC. In line with the above, BTG plans to develop a new liquid bulk facility with piping, custody metering and numerous tanks and road tanker loading at a new facility in the Coega SEZ Zone 7, near Port Elizabeth, on Erf 351 of Coega. This new facility is referred to as the BTG Coega Tank Farm throughout this report.

An environmental authorisation process was undertaken in 2018 and the Environmental Authorisation (EA)(ECm1/c/LN2/M/16-2018) granted on 15 March 2019. As part of this, this Construction Environmental Management Programme (CEMPr) was submitted.

Subsequently, the CDC has received funding from the Department of Trade and Industry (DTI) to develop a solution for Orion Engineered Carbons (OEC) to receive Carbon Black Oil (CBO[1]) (a type of Heavy Fuel Oil or HFO) at the Port of Ngqura. OEC currently receives via Dom Pedro facility at the Port of Port Elizabeth. However, due to the intended closure of the Dom Pedro facility at the Port of Port Elizabeth there is a requirement for a new replacement facility for OEC at the Port of Ngqura.

As part of this and subsequent to the initial BTG design process, the CDC has approached BTG regarding a possible solution for OEC. As part of the solution, BTG has entered into an agreement with the CDC to permit CDC to construct the necessary tanks and pipeline extensions from the berth to receive and store HFO within the necessary timeframes. In order to provide the necessary infrastructure for OEC, the initially planned storage capacity of the BTG facility needs to be amended to take into account the requirements of OEC.

To take this into account, an amendment in term of Regulation 31 and 32 of the Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) is required. This CEMPr has been updated to take into account these amendments which are as follows:

- Update of the Site Development Plan;
- Extension of Bulk Liquid Pipelines from the Port of Ngqura Boundary (Battery Limit) to the OTGC tie-in and removal of Condition 3.3.1;
- Reduction in the combined storage of Diesel from 80 000 m^3 to 77 000 m^3;
- Reduction in the combined storage of Unleaded Petrol (ULP) from 80 000 m^3 to 77 000 m^3;
- Increase in the combined storage of Heavy Fuel Oil (HFO) from 30 000 m^3 to 36 000 m^3;

[1] *Please note that the chemical composition of CBO falls within the broad definition of HFO.*

- Update of the timeframes for construction within the project description in the EA as well as within Condition 3.1.2. relating to completion of all construction activities within 24 months from the start of construction; and
- Update of Condition 3.3.2. to clarify that TNPA will be responsible for reviewing and updating the Port Oil Spill Contingency Plan and Emergency Preparedness Plan.

1.2 Project Location

The proposed development occurs in the Coega SEZ 7, near Port Elizabeth, on Erf 351 of Coega, located along the Algoa Bay coastline to the north-east of the Port of Ngqura. The coordinates for the project are provided in Table 1.

Table 1: Centre Coordinates

	Coordinates	
Centre Point	33°46’24.67” S	25° 42’16.56” E

The Surveyor General 21-digit diagram number for Erf 351 of Coega SEZ Zone 7 is provided in Table 2 below.

Table 2: Surveyor General Diagram Number

Portion	Surveyor General Diagram number
Erf 351	C07600230000035100000

An overview of the location of the development (as amended) is provided in Figure 1.

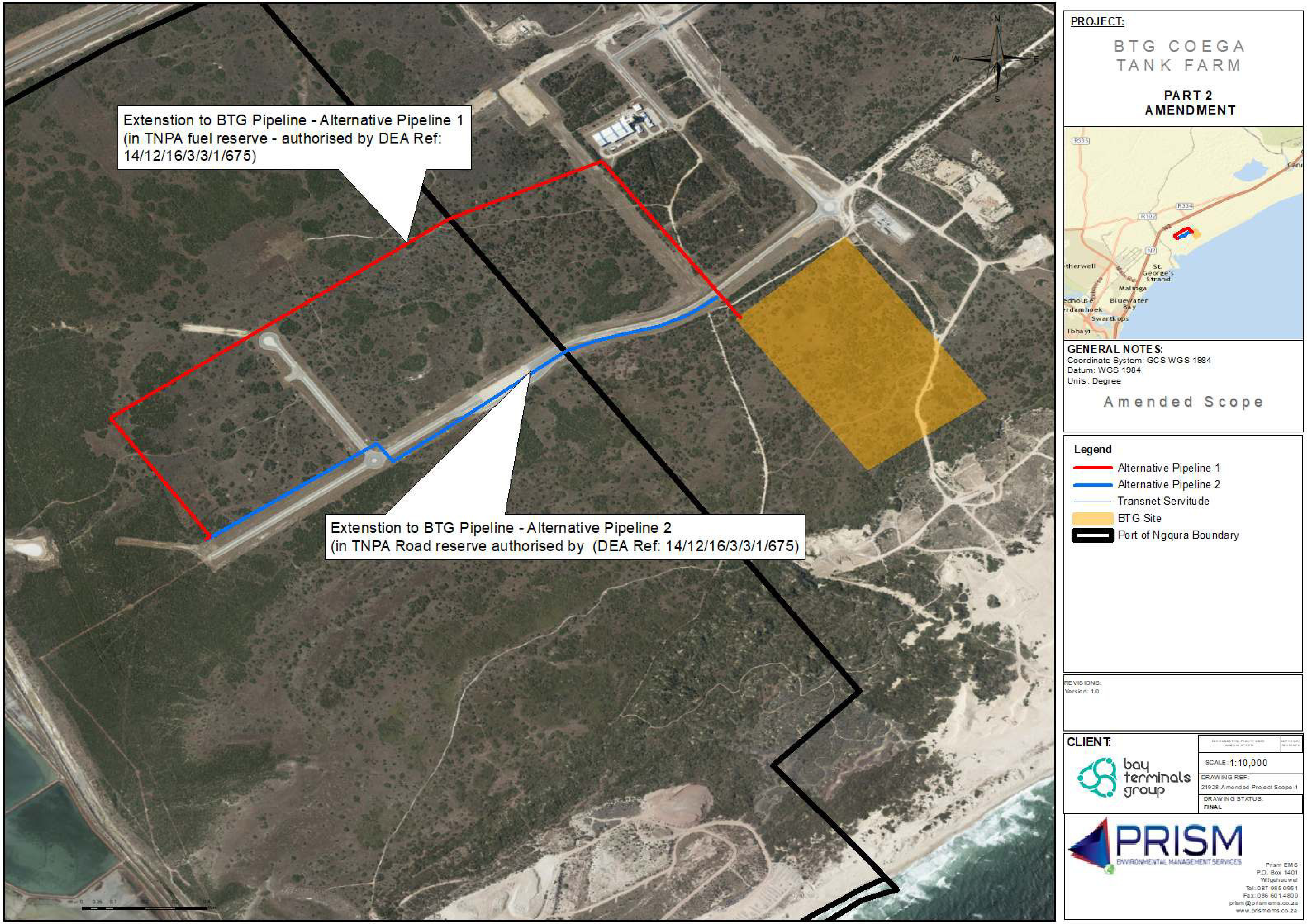

Figure 1: Aerial Locality Map

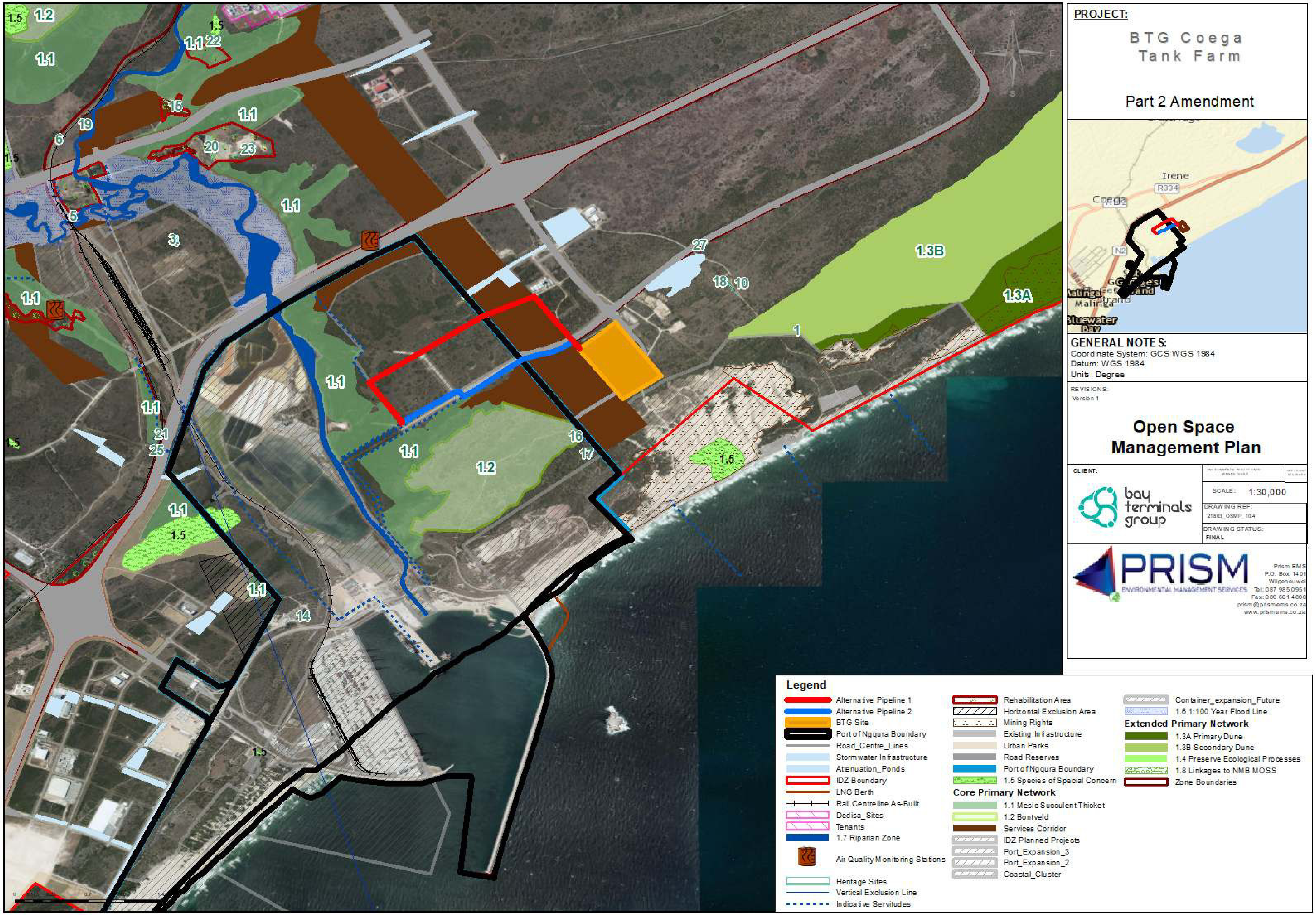

Figure 2: Pipeline Routes

2 EMPR REQUIREMENTS AND REPORT OUTLINE

The contents of this EMPr has been compiled according to the prescribed minimum legal requirements contained in Appendix 4 of the EIA Regulations, 2014 [as amended in 2017]. Refer to Table 3. Additional sections have been added to the report for purposes of best environmental practice.

Table 3: Contents of EMPr

Chapter Number	Chapter Name	Requirements included in Appendix 4 of 2014 EIA Regulations as amended in 2017:
1.	Introduction	-
2.	EMPr Requirements and Report Outline	-
3.	Details of EAP	(a) details of (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;
4.	Project Description and Activities, Aspects, and Impacts	(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description.
5.	Environmental Sensitivity	(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;
6.	Goals and Objectives	(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- (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;
7.	General Roles and Responsibilities	(i) an indication of the persons who will be responsible for the implementation of the impact management actions
8.	Environmental Awareness Plan	(m) an environmental awareness plan describing the manner in which-

Chapter Number	Chapter Name	Requirements included in Appendix 4 of 2014 EIA Regulations as amended in 2017:
		(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
9.	Waste Management Plan	-
10.	Emergency Preparedness Plan	-
11.	Monitoring Programme	(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);
		(h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);
		(j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;
		(k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);
		(l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;
12.	EMPr	(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 - (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;

3 DETAILS OF THE EAP

Prism EMS have been appointed to undertake the required Environmental Authorisation process in terms of the 2014 Environmental Impact Assessment (EIA) Regulations as amended in 2017. Details and expertise of the Environmental Assessment Practitioner (EAP) who prepared the EMPr is provided in Table 4 and Curriculum Vitae is appended in Appendix I2 of the Basic Assessment Report.

Table 4: Details of the EAP

EAP:	Monica Niehof
Company:	Prism Environmental Management Services
Qualifications:	BSc. (Hons) Environmental Management
Experience:	12 Years
Address:	PO Box 1401, Wilgeheuwel, 1736
Tel:	087 985 0951
Fax:	086 601 4800
Email:	monica@prismems.co.za

Prism EMS Team				
Contact Details	Post: PO Box 1401, Wilgeheuwel, Johannesburg, 1736		Tel: 087 985 0951 Fax: 086 601 4800 Email: prism@prismems.co.za www.prismems.co.za	
Designation	**Name**	**Qualification**	**Professional Registration**	**Experience:**
Project Director	De Wet Botha	M.A. (Env.Man.) (PHED)	Founder Member of Environmental Assessment Practitioners Association of South Africa (EAPASA) Member of the International Association for Impact Assessors (IAIAsa)(1653) Member of the Gauteng Wetland Forum Member of the South African Wetland Society	16 Years
Project Principle	Vanessa Stippel	MSc. Ecology, Environment and Conservation	SACNASP– Pr. Sci. Nat.(116221).	8 Years

4 PROJECT DESCRIPTION AND ACTIVITIES, ASPECTS, AND IMPACTS

4.1 Updated Project Description

4.1.1 Background information

This process description must be read in conjunction with the updated Site Development Plan (refer to **Error! Reference source not found.**) and the Process Flow Diagram [PFD] (Figure 4). A separate PFD is also included for Phase 1 (i.e. HFO) in Figure 5.

4.1.2 Scope

BTG will be responsible for the pipeline from the BTG site boundary to the OTGC Tie-in. The scope of the application is therefore, the proposed Coega Tank Farm and the pipeline from the BTG site boundary up to the OTGC Tie-in is shown in Figure 1.

It should be noted that TNPA confirmed that they will issue a wayleave for the construction of the HFO pipeline within their road reserve. Since this is the preferred route it is most likely that the HFO pipeline will follow the pipeline route indicated as Alternative Pipeline 2 (shown in blue in **Error! Reference source not found.**). From the OTGC tie-in, the HFO pipeline will be constructed on a second pipe rack to the berth. Please note that the OTGC pipelines and servitudes are already authorised (ECDEDEAT Ref: ECm1/LN2/M/11-57) and the TNPA Fuel Reserve is already authorised (DEA Ref: 14/12/16/3/3/1/675), therefore all impacts related to the construction and operation have been assessed. The second pipe rack for the HFO will be similar to the pipe racks described in the OTGC EIA.

In contrast, the Phase 2 pipelines required by BTG (i.e. LPG and Multiproduct pipelines) will be constructed from the BTG facility to the OTGC tie-in, along the pipeline route indicated as Alternative Pipeline 1 (shown in red in Figure 1). From the OTGC tie-in these pipelines will follow the approved OTGC pipeline servitude route and will be constructed and operated under the OTGC EA.

4.1.1 Site Overview

The Updated Site Development Plan (Figure 3) shows the proposed BTG Coega tank farm layout, which has the following infrastructure components:

- 2,4m high security fence complete with truck entry / exit gates and emergency exits;
- Associated lighting and closed-circuit television (CCTV);
- Pigging Station;
- Import manifold;
- Four bunded storage areas containing;
    - 4 x Diesel tanks, combined working capacity 77 000 m^3;

- 4 x ULP tanks, combined working capacity 77 000 m^3;
- 2 x HFO tanks, combined working capacity 36 000 m^3;
- 1 x JET tank working capacity 10 000 m^3;
- 1 x Paraffin tank, capacity 4 000m^3;

- A separate unbunded (open) area will contain 15 off LPG vessel vessels, with a combined working capacity of 15 000 m^3.
- Road Tanker loading pump bays as follows:
    - Diesel – 4 x 2000 l/m pumps (3 operating, 1 standby);
    - ULP – 4 x 2000 l/m pumps (3 operating, 1 standby);
    - HFO – 3 x 2000 l/m pumps (2 operating, 1 standby);
    - Jet – 2 x 2000 l/m pumps (1 operating, 1 standby);
    - Paraffin – 2 x 1 l/m pumps (1 operating, 1 standby);
- Fire Water Tank with Fire / Foam pump Station;
- Vapour Recovery Unit (VRU) (at loading gantry);
- Necessary Buildings:
    - Admin Building 684m^2;
    - Ablution and Rest Room 293 m^2;
    - Store Room 293 m^2;
    - Workshop 382 m^2;
    - Warehouse 302 m^2;
    - Electrical Sub Station 302 m^2;
    - Security Building 130 m^2;
    - Small laboratory for critical testing of the final product.
- Loading Gantries
    - 18 bays for liquid fuels (Diesel 3; ULP 3; HFO 2; JET 1; Paraffin 1);
    - 4 bays for LPG.
- Additive Bay
- Pump Bays
- Compressor Bay
- Generator Bay
- Boiler Room with Steam Reticulation System and dedicated Boiler Fuel Oil tank
- Tanker Wash Bay
- Effluent Handling
    - Drainage channels
    - Effluent Containment
    - Interceptor Oil-water Separator
- Slops Handling System:
    - 450m^3 Slops Tank (including freeboard);
- Pipe Racks, Pipe Bridges and interconnecting pipes from the BTG facility to the OTGC tie-in.
- Booster stations.

- Parking.

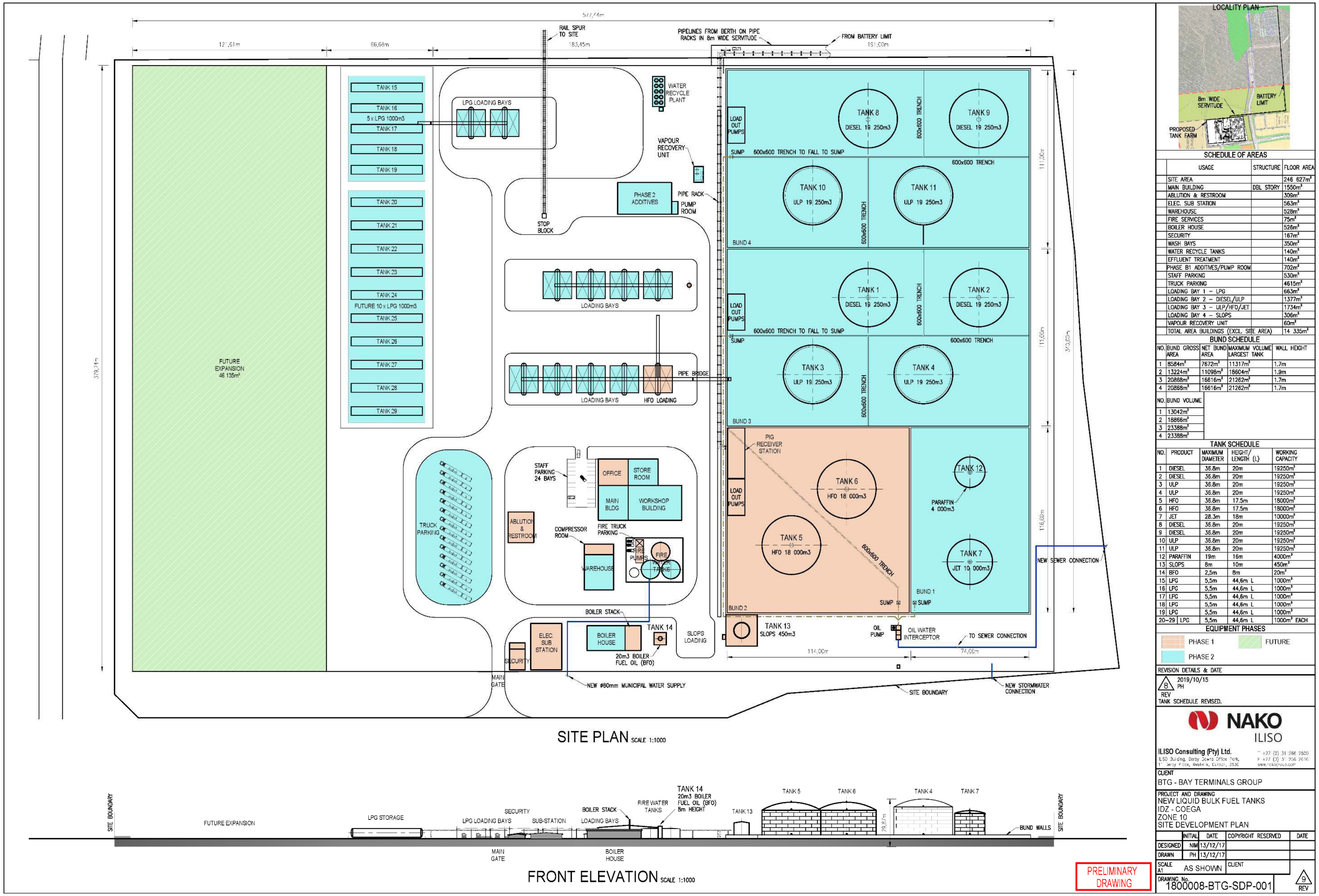

Figure 3: Updated Site Development Plan

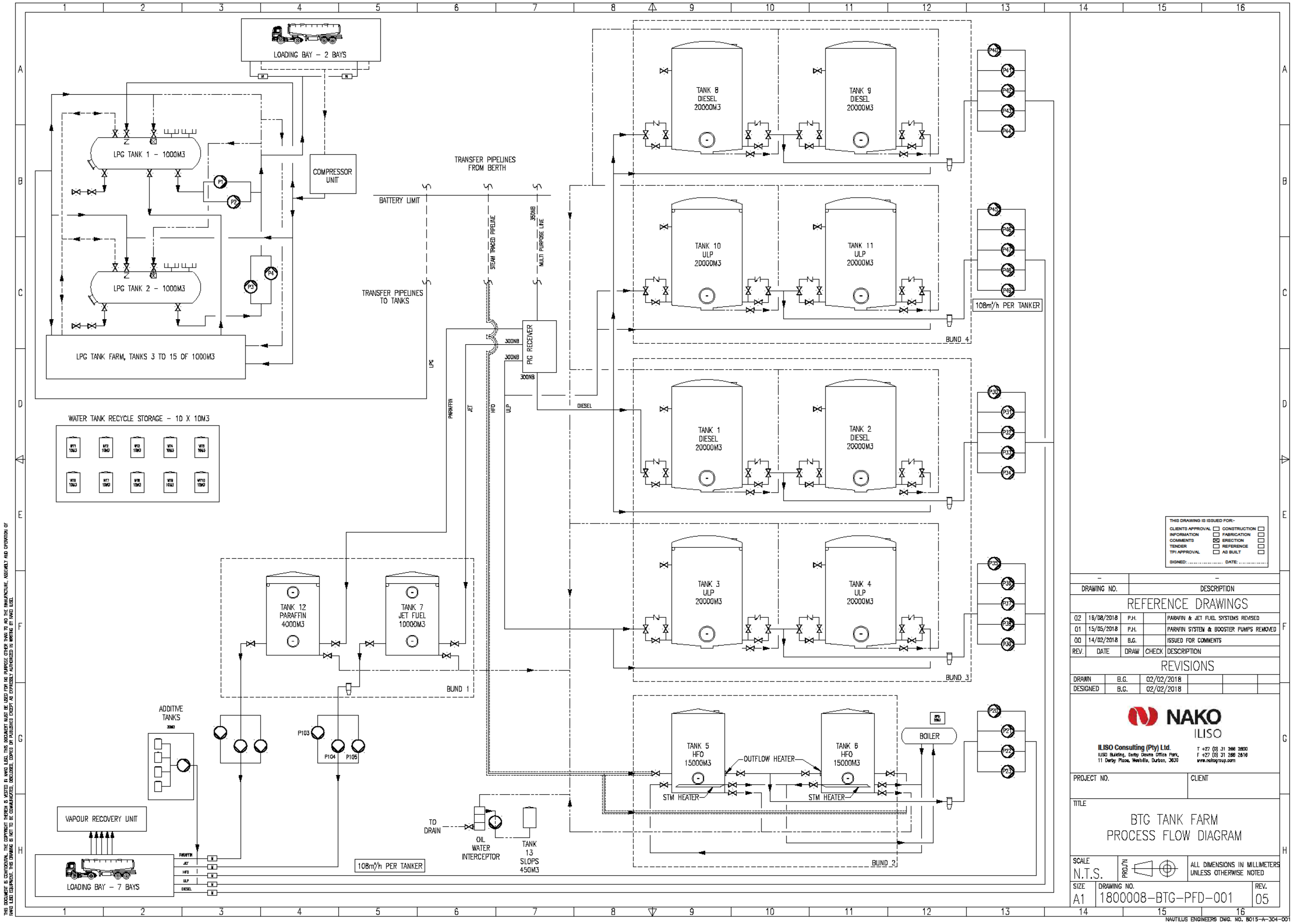

Figure 4: Proposed Coega Tank Farm Draft Process Flow Diagram

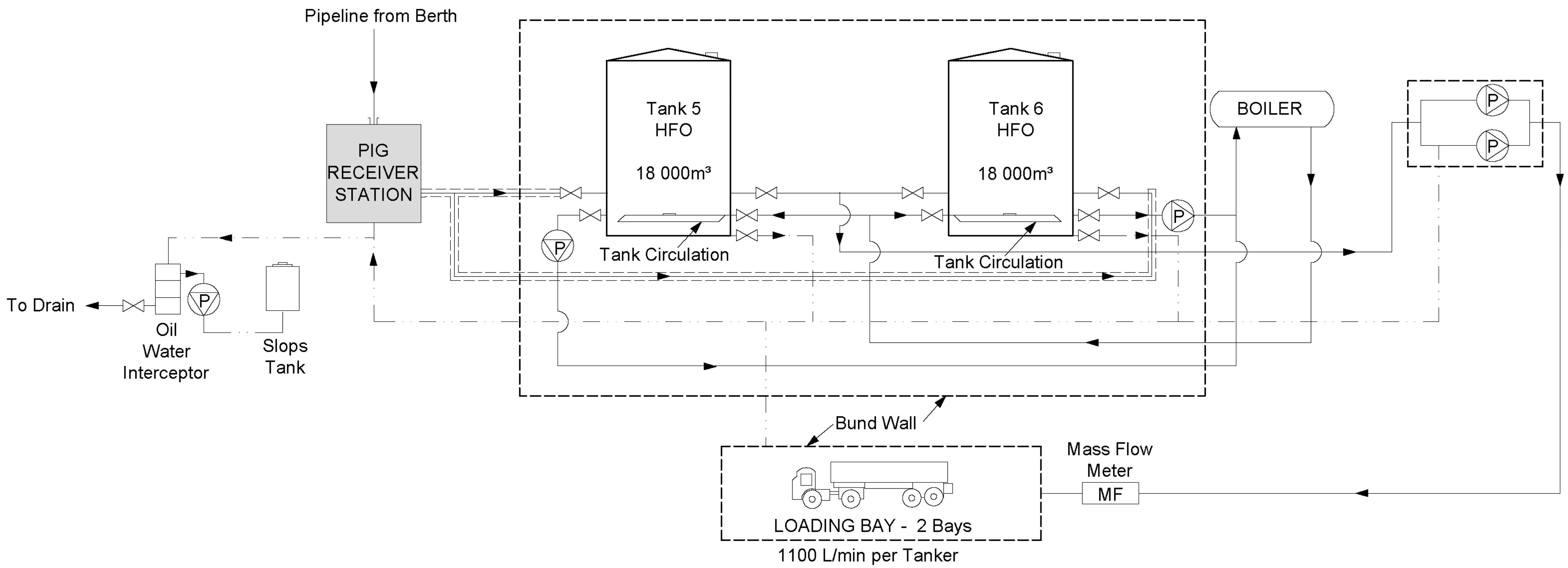

Figure 5: Phase 1 Process Flow Diagram

4.1.2 Project Phasing

In order to provide OEC with the required infrastructure within the necessary timeframes, the BTG project will be phased. The details of each phase are indicated on the updated site plan and described below.

4.1.2.1 Phase 1

The following will be undertaken as part of Phase 1:

- HFO Pipeline from the Tank Farm to the OTGC tie-in;
- 2 x HFO 18 000m^3 tanks (Tank 5 and 6) (total capacity 36 000m^3);
- Outflow Heaters;
- Pig Receiver Station;
- Boiler;
- 2 x Loading Bays for Road Tankers;
- Fire Protection and Suppression System;
- Oil Spill Management System;
- Booster Station;
- Part of Admin Buildings
- Toilets at Security Office.
- Access to: Tank 13 (slops); and
- Oil/water interceptor and all associated internal pipelines.

In terms of the loads of CBO from the berths, the following is applicable:

- Cargo volume: 33 000 tons (30 000m^3);
- Annual Frequency: 3 – 4 ships/annum;
- Pump rate: 500 – 900m^3/hr;
- Manifold pressure: 6 - 8 Bar;
- Manifold fluid temperature: 50 - 60ºC; and
- Manifold position: mid-ship.

Phase 1 will take approximately 15 months to construct and construction is planned from April/June 2020 till July/September 2021.

4.1.2.2 Phase 2

Phase 2 will involve the following:

- 2 x Multi Product Pipelines;
- 1 x LPG pipeline;
- Office and ancillary buildings;
- Bulk liquid Storage tanks total combined storage volume of 168 000m^3

  - 4 x Diesel tanks – 77 000m^3;
  - 4 x ULP tanks – 77 000m^3;
  - 1 x JET fuel tank – 10 000m^3; and
  - 1 x paraffin tank – 4 000m^3.
- LPG vessels with total combined storage capacity of 15 000m^3;
- Pigging Station;
- Booster Stations;
- Import Manifold;
- Road tanker loading pump bays;
- Loading gantries with associated vapour recovery unit;
- Fire water tank with fire/foam pup station;
- Additive bay;
- Pump bays;
- Compressor and generator bays;
- Boiler room with steam reticulation system and dedicated boiler fuel oil tank;
- Tanker wash bay;
- Effluent handling facilities;
- Slops handling system;
- Pipe racks, pipe bridges and interconnecting pipes up to the OTGC battery limit;
- Parking; and
- Security fencing around perimeter of the site;

It is expected that the next phase will take approximately 24 to 36 months to complete. The construction of Phase 2 is likely to overlap with the construction of Phase 1

4.2 Timeframes

The construction period is envisaged to stretch over a period of approximately 48 months. Refer to Table 5

Table 5: Construction timeframes

	Planned Start Date	Planned End Date	Planned Timeframe
Phase 1	April/June 2020	July/ September 2021	+/-15 Months
Phase 2	July/August 2020	*April/June 2024*	+/-45 months
Total expected time to completion *(from April/June 2020 – April/June 2024)*			48 months

**estimated dates*

The following construction conditions in respect of time restrictions will apply. Refer to Table **6**.

Table 6: Operational hours for construction phases

Period	Open	Close

Weekdays	07:00	18:00
Saturdays	07:00	15:00
Sunday	Only when required	
Public holidays	Only when required	

4.2.1 Ancillary Infrastructure Required for Construction

No major infrastructure is required on site for the construction of the development. The required ancillary infrastructure for the purposes of supporting services is discussed below.

4.2.1.1 Security

A construction camp will be erected on site for the duration of the construction. This camp will be fenced for security purposes. A security guard will also be posted on site during non-operational times. A fence will be erected around the property boundary as part of the development project.

4.2.1.2 Sanitation

During the construction phase of the project, chemical toilets will be placed on site for the duration of the construction phase. Where possible, existing toilets that occur on site already will also be used.

4.2.1.3 Construction Camp and Laydown Areas

Designated areas will be established during the construction phase for construction equipment and vehicles.

5 ENVIRONMENTAL SENSITIVITY

Figure 6 provides an overview of overall sensitivity of the study area. Based on the findings of the Ecology Study (Scherman, Colloty & Accociates), the various habitats within the Coega SEZ were ranked in terms of their sensitivity to development, using the following criteria, listed in order of importance, i.e. the habitat or vegetation unit:

- Contained Species of Special Concern (SSC);
- Habitat was protected under a form of legislation;
- Exhibited a high degree of biodiversity;
- Exhibited a limited degree of degradation;
- A unique habitat that is not well represented within the region;
- Provided an important ecosystem role or support system, e.g. ecological corridor.

Therefore:

- Habitats containing SSC were rated as Very High;
- All the natural wetlands and blind river valleys were rated Very High, due the unique and important function in the landscape, coupled to the presence of SSC within the ecotones;
- All intact vegetation units, which contained protected flora or wetland habitat, were rated Medium – High;
- All unimproved vegetation types and modified wetlands were rated as Medium, i.e. these have been impacted upon, but are still able to contribute at the landscape level towards ecosystem function and / or assist in the maintenance of ecological corridors;
- All modified, transformed or man-made systems were rated as Low. These systems have limited restoration / rehabilitation potential, but still provide a form of habitat.

Most of the remaining intact habitat from a terrestrial point of view would be rated as Medium, including the proposed development site. The Medium rating is since the remaining thicket areas (Bontveld) still contains large numbers of protected plants and species, however the most sensitive (rated as High) have been avoided by the development area (<u>including extended pipelines</u>).

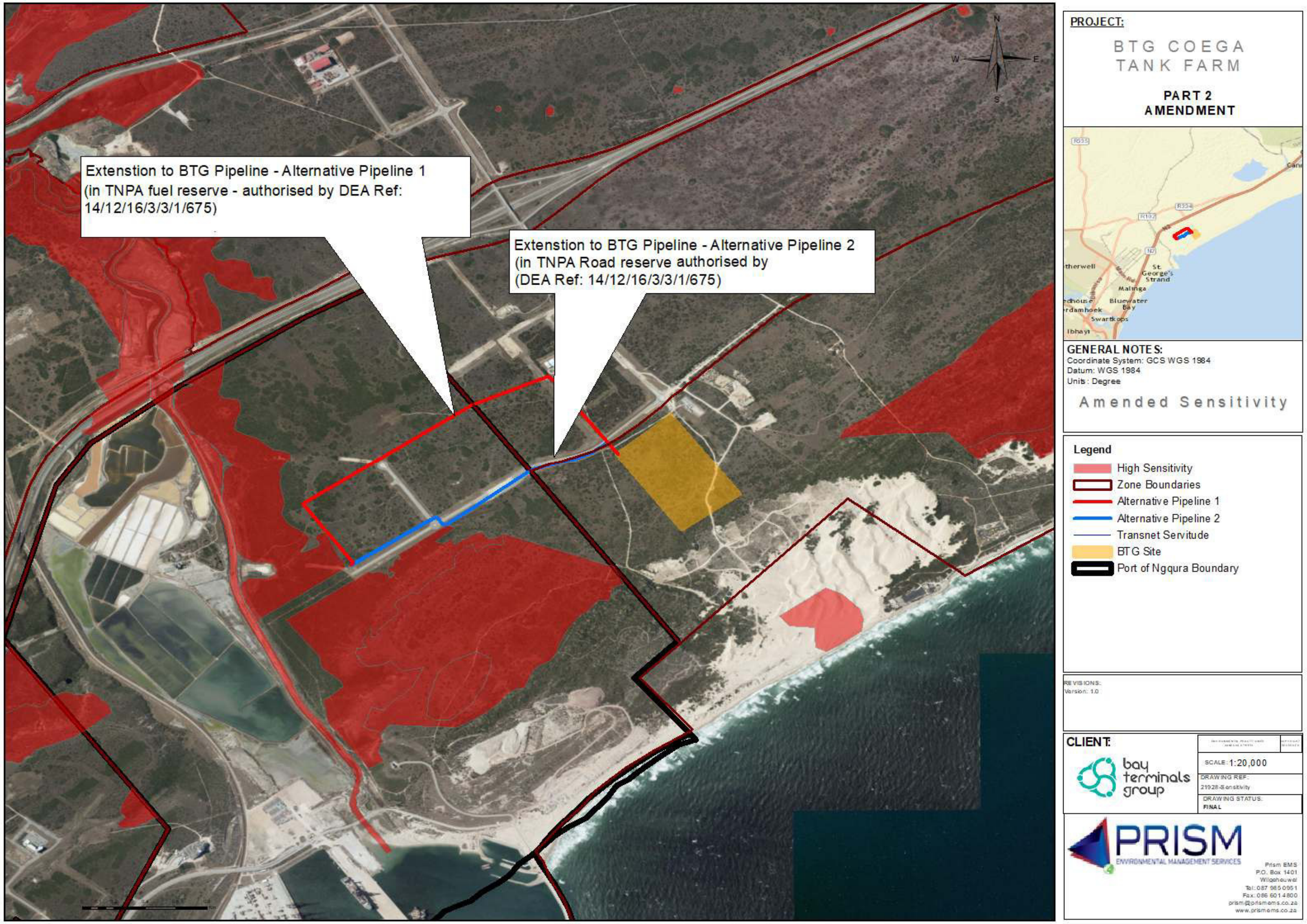

Figure 6: Overall Sensitivity Map (Adapted from Scherman, Colloty and Associates)

Further, as part of the amendment, extension of the pipelines within the approved fuel and road reserve is required. As such, the TNPA landside infrastructure BAR Aquatic and Terrestrial Biodiversity Assessment was reviewed. It noted that several of the supporting services and infrastructure described in this study, may impact on some of the sensitivities identified in the Coega Open Space Management Plan (OSMP Revision 9). However, the OSMP has been since updated and according to the OSMP Revision 1 (CDC, 2014), the extended pipelines will no longer cross sensitive habitats (Figure 7).

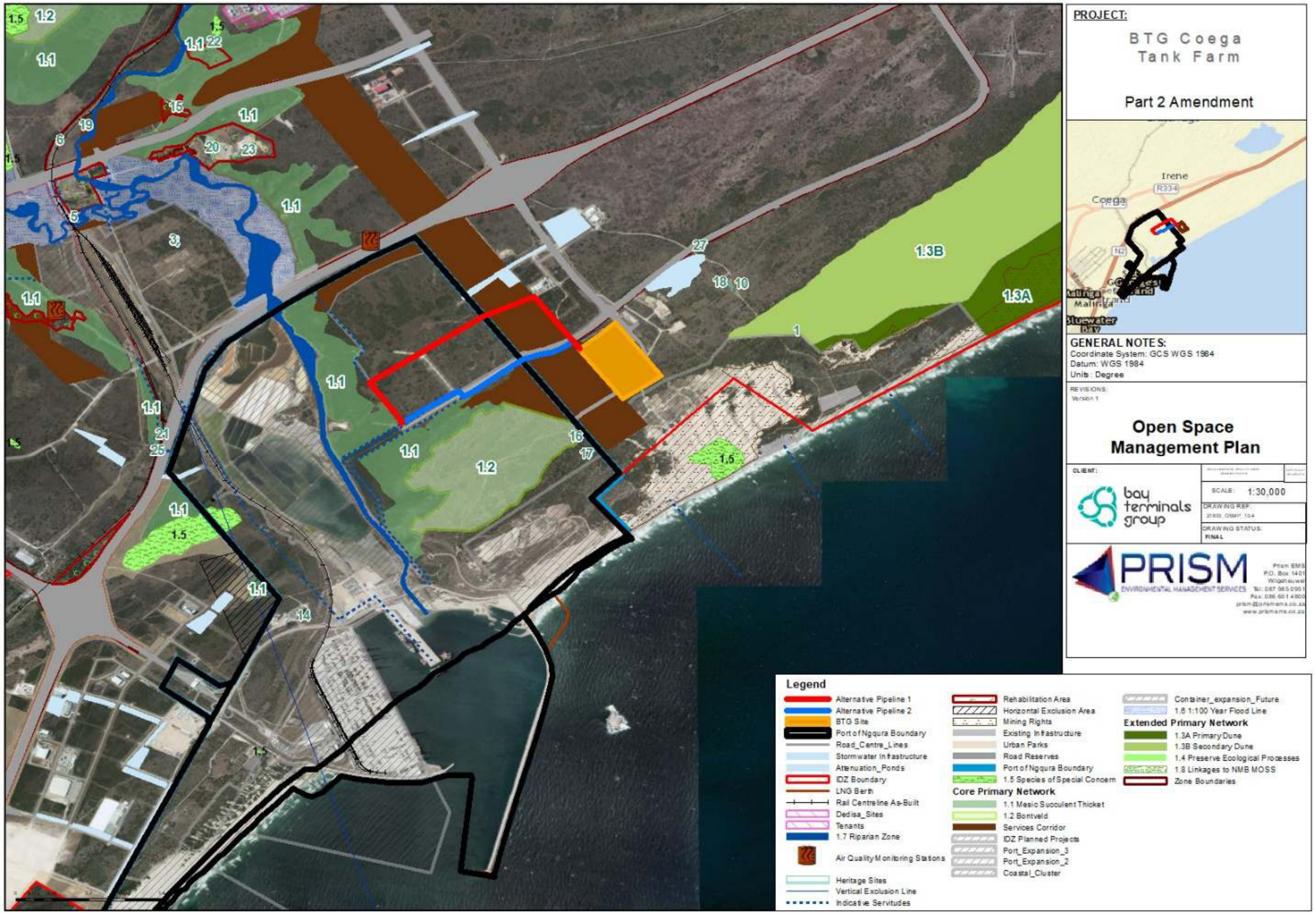

Figure 7: Open Space Management Plan Revision 1 (CDC, 2014)

6 GOALS AND OBJECTIVES

The **Construction EMPr** provides performance criteria required to address potential environmental impacts during the construction phase of the proposed development.

This document incorporates the relevant recommendations of the Scoping Report, Environmental Impact Assessment Report and other environmental studies and at a high level aims to provide the following:

- Establish **management objectives** for the construction phase of the proposed development to enhance benefits and minimise adverse environmental impacts;
- Describe **actions** required to achieve management objectives; and
- Outline institutional structures and roles required to implement the EMPr.

6.1 Key Objectives of the EMPr

The key objectives of the EMPr for the construction of the proposed development are as follows:

- To ensure effective communication with stakeholders and regulatory authorities;
- To ensure good housekeeping practices and general neatness on site;
- To mitigate any possible negative impacts identified in the EMPr for the construction phase of the development;
- To prevent pollution to the receiving environment that may emanate directly or indirectly from the source (development activities) during the construction phase;
- To reduce/eliminate the risk of fire and or explosions as a result of construction activities;
- To preserve flora and fauna;
- To preserve topsoil for optimal rehabilitation and landscaping following construction;
- To control the establishment of alien invasive plants during the construction phase of the project, as well as following rehabilitation of designated construction camp areas within the site thereafter.
- To ensure water saving and recycling mechanisms are implemented and adhered to;
- To ensure that all legislative requirements are met by the proposed development.

Following each site visit an audit report must be compiled to relay any non-compliance issues that need to be addressed, as well as compliance matters.

6.2 Impact Management Outcomes

Through effective implementation of the environmental management measures, the following outcomes must be achieved:

- Planning and layout of construction site is undertaken responsibly to ensure protection of sensitive environmental features;
- Environmental awareness creation and training is undertaken throughout the construction phase in order to minimise environmental impacts and ensure compliance to relevant legislation and authorisations;
- Minimise environmental impacts associated with emergency procedures;
- A safe working environment for contractors/construction workers and the public is provided;
- Proper management of site clearing is undertaken to ensure minimal environmental disturbance;
- Minimise environmental impacts associated with site establishment;
- Ensure access to surrounding sensitive environmental features is restricted and proper access control is in place;
- Minimal disturbances to traffic due to delivery of construction material;
- Proper management of labour force is undertaken to ensure that:
  - There are no security-related issues or disturbance to tenants or landowners outside the construction footprint'
  - There is optimal use of local labourers;
  - There is no disturbance to sensitive environmental features on or around the study area;
- Minimise environmental impacts associated with ablution facilities;
- Reduce the generation of waste by changing behaviours of contractors throughout the development;
- Re-use waste generated by the construction where possible thereby resulting in decreased waste disposal volumes;
- Waste separation and recycling must be undertaken as part of construction;
- Waste generated during the construction of the proposed development to be disposed of at licensed landfills;
- Minimal environmental impacts associated with waste;
- Effective and safe management of hazardous and non-hazardous materials on site, in order to minimise the impact of materials on the environment;
- Minimal environmental impacts associated with the management of temporary workshops and equipment;
- Ensure that all possible causes of pollution are mitigated as far as possible to minimise impacts to the surrounding environment;
- Prevent polluted water from entering the surface water;
- Minimise noise disturbance to surrounding areas;
- Preserve protected flora species outside of construction areas;
- Control alien plants and noxious weeds;
- Minimal impact to fauna species;
- To have no adverse impact on the historical inheritance of the area;
- The preservation and appropriate management of new findings should these be discovered during construction;

- Proper stormwater management as required by the Stormwater Management Plan to be implemented;
- Adequate reinstatement and rehabilitation of construction areas;
- Water conservation mechanisms to be implemented; and
- Energy conservation mechanisms to be implemented.

7 GENERAL ROLES AND RESPONSIBILITIES

It should be noted that, in addition to the BTG EA (ECm1/c/LN2/M/16-2018), a number of EAs exist in the Port and Coega SEZ environment which have bearing. A summary of these are visually represented in Figure 8 below. It is therefore clear that there are various role players that are involved and are responsible for environmental management in the Port and CDC environment. An overview of the applicable role players and institutional arrangements are provided in Figure 9. Information on each role player is then provided in the subsections below.

It should also be noted that a number of separate agreements are required and are in the process of being developed to ensure the various roles and responsibilities are well understood and determined for each party. As part of this, a number of ‘in principle support” letters are being compiled and a number of agreements being drafted. All necessary agreements should be finalised prior to construction so that all roles and responsibilities can be confirmed.

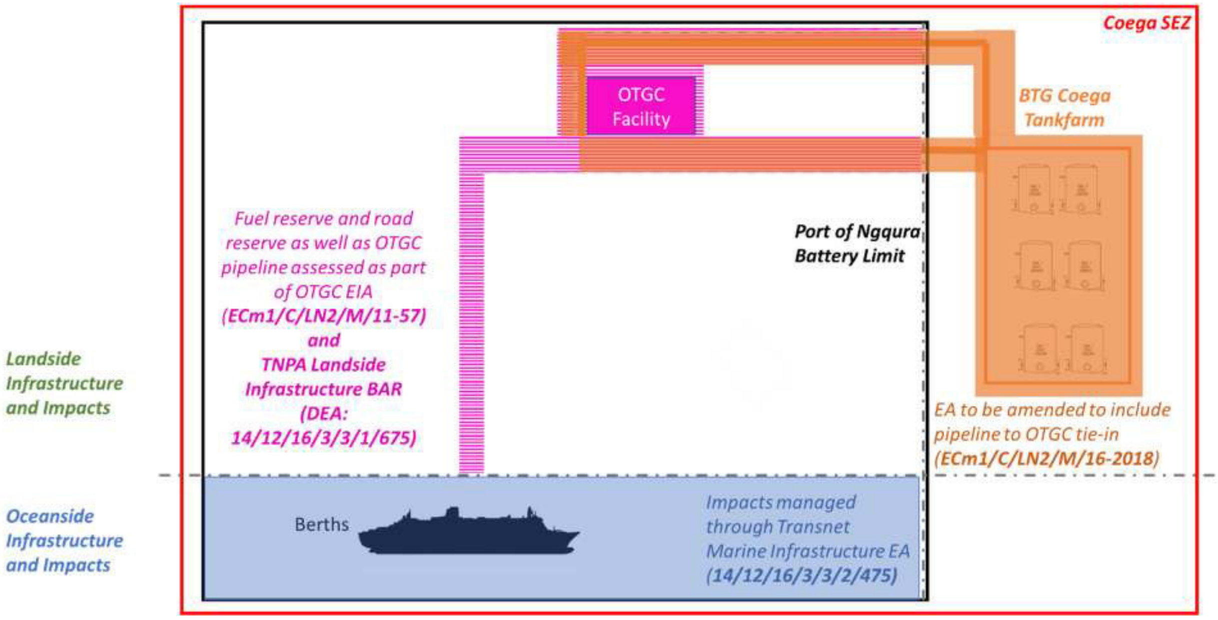

Figure 8: Visual representation of various applicable environmental authorisations in the Coega and Port environment

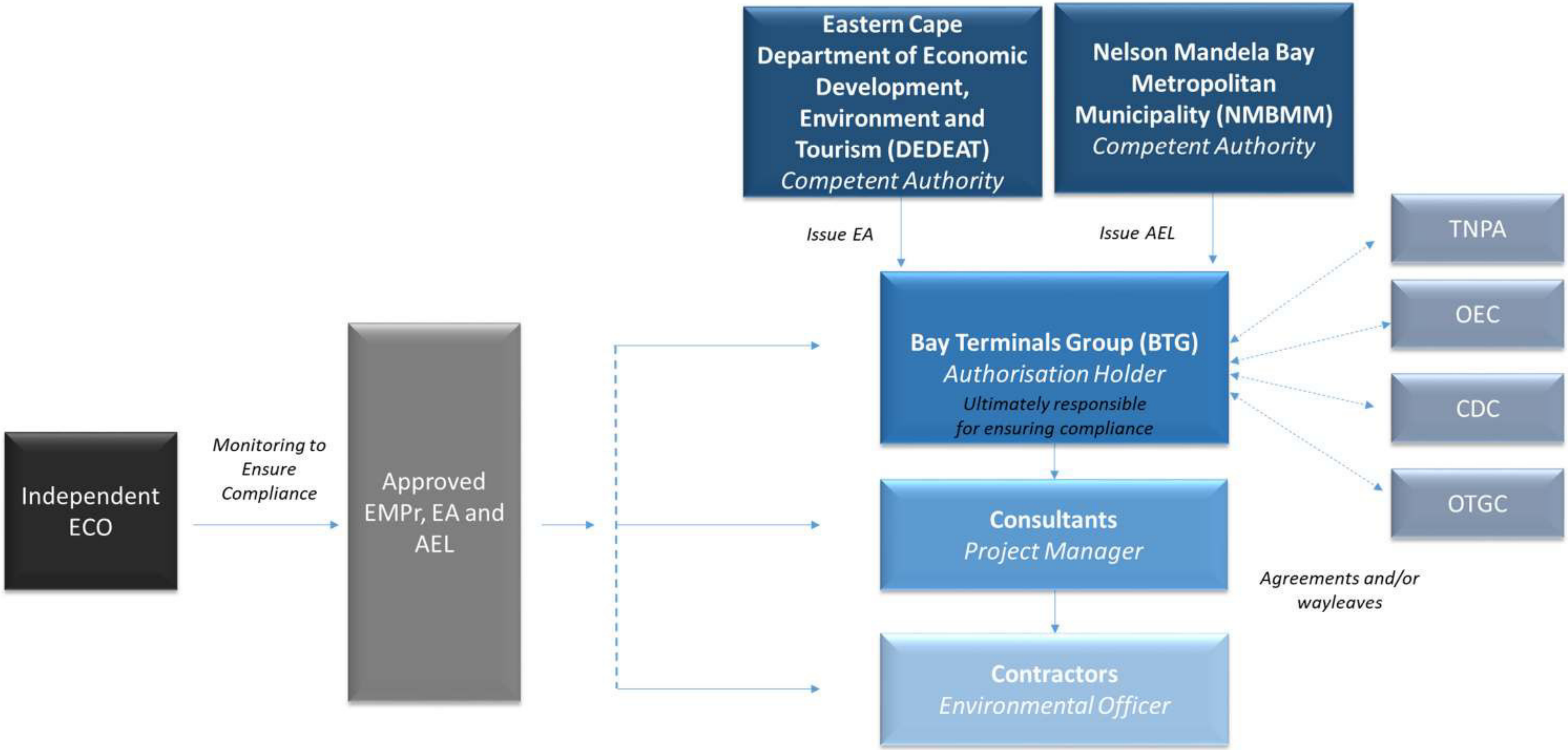

Figure 9: Roles and responsibilities

7.1 Competent Authorities

The following competent authorities are involved in the decision-making process:

- The Eastern Cape Department of Economic Development, Environmental Affairs and Tourism with reference to activities triggered in terms of the:
    - National Environmental Management Act, 1998 (Act No. 107 of 1998) [as amended] (NEMA); and
- The Nelson Mandela Bay Metropolitan Municipality with reference to activities in terms of the:
    - National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) [as amended] (NEMAQA).

Amendments may be required to the EMPr, based on adaptive management to the site conditions and the technical requirements of the project. These amendments will need to be approved by DEDEAT.

7.2 Authorisation Holder

Bay Terminals Group is the applicant in terms of NEMA and NEMAQA and is ultimately responsible for the development and implementation of the EMPr and ensuring that the conditions in the EA are satisfied. The liability for non-compliance also rests with the Authorisation Holder. Details of the Authorisation holder are contained in Table 7.

Table 7: Details of the Applicant

Applicant:	Bay Terminals Group
Contact Person:	Ms. T Mjacu

7.3 Coega Development Corporation

The BTG facility occurs within the CDC SEZ Zone 7. CDC awarded a tender to BTG to construct and operate a liquid bulk facility and associated facilities. CDC has also received funding from the DTI to develop a solution for OEC. A tripartite agreement between CDC, BTG and OEC has been developed and will ensure roles and responsibilities related to environmental management (amongst others) is confirmed. This agreement must be signed and binding before construction commences.

7.4 OEC

OEC requires a new facility to ensure continued supply of Carbon Black Oil to their facility in order to manufacture Carbon Black which OEC in turn supply to the automobile industry of South Africa.

As part of the BTG/CDC solution, the required facility for OEC will be developed under the BTG EA. A tripartite agreement between CDC, BTG and OEC has been developed and will ensure roles and responsibilities related to environmental management (amongst others) is confirmed. This agreement must be signed and binding before construction commences.

7.5 Transnet National Port Authority

The extended pipelines required for the project occur within the approved TNPA fuel reserve and road reserve. TNPA will be responsible for providing way leave agreements for the construction of pipelines within their reserves. Further, TNPA has confirmed that they are responsible (and are in the process of) updating the Harbour Oil Spill Contingency Plan for the Port of Ngqura.

7.6 OTGC

Oiltanking Grindrod Calulo (Pty) Ltd (OTGC) is the terminal operator on behalf of TNPA. From the OTGC tie-in, OTGC will be responsible for the pipelines to the berths. They are also responsible for operation and maintenance of such pipeline. An agreement with OTGC has been drafted and must be signed and binding before construction commences.

7.7 Consultants

7.7.1 Project Manager

In order to ensure that the proposed development is constructed as per the relevant designs and requirements, a project manager will be responsible for managing the planning, design and construction phases of the project. The Project Manager will furthermore also be required to tend to any environmental matters at the request of the Environmental Control Officer (ECO). The Project Manager shall assist the ECO where necessary and shall have the following responsibilities in terms of the implementation of the EMPr:

- Regular site inspections;
- Reviewing and approving the Contractor’s Method Statements;
- Assisting the Contractor in finding environmentally responsible solutions to problems with input from the ECO where necessary; and
- Communicating all environmental issues to the ECO.

7.7.2 Resident Engineer

The resident engineer that is employed by the Authorisation Holder will be responsible for the technical and contractual implementation, control and maintenance of the works to be undertaken. The responsibilities of the Engineer in terms of environmental matters include, but are not limited to:

- Supervising the installation of infrastructure, including pipelines to ensure as per approved designs and standards and codes;
- Inspecting all infrastructure on the tank farm for any engineering problems that may give rise to environmental pollution or safety incidents;
- Assisting the Project Manager in making decisions and finding solutions to environmental issues and risks;
- Review method statements from Contractors and Standard Operating Procedures;
- Order the removal of persons and equipment that are not complying with engineering specifications and operating procedures.

7.8 Contractors

Contractors will be responsible for constructing the proposed Development and associated infrastructure. All contractor/s employed by the developer in respect of any aspect of the construction of the subject site, will be bound by all and any agreement between the developer and the contractor, to ensure compliance with the Environmental Authorisation, mitigating measures included in the Specialist Studies, as well as this EMPr. The responsibilities include:

- Taking full responsibility for each of his/her employees;
- Be familiar with the contents of the EMPr and the specifications contained herein;
- Comply with the Environmental Specifications contained in the EMPr and subsequent revisions;
- Confirm legislative requirements for the construction works and ensure that appropriate permissions and permits have been obtained before commencing activities;
- Prepare Method Statements, programme of activities and drawings/plans for submission to the ECO when requested;
- Undertake daily site inspections to monitor environmental performance and compliance with the Environmental Specifications;
- Notify the ECO immediately in the event of any accident or infringements of the Environmental Specifications and ensure appropriate remedial action is taken;

- Notify the ECO at least 10 working days in advance of any activity he has reason to believe may have significant adverse environmental impacts, with specific reference to blasting, so that mitigatory measures may be implemented timeously.

7.9 Independent ECO

A competent and independent ECO must be appointed and will undertake bi-monthly inspections with monthly reporting on site as well as bi-yearly auditing against the EMPr and EA. The aforementioned report must be submitted to Bay Terminals Group and DEDEAT for their records.

The ECO will also audit the following:

- The record of environmental incidents (spills, impacts, legal transgressions, etc.) as well as corrective and preventive actions taken;
- The public complaints register in which all complaints are recorded, as well as actions taken; and
- Results from the environmental monitoring programme (water quality etc.).

In terms of Audits, the ECO will be required to ensure the following:

- All documentation (e.g. audit/monitoring/compliance reports and notifications) required to be submitted to the Department in terms of the EA;
- The holder of the EA must submit an environmental audit report to the Department within 30 days of the completion of the construction phase (i.e. within 30 days of site handover) and within 30 days of completion of rehabilitation activities;
- The Environmental Audit Report must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the EA conditions as well as the requirements of an approved EMPr;
- Records relating to monitoring and auditing must be kept on site and made available for inspection to any relevant and competent authority in respect of this development.

8 ENVIRONMENTAL AWARENESS PLAN

Training aims to create an understanding of environmental management obligations and prescriptive measures governing the execution of the project. It is generally geared towards project team members that require a higher-level of appreciation of the environmental management context and implementation framework for the project. In contrast, **Environmental Awareness Creation** strives to foster a general attentiveness amongst the construction workforce to sensitive environmental features and an understanding of implementing environmental best practices. The Environmental Awareness Plan for the Development incorporates both training and environmental awareness to ensure that the proposed development is implemented in line with the requirements of the EMPr and that environmental sensitivities on site are managed correctly.

As part of this, Bay Terminals Group is committed to remaining responsible and accountable for environmental practices on site. Being accountable for environmental practices undertaken during working tasks and activities remain the responsibility of both employer and employee awareness of the potential environmental impacts that could result from these activities.

All potential incidents to the environment may be effectively minimised through effective training and awareness of the employees using any of the following methods:

- Supervisory meetings (weekly);
- Induction training (annually);
- EMP Training (annually); and
- External environmental and/or health and safety courses (when applicable).

These methods are discussed below in more detail.

8.1 Meetings

Weekly supervisory meetings are ideal to facilitate awareness of specific environmental dangers pertaining to each week. Various topics may be discussed during these meetings and must be recorded or logged. All attendees at each meeting must sign an attendance register, these records must be kept on file at the administration office. Topics for discussion may include:

- Topics applicable to the entire operation;
- Area specific topics (e.g. heritage); and
- General environmental awareness:
    - Waste management;
    - Spillages;
    - Saving water;
    - Electricity consumption;
    - Dust control;
    - Noise generation;

- Housekeeping;
- Indigenous Vegetation;
- Fauna;
- Alien vegetation; and
- Fire-making

Should issues be identified by the ECO, these can also be addressed during these weekly meetings.

8.2 EMPr Training

Aspects of the EMPr must be selected and discussed at training workshops at least annually. Such training topics may be focused around the incidents that are frequently reported during the previous year and may be focused around the following:

- Hydrocarbon spillages;
- Stormwater Control;
- Waste Management;
- Monitoring Protocols; and
- Safety topics.

Workers should be informed that they may refuse work that is harmful to human health and/or the environment.

8.3 Induction Training

All new employees are required to undergo induction training prior to commencement of work. Returning and existing employees must undergo repeat induction training at least annually. Environmental awareness training must form part of the induction and must include the basic topics relating to the environment:

- Main environmental legislation (e.g. NEMA, NEMAQA; NEM:WA[2] or NWA[3]);
- Constitutional right pertaining to the environment;
- Waste Management hierarchy;
- Environmental, social and economic concerns;

[2] National Environmental Management Waste Act (NEM:WA), 2008 (Act No. 59 of 2008)

[3] National Water Act (NWA), 1998, (Act No. 36 of 1998)

- Sensitive environmental features; and
- Prevention of poaching.

9 WASTE MANAGEMENT PLAN

In order to ensure waste is properly dealt with, waste management is included in the EMPr. In addition, a **Waste Management Plan** is discussed below.

9.1 Legal Requirements

Section 16 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), as amended states that –

"A holder of waste must, within the holder's power, take all reasonable measures to –

- *Avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;*
- ***Reduce, reuse, recycle and recover waste;***
- *Where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;*
- *Manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts;*
- *Prevent any employee or any person under his or her supervision from contravening this Act;*
- *Prevent the waste from being used for any unauthorised purpose.*

Only temporary storage of waste is allowed (once of storage of waste for a period less than 90 days). The volume of material should be limited to less than 100m^3 of general waste and less than 80m^3 of hazardous waste. Should this be exceeded the Norms and Standards for the Storage of Waste will need to be complied with.

9.2 Waste Hierarchy

Management objectives provided in this EMPr are aligned to the waste management hierarchy indicated in Figure 10.

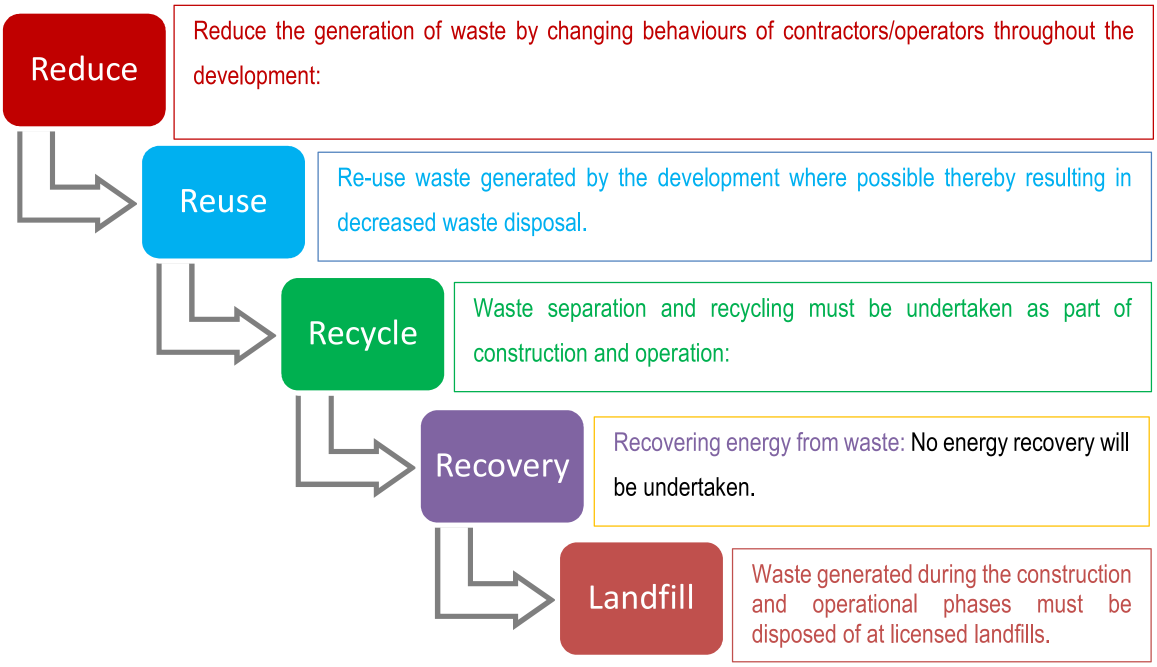

Figure 10: Waste Hierarchy

9.3 Waste Management Actions

The following waste management actions must be implemented in order to ensure the objectives included in the waste hierarchy above are met.

9.3.1 Waste Avoidance and Reduction

Avoidance and reduction should be practiced wherever possible. Recommended actions include: but are not limited to:

- Bulk buying of materials to reduce the volume of packaging required;
- Avoidance of materials/items/brands that are heavily packaged, have a short lifespan or are low quality;
- Buying items that last longer and can be repaired;
- Buying items in refillable containers;
- Environmental awareness training should focus on management of waste and all construction workers should be aware of the importance of waste minimisation and avoidance.

9.3.2 Recycling

Recycling should be practiced whenever waste prevention or reuse is not possible, provided that any such recycling is cost effective, taking into consideration environmental benefits, financial costs and community interests.

Potential priority recyclable waste streams include:

- Used Oil;
- Paper;
- Glass;
- Tyres;
- Plastics;
- Timber;
- Building rubble; and
- Electronic waste.

The following actions must be implemented:

- To reduce or avoid the need for sorting after collection, the categories of distinctively marked waste receptacles must be provided in order to receive waste as it is generated.
- These receptacles shall be fitted with a tight cover;
- All types of waste collection receptacles shall be clearly marked with the type of waste they are receiving;
- Obtain and label recycling containers for office waste, aluminium, steel, glass, ferrous metals, nonferrous metals, waste timber;
- Locate these containers within office buildings and trailers;
- Establish a recycled material collection schedule; and
- Arrange full bins to be hauled away.

9.3.3 Waste Disposal

The contractor is responsible for removal of all waste from the site, generated through the contractor's activities. The contractor shall ensure that all waste is removed to an appropriately licensed waste management facilities (the following source may be utilised – www.sawic.org.za). During operation, waste that is not collected for recycling must be collected by the municipality or by a municipality approved 3rd party collector.

In addition, it should be noted that the classification of waste determines the handling methods and the ultimate disposal of the material. All **hazardous waste** that may be generated by construction must be managed as follows:

- Characterise the waste to determine if it is general or hazardous (Use the Appendix 1 of the Norms and Standards for the Classification of Waste for landfill to determine whether additional classification is required);
- Obtain and provide an acceptable container with a label;
- Place hazardous waste material in the container;
- Inspect the container on a regular basis;
- Haul the full container to the licenced and correct disposal site;
- Provide documentary evidence of proper disposal of the waste.

In addition, the following actions must also be undertaken:

- Provide waste skips on site. These skips should be sufficient in number, the skip storage area should be kept clean, skips should be emptied and replaced before overflowing or spillage occurs;
- Skips should be covered to prevent waste blowing away;
- Vermin / weatherproof bins will be provided in sufficient numbers and capacity to store domestic waste. These bins must be kept closed to reduce odour build-up and emptied regularly to avoid overfilling and other associated nuisances;
- Ensure that solid waste is transported so as to avoid waste spills en-route;
- No waste shall be buried or burned anywhere on the site;
- Permits to transport/dispose of waste must be in place.

10 EMERGENCY PREPAREDNESS PLAN

10.1 Potential Emergencies

The following potential emergencies that may occur on site include:

- Environmental Incidents:
  - Fuel and hydrocarbon spillages;
  - Sewage spillages from the Chemical Toilets; and
  - Fire Hazards.
- Safety Incidents:
  - Injuries related to operation of heavy machinery such as Front-End Loaders, Excavators, Mobile Crushers etc. during construction;
  - Driving related accidents and incidents from Trucks on site during construction;
  - Accidents during earth moving, levelling and rehabilitation activities; and
  - Criminal incidents such as theft or potential violent crime during construction and operation.

10.2 Emergency Plan

10.2.1 Emergency Assemblage Area

A central area on site must be demarcated with appropriate signage for the gathering of all employees and visitors on site in the event of an emergency.

10.2.2 Emergency Procedures

The following procedures must be compiled in order for the identified potential emergencies to be managed effectively:

- Drill and evacuation procedure for any emergency related incidents containing information on the following:
  - Reporting structure for all incidents;
  - Emergency contact information (e.g. telephone numbers);
  - Procedure to be followed for the specific emergency;
  - First Aid information;
- Spillages of fuel and hydrocarbons:
  - Immediate action plan (e.g. use of spill kits) to prevent spill for spreading;
  - Reporting of incident to manager and supervisor to advise on next steps;

- Procedure for Theft and Crime:
  - Details on security system on site;
  - Emergency response units;
  - Panic alarms;
  - Details of community response units.

10.2.3 Emergency Contact Information

A list of potential emergency contact centers specific to the area must be drawn up and displayed on common notice boards for all employees to access. The following emergency centers must be sourced:

- Nationwide emergency response;
- Cell phone Emergency;
- Ambulance;
- Hospitals;
- Fire Response; and
- Police.

This list must be checked and updated at least quarterly to ensure that the information remains up to date.

11 MONITORING PROGRAMME

Monitoring is required to ensure that the receiving environment at the proposed Development is suitably safeguarded against the identified potential impacts, and to ensure that the environmental management requirements are adequately implemented and adhered to during the execution of the project.

The method of monitoring the implementation of the management and mitigation measures stipulated within the EMPr are indicated in Table 8.

Table 8: Method of monitoring implementation of Construction EMPr

Method	Frequency	Responsibility	Main Topics	Outcome
Internal Inspections	Daily – Weekly	Project Manager	• Observe housekeeping practices • Check for spillages, leaks or any other sources of pollution • Observe waste management • Observe stormwater control	• Based on observations identify need for protocols / procedures and compile where needed in order to comply with EMPr; • Verbally inform employees on any identified issues.
External Inspections	Bi-monthly	ECO	• Check compliance with management measures in EMPr	• Based on observations identify need for protocols / procedures and compile where needed in order to comply with EMPr; • Verbally inform employees on any identified issues; • Information from inspections will be used to compile monthly report; • Photos from inspections to be utilised in monthly reporting.
External audits	Bi-yearly	External Auditor	• Check compliance with management measures in EMPr	• Compile audit report with recommendations / actions where non-compliance was identified.

Method	Frequency	Responsibility	Main Topics	Outcome
Management Meetings	Quarterly – Bi-annually	Management	• Discuss (problem solve) recurring issues or actions that require management intervention	• Record minutes of main points of discussion; • Implement outcome actions of meeting.

11.1 Compliance Monitoring and Auditing

11.1.1 Environmental Audits

The mechanism for monitoring compliance with the management and mitigation measures stipulated within the EMPr must include an audit undertaken by an independent Environmental Control Officer (ECO) as discussed in Section 7.9.

The objective of the environmental audit is to:

- Report on the level of compliance with the conditions of the environmental authorisation and the management and mitigation measures stipulated within the EMPr;
- The extent to which the avoidance, management and mitigation measures provided in Section 12 achieve the objectives and outcomes in Section 0;
- Identify and assess new impacts and risks as a result of undertaking the activities;
- Evaluate the effectiveness of the management and mitigation measures generated in the EMPr;
- Identify shortcomings in the EMPr;
- Identify the need for any changes to the avoidance, management and mitigation measures provided for in the EMPr.

11.1.2 Procedure

The following methodology or procedure is to be used for assessment of the management and mitigation measures of the EMPr:

- **Pre-site preparation:** prior to the site inspection a review of the management measures contained in the EMPr, and a checklist must be drawn up;
- **Site inspection:** The Development must be traversed on foot and must include an assessment of each major component of the facility;
- **Documentation review:** after the site inspection a documentation review must be undertaken by requesting specific key documentation relating to the proposed development.

11.1.3 Evaluation Criteria

During evaluation of the EMPr, the following criteria must be used:

- Management measures stipulated in the plan;
- Environmental monitoring required;
- Legal requirements; and
- Best practice observations.

Where any indication of non-compliance is determined, recommended actions will be provided.

11.1.4 Reporting

All inspections undertaken as part of internal / external auditing must be provided in the form of a report. Internal and / or external audit reports will be compiled in accordance with Appendix 7 of the EIA Regulations, 2014 (as amended in 2017) and will be submitted to the competent authority as required by the Regulations.

11.2 Penalties

In order to ensure that there is adequate motivation for the contractor to comply with the conditions set out in the EMPr, the following applies with regards to penalties:

- The Contractor will comply with the environmental requirements on an ongoing basis, and any failure on their part to do so will entitle the Project Manager, in consultation with the Environmental Manager and ECO, to certify the imposition of a fine subject to the details set out in the EMPr;
- The Project Manager, Environmental Manager and any other specific personnel as designated by the Project Manager may alter the Schedule of Fines for this specific project;
- Fines may be issued per incident at the discretion of the Project Manager. Such fines will be issued in addition to any remedial costs incurred as a result of non-compliance with the requirements of the EMPr and documents supporting thereof. Fines may be omitted from construction guarantees as supplied by the contractor;
- The Project Manager and ECO will be the judge as to what constitutes a transgression in terms of the above clause. Further, note that in the event that transgressions continue to an unacceptable level the client may cancel the contract;
- Where the Contractor inflicts non-repairable damage upon the environment or fails to comply with any of the environmental requirements, he will be liable to pay a penalty fine over and above any other contractual consequence. This may also lead into a Rectification Application in terms of Section 24G of the NEMA, which could lead to certain fines and / or prosecution;
- The Contractor is deemed NOT to have complied with this specification if:-

  - Within the boundaries of the site, site extensions and access roads there is evidence of contravention of the requirements of the EMPr;
  - Environmental damage ensues due to negligence;
  - The Contractor fails to respond adequately to complaints from the public; and
  - Legal action is instituted against the developer in terms of Environmental laws due to any action / activities undertaken by the Contractor;
- Payment of any fines in terms of the contract will not absolve the offender from being liable from prosecution in terms of any law;
- A record of penalties will be maintained within the procurement department and may influence later commissions awarded to the contractor.

12 EMPR

12.1 Pre-Construction

General requirements during the pre-construction phase include the following:

- Design to consider and incorporate environmental requirements;
- Define and communicate roles and responsibilities for the implementation of the EMPr;
- Ensure that all structures within the construction area are identified and recorded;
- Determine and document the road conditions; and
- Develop and implement an environmental awareness programme.

Specific management measures related to the identified environmental aspects follow:

Table 9: Management measures to be implemented during pre-construction

Potential Impact	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
LEGISLATIVE REQUIREMENTS AND DOCUMENT CONTROL				
General Requirements	All relevant authorisations, licences and approvals are in place prior to the commencement of construction.	• Approvals to be in place prior to construction.	Once off prior to construction	Project Manager
	A formal document control system is in place to ensure all relevant documents are in place prior to commencement.	• An environmental file/document control system must be designed and put in place. • Prior to construction, the following documents must be included in the file: o Construction EMPr; o Environmental Authorisation (EA); o Stormwater management plan – approved; o Relevant permits for the removal of plant species of special conservation concern.	Once off prior to construction	Project Manager
	Nelson Mandela Metropolitan Municipality (NMBM) requirements regarding notification have been met.	• A copy of the EA should be provided to NMBM; • NMBM should be notified of the commencement of construction.	Once off prior to construction	Project Manager/ECO

Potential Impact	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
	Eastern Cape Department of Economic Development, Environment and Tourism (EC DEDEAT) requirements regarding notification have been met.	• A copy of the Atmospheric Emissions License should be provided to DEDEAT; • DEDEAT should be notified of the commencement of construction.	Once off prior to construction	Project Manager/ECO
	Site specific method statements are compiled and approved.	• Based on the EMPr, the contractor must compile specific method statements which must be approved by the Project manager prior to construction. At a minimum this should include: ○ Method Statement for Search and Rescue of plants that were identified as Species of Special conservation Concern (SSC); ○ Method Statement for site clearing; ○ Method Statement for establishing the construction camp; ○ Method Statement regarding waste and wastewater management; ○ Method Statement to show procedures for dealing with possible emergencies that can occur, such as fire and accidental leaks and spillage of carbon fuels and oils;	Prior to construction	EO to compile Project manager to approve

Potential Impact	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
		○ Method Statement for dust control; ○ Method Statement for the storage and handling of hazardous substances; ○ Method Statement for controlling alien invasive species and noxious weeds; and ○ Method Statement for rehabilitation of construction footprint.		
SENSITIVE SPECIES				
Loss/disturbance of sensitive species	Proper management of sensitive species through identification, rescue and relocation.	• Note: Several sensitive species were identified during the ecological study. Particular species include: ○ *Aloe striata* ○ *Haworthia translucens* ○ *Cyrtanthus clavatus* ○ *Cyrtanthus spiralis* ○ *Bergeranthus addoensis* ○ *Bergeranthus longisepalus* ○ *Bergeranthus scapiger* ○ *Trichodiadema bulbosum* ○ *Cotyledon orbiculata var. flanaganii* ○ *Euphorbia globose;* • Table 1 of the Ecological Specialist Study indicates the species that will require permits for removal or destruction prior to construction commencing. These species, where possible, should then be relocated to the suitable nursery	Once off prior to construction	ECO

Potential Impact	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
		being established for use in other parts of the IDZ or to revegetate the pipeline servitude area; • Before the removal of any of these species, a permit must be obtained; • The plant rescue and protection plan* which allows for the transplantation of conservation important species from areas to be transformed must be implemented prior to construction; • Procedures for conducting search & rescue (S&R): The appointed contractors for the development have to draft and submit method statements, required as part of the CDC's Construction Environmental Specifications for the IDZ (construction EMP). A method statement for S&R is required. The method statement would need to stipulate how the S&R will be conducted and where the plants will be taken. Options are that the plants will be reused in the landscaping and rehabilitation of the Bay Terminals site, or used in the rehabilitation of specific areas in the IDZ, or held in the CDC's plant nursery for later reuse by the investor; • In addition to the plant rescue and protection plan, all the conditions of the relevant permits, must be complied with.		

Potential Impact	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
SITE PLANNING AND LAYOUT				
Loss/disturbance of sensitive features	Planning and layout of construction site is undertaken responsibly to ensure protection of sensitive environmental features.	• Contractor to submit a site plan to the ECO and Project Manager for comment. The site plan must be approved by the Project Manager prior to the establishment of the site. The plan must show the following): o Sensitive environmental features; o Buildings and structures; o Contractors' camp and lay down areas; o Site offices; o Roads and access routes; o Temporary waste storage areas o Site toilets and ablutions; o Topsoil stockpiles areas; o Construction materials stores areas; o Workshops; and o Hazardous substance stores. • Authorised construction footprint to be pegged • Ablution facilities must be located at least 100m away from wetlands.	Once off prior to construction	Contractor to compile plan, ECO to comment, Project Manager to approve.

Potential Impact	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
ENVIRONMENTAL AWARENESS CREATION – INDUCTION				
General Requirements	Environmental awareness creation and training is undertaken prior to construction commencement to minimise environmental impacts and ensure compliance to relevant legislation and authorisations.	• ECO to induct relevant contractor managers at the start of the project. This induction should provide an overview of the authorisation and the CEMPr. The environmental awareness training course for management shall include all management and foremen. • The Contractor must arrange that all of his employees and those of his sub-contractor go through the project specific environmental awareness induction before the commencement of construction and as and when new staff or sub-contractors are brought on site. • A system must be in place to ensure all new employees have received training. • All attendees shall remain for the duration of the course and sign an attendance register that clearly indicates participant's names on completion. A copy of the attendance register is to be retained by the ECO/Project Manager.	Once off prior to construction	ECO to induct construction managers/ Environmental officer (EO) Contractor to induct all workers
STORMWATER MANAGEMENT PLAN				
General Requirements	Nelson Mandela Metropolitan Municipality requirements regarding Stormwater management are considered.	• The design of storm water management systems should be based on Sustainable Urban Drainage Systems (SUDS) and Water Sensitive Urban Design approaches (WSUDS) which enhance natural drainage through permeable surfacing and which integrate landscaping with stormwater in line with the best practice stormwater management.	Once off prior to construction	Authorisation Holder Project Manager Resident Engineer

Potential Impact	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
		• A Stormwater Management Plan should be developed and submitted to NMBM/CDC for approval prior to development. • All the terms and conditions of the approval must be implemented. • Management of stormwater will also need to be designed in such a manner as to prevent negative impacts such as erosion and sedimentation, and to ensure environmental protection of downstream areas. Such plan would be required to meet the following criteria/standards.: o Peak discharge: no increase in discharge for any event of any duration up to the 25-year RI event, o Volume of runoff - no increase up to the annual 10-year rainfall. o Runoff frequency - no surface runoff for the 1-year RI event of any duration. o Water quality - no deterioration.		

Potential Impact	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
RISK ASSESSMENT CONDITIONS				
General Requirements: Prevention of pollution and fire and explosions.	NEMA Risk Assessment conditions are implemented.	• Correct designs to relevant standards and codes as per NEMA and MHI Risk Assessment; • Major Hazard Installation risk assessment which should be completed prior to construction of the terminal; • Compliance with all statutory requirements, i.e. pressure vessel designs; • Compliance with applicable SANS codes, i.e. SANS 10087, SANS 10089, SANS 10108, etc.; • Demonstration that preventative measures are in place to prevent the above ground pipelines from being damaged from road vehicles; • Demonstration that above ground pipelines are protected from vegetation fires below or near the pipelines and cannot be damaged or exceed the design ratings of the pipelines, under such circumstances; • Demonstration that the pipelines will not exceed the design pressure when not in use, due to thermal expansion; • LPG vessels to be mounded, or detailed justification provided for non-mounding vessels, with adequate mitigation provided to prevent a major incident; • Incorporation of applicable guidelines or equivalent international recognised codes of good design and practice into the designs;	Once off prior to construction	Authorisation Holder Project Manager Resident Engineer

Potential Impact	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility

		• Completion of a recognised process hazard analysis (such as a HAZOP study, FMEA, etc.) on the proposed facility prior to construction to ensure design and operational hazards have been identified and adequate mitigation put in place;
		• Full compliance with IEC 61508 and IEC 61511 (Safety Instrument Systems) standards or equivalent to ensure that adequate protective instrumentation is included in the design and would remain valid for the full life cycle of the tank farm:
		  o Including demonstration from the designer that sufficient and reliable instrumentation would be specified and installed at the facility;
		• Preparation and issue of a safety document detailing safety and design features reducing the impacts from fires, explosions and flammable atmospheres to the MHI assessment body at the time of the MHI assessment:
		  o Including compliance to statutory laws, applicable codes and standards and world's best practice;
		  o Including the listing of statutory and non-statutory inspections, giving frequency of inspections;
		  o Including the auditing of the built facility against the safety document;
		  o Noting that codes such as IEC 61511 can be used to achieve these requirements;		

Potential Impact	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
		• Demonstration by BTG or their contractor that the final designs would reduce the risks posed by the installation to internationally acceptable guidelines; • Signature of all terminal designs by a professional engineer registered in South Africa in accordance with the Professional Engineers Act, who takes responsibility for suitable designs; • Completion of an emergency preparedness and response document for on-site and off-site scenarios prior to initiating the MHI risk assessment (with input from local authorities); • Permission not being granted for increases to the product list or product inventories without redoing part of or the full EIA; • Final acceptance of the facility risks with an MHI risk assessment that must be completed in accordance to the MHI regulations: o Basing such a risk assessment on the final design and including engineering mitigation.		

***Proposed "Rescue and Relocation" Plan**

Step 1:

An appropriate service provider must be appointed to conduct and manage the operation.

Step 2:

Locate with a GPS and physically mark the positions of individuals of the various species before vegetation clearing commences. If a species is represented by too many individuals to make a relocation of the entire population feasible, plants should be taken from difference parts of the site and from different habitats. Both young and old individuals should be selected as well as any individuals reflecting variability in the population (for example, flower colour or leaf size) to ensure that translocation will express the broadest genetic variation and the plants will have the maximum chance of survival.

Step 3:

Many of the Species of Special Conservation Concern (SSC) are plants that cannot be successfully uprooted and replanted at all. The best chance of successfully relocating these species will be to collect seeds or possibly small cuttings and establish them under nursery conditions. Healthy cultivated individuals will then be able to be introduced to carefully chosen localities. Options are to be reused in the landscaping and rehabilitation of the Bay Terminals site or used in the rehabilitation of specific areas in the IDZ or held in the CDC's plant nursery for later reuse by the investor.

Plants should be translocated in the most appropriate form. This implies that not only whole plants will be moved but also seeds, bulbs and cuttings.

Private individual and / or nurseries should also be given the opportunity to collect plants that will not be relocated (in other words, they will be destroyed).

Step 4:

A list with numbers of all species collected, and the Zone in the IDZ where the plants were rescued from, together with their GPS co-ordinates, should be forwarded to this office after each search and rescue operation of the operator appointed by the CDC to undertake this task.

12.2 Construction

Mitigation measures for all activities related to construction are provided below. The mitigation measures included in the all the specialist studies and the Environmental Impact Assessment Report (EIR) have also been incorporated below. Management actions are linked to a specific impact and overall management objective. Information on the institutional responsibilities and the frequency of the actions is also provided.

Table 10: Management measures to be implemented during construction

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
ATMOSPHERIC EMISSIONS					
Dust emissions	Site Clearing General construction activities Driving on gravel roads	Ensure that all possible causes of dust are mitigated as far as possible to minimise impacts to the surrounding environment	• A speed limit of 20km/h must be maintained on all dirt roads; • Dust suppression measures by means of either water or biodegradable chemical agent will be implemented during the construction phase to minimise dust generated by construction activities. Recycled water to be used, instead of potable water, to save water.	Daily	Contractor to implement actions ECO to monitor
Emissions from vehicles and equipment (CO^2, NOx, SOx, VOC's etc.)	Use of vehicles and plant during construction	All vehicles and machinery on site must be properly maintained to reduce emission sources.	• All construction vehicles and machinery will be maintained such as to operate efficiently. Idling times of vehicles and machinery to be minimised; • In terms of transportation of workers and materials, collective transportation arrangements should be made to reduce individual car journeys where possible; • All vehicles used during the project should be properly maintained and in good working order; • All vehicles and other machinery should comply with road worthy requirements and comply with legislation in terms of allowable emissions.	Daily and as required by maintenance schedule	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
Noise increase due to construction activities	General construction activities	Ensure that noise disturbance to surrounding areas are minimised and that construction activities comply with the Noise Control Regulations and the provisions of South African National Standards; Environmental, Health and Safety (EHS) Guidelines, World Health Organisation (WHO, 2002).	• The provisions of SANS 10103:2008 will apply to all areas within audible distance of residents or adjacent landowners; • Equipment and/or machinery which will be used must comply with the manufacturer's specifications on acceptable noise levels; • Construction activities should be limited to daytime only; • Noise monitoring should be undertaken as spot checks; • When required noise mufflers should be utilised to reduced noise; • It is important to keep an open channel of communication between all stakeholders and keep record of any concerns raised.	Daily	Contractor to implement actions ECO to monitor
WATER IMPACTS (SURFACE AND GROUNDWATER)					

Liquid waste including sewage may cause stormwater and groundwater pollution if not managed and	Sewage management
	Waste water management
		Construction activities are managed correctly to ensure no negative impacts to water quality is incurred. This includes proper management of	• Management of Ablution Facilities:
			  ○ Chemical toilets will be placed on site for the duration of the construction phase;
			  ○ Ablution facilities (chemical toilets) are to be provided by the Contractor, at a ratio of 1:10;
				Daily and/or as and when required (removal of waste)	Contractor to implement actions
					ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
disposed of correctly.		ablution facilities and waste water.	○ Ablution facilities (chemical toilets) must be erected within 100m from all workplaces but within the development footprint; ○ Toilets are to be secured to the ground and must have a closing mechanism; ○ Toilet paper must be provided at these facilities and must be serviced once per week; ○ Certified contractors to maintain and empty chemical toilets regularly; ○ Safe disposal certificates to be kept in the site file; ○ The contractor must ensure that spillage does not occur when toilets are cleaned/serviced, and contents must be properly stored and disposed of properly; ○ Discharge of waste into the environment and/or burial of waste are strictly prohibited; ○ Sanitary arrangements must be to the satisfaction of the PM, ECO, the local authorities and the applicable legal requirements. • Management of waste water: ○ The contractor is to ensure that clean run-off water is diverted away from potentially contaminated areas of the construction site;		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			○ Contaminated liquids and soil from the site must be disposed of at a permitted disposal site; ○ Safe disposal certificates to be kept in the site file.		
Impact of changes to water quality through construction materials such as sediments, topsoil/soil, diesel, oils and cement may pose a threat to the instream and adjacent vegetated areas, if by chance it is dispersed via surface run-off or allowed to permeate groundwater.	Construction activities Clearing of vegetation Earthworks Site camp Concrete mixing Workshop and equipment Storage of hazardous substances; Construction vehicles	Ensure no spillages through proper management of site clearing, earthworks, site camp, concrete mixing, workshop and equipment. Ensure stormwater is properly managed during construction. Effective and safe management of hazardous materials on site, to minimise the impact of materials on the environment.	• The following best practise measures in terms of erosion apply: ○ Instability and erosion of steep slopes must be stabilised immediately. Re-vegetation in consultation with landscape architect and ECO should be done if required; ○ To reduce the loss of material by erosion, causing sedimentation, disturbance must be kept to a minimum; ○ If clearing of slopes occur within the rainy season, earth berms must be created along the up-slope side of the construction area; ○ Where possible, natural vegetation should be retained to reduce the risk of erosion; ○ Should erosion occur due to negligence on the part of the Contractor to apply the above measures, the Contractor will be responsible for reinstatement of the eroded area to its former state at his own expense. Any surface water pollution occurring as a result of this negligence will be cleaned up by the	Daily	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			Contractor or a nominated clean up organisation at the expenses of the Contractor; ○ Proper Stormwater management must be implemented; ○ Run-off containing high sedimentation loads must not be released into natural or municipal drainage systems; ○ Silt fences must be used to stabilise the site, reduce erosion and silt entering the natural environment. No unchecked silt may enter the natural environment.; ○ Silt fences must be fit for purpose, effective and regularly maintained.		
			• Management of workshop and equipment: ○ Maintenance of equipment and vehicles is not allowed at the construction site. Faulty equipment must be removed from site and repaired at a workshop. ○ A designated vehicle wash bay must be put in place and must meet the following requirements: ▪ Must have an impermeable surface. ▪ Must have drainage measures in place to direct contaminated water towards the oil separator.	Daily	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			▪ Quality of water to be tested prior to release. If not safe then contaminated water must be disposed of as hazardous waste at a licensed waste disposal facility. Safe disposal certificates to be obtained from the final disposal facility. ▪ Emergency spill kit o No washing of plant outside of designated wash bay. o Drip trays will be provided for the stationary plant and for the "parked" plant. o All vehicles and equipment will be kept in good working order and serviced regularly. Leaking equipment will be repaired immediately or removed from the site. • Management of concrete mixing: o Cement mixing to take place on an impervious surface (e.g. plastic or cement mixing pit). o Unused cement bags will be stored in an area not exposed to the weather and packed neatly to prevent hardening or leakage of cement. • Prevention of spillages and spill management; o Drip trays must be placed under all vehicles when immobile for longer than 24 hours. Vehicles		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			suspected of leaking must be monitored and conduct a pre start-up inspection checklist. ○ Drip trays must be checked and replaced for vehicles standing (parked) for prolonged periods. ○ Drip trays must be of a sufficient size and volume to collect any hydrocarbon leakages from a stationary vehicle. ○ Spill kits (absorbent material) must be available on site and in all vehicles that transport hydrocarbons for dispensing to other vehicles on the construction site. ○ Spilled substances must be contained in impermeable containers for removal to a licensed hazardous waste site. ○ Significant spills should be reported to the Project Manager or Contractors Manager and ECO who should report this to the relevant authority.		
			• Storm water management during construction will be implemented however, as the proposed development does not cross any watercourses and is not in close proximity to any wetlands, minimal impacts are expected. Further, as a precaution, the following measures should be implemented:	Once off (design and approval) Implementation – ongoing	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			○ Compile and implement proper stormwater management plan; ○ Increased run-off during construction should be managed using berms, temporary cut-off drains, attenuation ponds or other suitable structures, in consultation with the ECO and resident Engineer; ○ Cut off drains may not cause additional harm to environment. Care must be taken to consider their position and the receiving environment; ○ Stormwater management system is to be installed as soon as possible following site establishment, to attenuate stormwater during the construction phase, as well as during the operational phase; • Surface-water run-off and stormwater must be directed away from trenches and areas of excavation.		
			Management of Hazardous Substances: • The proposed development does not cross any watercourses and is not in close proximity to any wetlands as such minimal impacts apply. Further, the following measures must be implemented: • Proper storage of hazardous material ○ Hazardous materials to be suitably stored to prevent environmental contamination and visual impacts. Storage requirements to be determined	Daily	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			based on chemical qualities of material and Material Safety Data Sheets (MSDS). At a minimum, hazardous chemical substances (HCS) must be stored at a designated area that meets the following requirements: ▪ Earthed; ▪ Fire extinguisher must be present; ▪ Relevant signage to be displayed including No Smoking/ No open flames; Hazardous Chemical Substance Store; Type of HCS (e.g. Diesel); Maximum contents volume and Fire extinguisher o Storage areas should be located 100m from the edge of wetlands or drainage lines; o Hazardous substances must be stored and handled in accordance with the appropriate legislation and standards, which include the Hazardous Substances Act (Act No. 15 of 1973), the Occupational Health and Safety Act (No. 85 of 1993), relevant associated Regulations, and applicable SANS and international standards. o Any hazardous materials (apart from fuel) must be stored within a lockable store with a sealed floor. Suitable ventilation to be provided.		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			○ All storage tanks containing hazardous materials must be placed in bunded containment areas with impermeable surfaces. The bunded area must be able to contain 110% of the total volume of the stored hazardous material. • Spillages ○ In the event of spillages of hazardous substances, the appropriate clean up and disposal measures are to be implemented. ○ The contractor must ensure that necessary materials and equipment are available on site to deal with spills of any hazardous materials present ○ The ECO and Project Manager must be notified of all significant spillages. • Training ○ Staff that will be handling hazardous materials must be trained to do so. • General ○ Drip trays must be placed under all vehicles when immobile for longer than 24 hours. Vehicles suspected of leaking must be monitored and conduct a pre-start-up inspection checklist. ○ Drip trays must be checked and replaced for vehicles standing (parked) for prolonged periods.		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			o Drip trays must be of a sufficient size and volume to collect any hydrocarbon leakages from a stationary vehicle. o Spill kits (absorbent material) must be available on site and in all vehicles that transport hydrocarbons for dispensing to other vehicles on the construction site. o Spilled substances must be contained in impermeable containers for removal to a licensed hazardous waste site. • Contaminated wastewater to be contained, and removed to a registered site, to ensure water bodies on site are not contaminated.		
WASTE GENERATION					
Domestic Waste	Waste generation, storage and disposal	Domestic waste must be managed properly to ensure minimal impacts.	• Waste recycling to be put in place. • Domestic waste must be stored in containers labelled or colour coded for general waste. • Vermin / weatherproof bins will be provided in sufficient numbers and capacity to store domestic waste. • Containers must be emptied frequently before reaching capacity • Solid waste shall only be stored in the designated general waste storage area which must be enclosed and impermeable.	Daily	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			• No waste shall be buried or burned anywhere on the construction site. • All solid waste shall be disposed of by a certified contractor, off-site, at an approved landfill site if no municipal services is available. The Contractor shall supply the ECO with a certificate of disposal for auditing purposes. • Avoidance, reduction and reuse should be practiced wherever possible – see waste management plan. • Waste may not cause any nuisance (e.g. odour) • Records of waste manifest documents must be retained at the administration office		
Construction Waste	Waste generation, storage and disposal	Construction waste must be managed properly to ensure minimal impacts.	• Construction waste must be collected and put into suitable closed bins on a daily basis. • Provide waste skips on site. These skips should be sufficient in number, the skip storage area should be kept clean, skips should be emptied and replaced before overflowing or spillage occurs. Skips should be covered to prevent waste blowing away. • Construction rubble must be disposed of at a registered landfill site. • Avoidance, reduction, and reuse should be practiced wherever possible – see waste management plan.	Daily	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			• Records of waste manifest documents must be retained at the administration office.		
Hazardous waste	Waste generation, storage and disposal	Hazardous waste must be managed properly to ensure minimal impacts.	• The classification of waste determines the handling methods and the ultimate disposal of the material. The contractor shall manage hazardous waste that are anticipated to be generated by his operations as follows: o Characterise the waste to determine if it is general or hazardous (Use the Appendix 1 of the Norms and Standards for the Classification of Waste for landfill to determine whether additional classification is required). o Obtain and provide an acceptable container with a label. o Place hazardous waste material in the container. o Inspect the container on a regular basis o Haul the full container to the licenced and correct disposal site. o Provide documentary evidence of proper disposal of the waste. • Only temporary storage of waste is allowed (once of storage of waste for a period less than 90 days). The volume of material should be limited to less than 80m^3 of hazardous waste. Should this be exceeded the Norms and	Daily	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			Standards for the Storage of Waste will need to be complied with. • Containers must be emptied frequently before reaching capacity • All hazardous waste must be disposed of at the nearest hazardous landfill • Waste may not cause any nuisance (e.g. contamination) • Records of waste manifest documents must be retained at the administration office • Certificates of registration must be retained for transporters of hazardous waste and retained in record at the administration office.		
SOIL ALTERATION					
Alteration of topography	Site clearing Landscaping Construction activities	Changes to topography to be planned properly to prevent negative impacts.	• Changes to topography must be properly designed and landscaped. • Stormwater management measures must be implemented to ensure these changes to not impact on stormwater.	Ongoing	Contractor to implement actions ECO to monitor
Loss of topsoil	Site clearing	Effective management of topsoil, in order to minimise the impact of construction activities.	• During site preparation, topsoil and subsoil must be stripped separately from each other and must be stored separately from spoil material for use in the rehabilitation phase. • Topsoil should be protected from wind and rain, as well as contamination from diesel, concrete or wastewater. Topsoil	At start of construction. Checks to occur on a monthly basis	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			stockpiles should be checked on a monthly basis to ensure that this is the case. • Topsoil should be used in landscaping and rehabilitation where possible.		
Soil erosion	Site clearing Landscaping Construction activities	Ensure that all possible causes of erosion are mitigated as far as possible to minimise impacts to the site and surrounding environment	• Instability and erosion of steep slopes must be stabilised immediately. Re-vegetation in consultation with landscape architect and ECO should be done if required. • To reduce the loss of material by erosion, disturbance must be kept to a minimum. • If clearing of slopes occur within the rainy season, earth berms must be created along the up-slope side of the construction area. • Where possible, natural vegetation should be retained to reduce the risk of erosion. • Should erosion occur due to negligence on the part of the Contractor, the Contractor will be responsible for reinstatement of the eroded area to its former state at his own expense. Any surface water pollution occurring as a result of this negligence will be cleaned up by the Contractor or a nominated clean up organisation at the expenses of the Contractor.	Ongoing	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
Solid waste from construction activities may cause soil pollution if not managed and disposed of correctly.	Site camp Storage of waste Construction activities	Ensure that all possible causes of soil pollution are mitigated as far as possible to minimise impacts to the site and surrounding environment	• Construction waste must be collected and put into suitable closed bins on a daily basis. • Provide waste skips on site. These skips should be sufficient in number, the skip storage area should be kept clean, skips should be emptied and replaced before overflowing or spillage occurs. Skips should be covered to prevent waste blowing away. • Construction rubble must be disposed of at a registered landfill site. • Avoidance, reduction, and reuse should be practiced wherever possible – see waste management plan. • Records of waste manifest documents must be retained at the administration office.	Daily	Contractor to implement actions ECO to monitor
Liquid waste including sewage may cause soil pollution if not managed and disposed of correctly.	Site camp Storage of waste Construction activities Waste water Ablution facilities	Ensure that all possible causes of soil pollution are mitigated as far as possible to minimise impacts to the site and surrounding environment	• Management of Ablution Facilities: o Chemical toilets will be placed on site for the duration of the construction phase; o Ablution facilities (chemical toilets) are to be provided by the Contractor, at a ratio of 1:10; o Ablution facilities (chemical toilets) must be erected within 100m from all workplaces but within the development footprint; o Toilets are to be secured to the ground and must have a closing mechanism;	Daily	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			○ Toilet paper must be provided at these facilities and must be serviced once per week; ○ Certified contractors to maintain and empty chemical toilets regularly; ○ Safe disposal certificates to be kept in the site file; ○ The contractor must ensure that spillage does not occur when toilets are cleaned/serviced, and contents must be properly stored and disposed of properly; ○ Discharge of waste into the environment and/or burial of waste are strictly prohibited; ○ Sanitary arrangements must be to the satisfaction of the PM, ECO, the local authorities and the applicable legal requirements. • Management of waste water: ○ The contractor is to ensure that clean run-off water is diverted away from potentially contaminated areas of the construction site; ○ Contaminated liquids and soil from the site must be disposed of at a permitted disposal site; ○ Safe disposal certificates to be kept in the site file.		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
RESOURCE CONSUMPTION					
Electricity consumption	General site activities	Electricity reduction mechanisms to be implemented.	• Enforce electricity reduction strategies; • Environmental awareness training.	Ongoing	Contractor to implement actions ECO to monitor
Water consumption	General site activities	Water conservation mechanisms to be implemented.	• Enforce water saving strategies including design of recycling and reuse, rainwater harvesting etc.; • Environmental awareness training.	Ongoing	Contractor to implement actions ECO to monitor
Fuel consumption	Fuelling of plant, vehicles and generators	Fuel conservation mechanisms to be implemented.	• Record and monitor fuel consumption regularly; • Reduce theft of fuel (increase security).	Ongoing	Contractor to implement actions ECO to monitor
Raw materials consumption	General construction activities requiring raw materials	Raw materials conservation mechanisms to be implemented.	• Promote effective use of raw materials; • Recycling will be implemented on applicable waste streams.	Ongoing	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
EFFECTS ON BIODIVERSITY					

Loss of vegetation and open space management habitat.	Site clearing
	Construction activities.
		No loss of habitat outside the approved footprint.	• Proper management of site establishment:
			  ○ Locate construction camp in area where sensitive environmental features will not be impacted on. The location should be approved by the ECO, Project Manager and EO.
			  ○ Construction camp should be fenced, and access control should be exercised.
			  ○ The extent of the site should by all means be limited, to avoid any additional clearance of vegetation.
			• Proper management of site clearing:
			  ○ Restrict site clearing activities to construction area /domain.
			  ○ Clearing of vegetation to be conducted in a phased manner (where possible).
			• The natural areas surrounding the Project area should be declared 'no-go' area's during the construction and operational phases and all efforts must be made to prevent access to these areas from construction workers, machinery and the general public;
			• All laydown, storage areas etc should be restricted to within the Project area and all access roads must be kept within this area or from existing access roads.
				Ongoing	Contractor to implement actions
					ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			• A qualified environmental control officer must be on site when construction begins to identify species that will be directly disturbed and to relocate fauna/flora that is found during construction (including all reptiles and amphibians). • Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood events. This will also reduce the likelihood of encroachment by alien invasive plant species. • A condition of the Environmental Authorisation issued by the Department of Environmental Affairs to the Coega Development Corporation for the removal of vegetation within the Coega IDZ area indicate that an Alien Invasive Species monitoring and control plan must be implemented. The CDC has such a plan, called "Invasive species monitoring, control and eradication plan for the Coega SEZ", dated 9 February 2017. This plan must be implemented on site and along the pipeline reserve.		
Increased risk of alien plant invasion.	Construction activities Earthworks Site Camp	To ensure alien plants are eradicated and controlled, to prevent invasion.	• Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood events. This will also reduce the likelihood of encroachment by alien invasive plant species; • A condition of the Environmental Authorisation issued by the Department of Environmental Affairs to the Coega Development Corporation for the removal of vegetation	Ongoing	Contractor to implement actions ECO to monitor.

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			within the Coega IDZ area indicate that an Alien Invasive Species monitoring and control plan must be implemented. The CDC has such a plan, called “Invasive species monitoring, control and eradication plan for the Coega SEZ”, dated 9 February 2017. This plan must be implemented on site and along the pipeline reserve.		
Loss of faunal species community composition and diversity.	Site clearing Construction activities.	Minimal disturbance to fauna occurs during construction.	• Comply with the requirements of the National Environmental Management: Biodiversity Act (No. 10 of 2004), Natal Nature Conservation Ordinance 15 of 1974 and Animal Protection Act (No. 71 of 1962); • All domesticated animals are forbidden within the entire Project area (especially feral cats); • The use of “migratory friendly” property borders, such as palisade fencing or wire fencing with large gaps, should be considered along the pipeline, as this will allow for the ongoing survival of most species presently inhabiting the property. This will allow for the free movement of small mobile organisms (such as rodents).	Ongoing	Contractor to implement actions ECO to monitor
Hunting, trapping and killing of animals.	Site clearing Construction activities.	Minimal disturbance to fauna occurs during construction.	• If any faunal species are recorded during construction, activities should temporarily cease, and an appropriate specialist should be consulted to identify the correct course of action;	Ongoing	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			• Environmental awareness training should be provided to contractors regarding disturbance to animals. Particular emphasis should be placed on talks regarding snakes; • No poaching or killing of animals to be allowed whatsoever; • No wilful harm to any animals, unless a direct threat is posed to a worker's health or safety; • Animals residing within the designated area shall not be unnecessarily disturbed; • Before construction starts, construction workers must be educated with regards to littering and poaching; • No trapping or snaring of wild animals if any. Nesting sites should not be disturbed; • If the development is approved, construction contractors, sub-contractors and operators must ensure that no fauna taxa are unduly disturbed, trapped, hunted or killed; • All workers will undergo environmental awareness training to address potential human and wildlife interaction and the permissible reactions to this interaction; • Environmental awareness training should include this aspect.		
Increased animal road mortality.	Construction activities Construction vehicles.	Ensure no accidental deaths of fauna on the roads.	• Speed limits to be adhered to. • Environmental awareness training to all visitors to the site, especially drivers to include this aspect.	Ongoing	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
Changes to migration corridors.	Construction activities	Ensure that minimal disturbance of ecological systems and natural corridors takes place during construction.	• The use of “migratory friendly” property borders, such as palisade fencing or wire fencing with large gaps, should be considered along the pipeline, as this will allow for the ongoing survival of most species presently inhabiting the property. This will allow for the free movement of small mobile organisms (such as rodents).	Ongoing	Contractor to implement actions ECO to monitor
INCIDENTS, ACCIDENTS, AND POTENTIAL EMERGENCY SITUATIONS					
Pollution incidents	Workshop Site Camp Storage of Hazardous material Use of plant and vehicles	Minimise potential pollution incidents due to construction.	• Proper emergency response procedure to be in place for dealing with spill or leaks at the construction site; • Ensure that the necessary materials and equipment for dealing with spills and leaks are available on site, where practicable; • Remediation of the spill areas will be undertaken to the satisfaction of the Project Manager; • In the event of a hydrocarbon spill, the source of the spillage will be isolated and contained. The area will be cordoned off and secured; • The Contractor will ensure that there is always a supply of an appropriate absorbent material readily available to absorb, breakdown and where possible, encapsulate a minor hydrocarbon spillage; • All staff on site will be made aware of actions to be taken in case of a spillage;	Daily	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			• Provide contact details of person to be notified in a case of spillages – signage to be displayed at strategic points within the construction domain (e.g. workshop, fuel storage area, hazardous material containers).		
Health and safety incidents e.g. injury to workers or visitors to the site.	General construction activities	A safe working environment for contractors/construction workers and the public is provided.	• Appoint Safety Agent; • Contractor to submit a Health and Safety Plan, prepared in accordance with the Health and Safety Specification, for approval prior to the commencement of work; • All construction personal must be clearly identifiable. All employees must also be issued with employee cards for identification purposes; • All workers will be supplied with the required Personal Protective Equipment as per the Occupational Health and Safety Act (Act No. 85 of 1993); • Fencing and barriers will be in place in accordance with the Occupational Health and Safety Act (Act No. 85 of 1993); • Applicable notice boards and hazard warning notices will be put in place and secured. Night hazards will be indicated suitably (e.g. reflectors, lighting, traffic signage); • Maintain access control to prevent access of the public to the construction areas, as far as practicable; • 24-hour security and access control; • Health and Safety awareness training;	Appointment and Plan – once off at start, other actions, ongoing	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			• A Dedicated Occupational Health and Safety system to be implemented by Contractor's Safety Officer. To be monitored and audited by the Client's Safety Agent, in terms of the Construction Regulations (2003).		

Spillage and accidents and injury caused by the inappropriate storage of hydrocarbons and other hazardous material.	Storage of fuel
	Site Camp
	Workshop areas
		Effective and safe storage of hydrocarbons on site, in order to minimise the impact of hydrocarbons on the environment	• Proper storage of hydrocarbons
			  ○ Storage requirements to be determined based on chemical qualities of material and Safety Data Sheets (SDS). As a minimum, hazardous chemical substances (HCS) must be stored at a designated area that meets the following requirements:
			    ▪ Earthed;
			    ▪ Fire extinguisher must be present;
			    ▪ Relevant signage to be displayed including No Smoking/ No open flames; Hazardous Chemical Substance Store; Type of HCS (e.g. Diesel); Maximum contents volume and Fire extinguisher;
			• Storage areas should be located 100m from the edge of wetlands;
			• Hazardous substances must be stored and handled in accordance with the appropriate legislation and standards, which include the Hazardous Substances Act (Act No. 15 of 1973), the Occupational Health and Safety Act (No. 85
				Ongoing	Contractor to implement actions
					ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			of 1993), relevant associated Regulations, and applicable SANS and international standards; • Any hazardous materials (apart from fuel) must be stored within a lockable store with a sealed floor. Suitable ventilation to be provided; • All storage tanks containing hazardous materials must be placed in bunded containment areas with impermeable surfaces. The bunded area must be able to contain 110% of the total volume of the stored hazardous material. • Spillages: o In the event of spillages of hazardous substances, the appropriate clean up and disposal measures are to be implemented; o The contractor must ensure that necessary materials and equipment are available on site to deal with spills of any hazardous materials present; o The ECO and Project Manager must be notified of all significant spillages.		
Fire and or explosions and resultant injury, death and damage to property.	Storage of fuel Site Camp Workshop areas	Minimise potential fire incidents during construction.	• Appropriate emergency response to be in place for dealing with fire at the construction site; • All fire control mechanisms (firefighting equipment) will be routinely inspected by a qualified investigator for efficacy thereof and be approved by local fire services;	Ongoing	Contractor to implement actions ECO to monitor Resident engineer to

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
	General Construction Activities		• All staff on site will be made aware of general fire prevention and control methods, and the name of the responsible person to alert to the presence of a fire; • Burning of waste is not permitted; • Suitable precautions will be taken (e.g. suitable fire extinguishers, water bowsers, welding curtains) when working with welding or grinding equipment; • Designated smoking areas should be provided, with special bins for discarding of cigarette butts; • All recommendations of the NEMA Risk Assessment, to be implemented. • All recommendations of the MHI Risk Assessment to be implemented.		monitor installation of infrastructure
SOCIAL					
Visual impact through site clearing and construction camp and activities.	General Construction activities Site camp	Proper management of construction activities to minimise disturbance to visual environment.	• Suitable screening to be put in place during construction to minimise visual impacts; • No littering to be allowed; • Good housekeeping practices to be followed.	Ongoing	Contractor to implement actions ECO to monitor
Safety and security: Potential influx of work seekers. Unauthorised access.	General construction activities	Proper management of labour force is undertaken to ensure that there are no security-related issues	• 24-hour access control to the site and 24-hour security. • Workers found to be engaging in activities such as excessive consumption of alcohol, drug use or selling of any such items on site must be disciplined.	Ongoing	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
		or disturbance to tenants or landowners outside the construction footprint.			
Traffic disruptions	General construction activities	Minimal disturbances to traffic due to construction activities.	• Traffic warning and calming measures will be put in place when construction activities may impact on traffic flow; • Integration with other planned construction activities must be implemented, communication channels to be kept open between developers, contractors and the CDC.	Ongoing	Contractor to implement actions ECO to monitor
Impact on road safety due to heavy vehicles during construction.	Construction vehicles	No accidents or incidents occurring on roads.	• Traffic warning and calming measures will be put in place when construction activities may impact on traffic flow; • A speed limits to be clearly marked and adhered to on and around the study area. Environmental awareness training to all workers and visitors to the site, especially drivers to include this aspect.	Ongoing	Contractor to implement actions ECO to monitor
Impact on road infrastructure due to heavy vehicles during construction.	Construction vehicles	Minimal disturbances to road infrastructure.	• Detailed planning to be implemented to avoid unnecessary trips; • In terms of transportation of workers and materials, collective transportation arrangements should be made to reduce individual car journeys where possible; • All construction vehicles to be maintained.	Ongoing	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
Potential loss of archaeological heritage.	General Construction activities Site clearing	No adverse impact on the historical and cultural inheritance of the area.	• No heritage resources were identified on site. o Chance find procedure: ▪ If during the construction phase of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager; ▪ It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find and confirm the extent of the work stoppage in that area. ▪ The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA and ECPHRA.	Ongoing	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
Potential loss of palaeontological heritage.			• No heritage resources were identified on site. o Chance find procedure: ▪ If during the construction phase of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any sign of palaeontological significance, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager; ▪ It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find and confirm the extent of the work stoppage in that area. • The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA and ECPHRA.		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
Loss of rural/cultural sense of place	General Construction activities Site camp	Proper management of construction activities to minimise disturbance to sense of place.	• The development should be designed in line with future planning documents, CDC's architectural guidelines and existing and planned surrounding land uses.	Ongoing	Contractor to implement actions ECO to monitor
ECONOMIC					
Decline/increase in economy	Supplier and contractor selection	Preferential use of local contractors and suppliers.	• Local contractors and suppliers to be used during the construction phase as far as possible.	Ongoing	Contractor to implement actions ECO to monitor
Employment	Employment of construction workers	Proper management of labour force is undertaken to ensure that there is optimal use of local labourers and local contractors.	• Wherever possible labour, materials and services must be sourced locally.	Ongoing	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
REHABILITATION AND LANDSCAPING					

General	Rehabilitation and landscaping activities	Adequate reinstatement and rehabilitation of construction areas	• In line with the requirements the National Environmental Management: Biodiversity Act (Alien and Invasive Species Regulations, 2014), the following must be undertaken:
			  ○ Eradicate all Listed Invasive Species (Category 1a), if present;
			  ○ Control all Listed Invasive Species (Category 1b), if present;
			  ○ Apply for a permit for all Listed Invasive Species (Category 2), if present;
			  ○ Apply for exemption for all Listed Invasive Species (Category 3), if present.
			• After the construction phase, the area to be reinstated to the same or better condition than it was prior to construction.
			• Clear and completely remove from site all construction plant, equipment, storage containers, temporary fencing, temporary services, and fixtures
			• Ensure that all access roads utilised during construction are returned to a usable state and/or a state no worse than prior to construction.
			• Inert waste and rubble
			  ○ Clear the site of all inert waste and rubble, including surplus rock, foundations and batching
				Ongoing	Contractor to implement actions
					ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			plant aggregates. After the material has been removed, the site shall be re-instated and rehabilitated. o Remove from site all domestic waste and dispose of in the approved manner at a registered waste disposal site, or with a registered service provider. • Hazardous waste and pollution control o Remove from site all pollution containment structures. o Remove from site all temporary sanitary infrastructure and waste water disposal systems. o Take care to avoid leaks, overflows and spills and dispose of any waste in the approved manner • Control of Invasive Plant species: o Control invasive plant species and noxious weeds by means of extraction, cutting or other approved methods. o Encroachment of alien vegetation should be monitored regularly and controlled; the area must be kept clear of all invader plants as per the Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983). Rehabilitation measures must be employed until such a time as indigenous species is established.		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			○ As much vegetation growth as possible should be promoted within the proposed replacement in order to protect soils and to reduce the percentage of the surface area which is left as bare ground. In this regard special mention is made of the need to use indigenous vegetation species as the first choice during landscaping • Landscaping ○ Make safe all excavations outside of the construction area by backfilling and grading, as required. ○ In general, no slopes steeper than 1(V):3(H) are permitted in cut-and-fill areas, unless otherwise specified by the landscaping plan. ○ Programme the backfill of excavations so that subsoil is deposited first, followed by the topsoil. ○ Monitor backfilled areas for subsidence (as the backfill settles) and fill depressions using available material. ○ Shape the area surrounding the development to blend in with the surrounding landscape, where possible. Landscaping shall be done through the use of indigenous plant species, following water conscious design principles.		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			○ Ensure that no excavated material or stockpiles are left on site and that all material remaining after backfilling is landscaped to blend in with the surrounding landscape. • Topsoil replacement and soil amelioration ○ Execute top soiling activity prior to the rainy season or any expected wet weather conditions. ○ Execute topsoil placement only after all construction work has ceased. ○ Replace and redistribute stockpiled topsoil together with herbaceous vegetation, overlying grass and other fine organic matter in all disturbed areas of the construction site, including temporary access routes. Replace topsoil to the original depth. ○ Place topsoil in the same area from where it was stripped. If there is insufficient topsoil available from a particular soil zone to produce the minimum specified depth, topsoil of similar quality may be brought from other areas of similar quality. ○ The suitability of substitute material will be determined by means of a soil analysis addressing soil fraction, fertility, pH and drainage.		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			○ Do not use topsoil suspected to be contaminated with the seed of alien vegetation. Alternatively, the soil is to be appropriately treated. ○ Ensure that storm water run-off is not channelled alongside the gentle mounding, but that it is taken diagonally across it. ○ Shape remaining stockpiled topsoil not utilised elsewhere in an acceptable manner so as to blend in with the local surrounding area. ○ After topsoil placement is complete, spread available stripped vegetation randomly by hand over the top-soiled area • Ripping and scarifying ○ Rip and/or scarify all areas following the application of topsoil to facilitate mixing of the upper most layers. Whether ripping and/or scarifying is necessary will be determined based on the site conditions immediately before these works begin. ○ Rip and/or scarify all disturbed areas (and other specified)		

The mitigation measures suggested by the TNPA Landside Infrastructure Aquatic and Biodiversity Study are included below.

Table 11: Applicable Management measures to be implemented during construction – from TNPA Landside Infrastructure BAR Biodiversity Assessment (related to servitudes and road reserves(

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
Extended Pipelines within TNPA approved servitudes					
Impact to sensitive vegetation and habitats	Site Clearing General construction activities	Impacts related to the construction and operation of pipelines within approved reserves/servitudes takes into account the requirements of the specialist	• After construction the Coega Estuary channel, where impacted upon must be reinstated and where possible diversions should be limited for short periods. The new channel must accommodate current flows (low flow and floods), i.e. simulate the current hydrological regime. • Alien plant regrowth should also be monitored, and any such species should be removed during the construction and operational phases in line with the relevant Transnet environmental specifications and the Transnet Alien Vegetation Management Plan for the Port of Ngqura. • Clearing of vegetation should be kept to a minimum, keeping the width and length of the earthworks to a minimum (Construction phase). • It is understood that Transnet currently holds an Alien Vegetation Management Plan for the Port of Ngqura, which needs to be implemented for the proposed project. This	Ongoing	Contractor to implement actions ECO to monitor

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			plan must be updated if required. The plan needs to include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken. • A number of species will require permits prior to removal or destruction prior to construction commencing. These species, where possible, should then be relocated to the suitable nursery being established by Transnet for use in other parts of the IDZ.		
Erosion and sedimentation	Site Clearing General construction activities		• All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised (Construction Phase). • Erosion and sedimentation into water bodies must be minimised through the effective stabilisation (such as silt traps, gabions and Reno mattresses or similar suitable stabilising structures) and the re-vegetation of any disturbed areas (Operational Phase).		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			• Install silt traps, sumps and oil separators as part of the Stormwater Management System, where required (Operational Phase). • Stockpiles must be located away from river channels i.e. greater than 32m or outside of the 1:100 floodline whichever is greater (Construction Phase). Refer to Figure 6-4 which illustrates the 32m buffer of the drainage line, as well as the delineation of the Coega Estuary. • The Subsequent Environmental Impact Report for the Port of Ngqura explains that “slopes exceeding a 1:3 gradient should ideally not be developed but were development does take place the slopes must be stabilised and rehabilitated” (CES, 2000, page 83). In the case of this project, areas with slopes of 1:3 or greater are unavoidable as a result of the proposed access road. As a result, it is recommended that suitable stabilizing structures and erosion prevention controls be implemented during the operational phase. • It is understood that there is an existing Storm Water Management Plan in place. Transnet need to ensure that this plan is updated to cater for this proposed project		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			development. Gabion structures and rocks should be used where appropriate. It is recommended that stormwater and any runoff generated by the hard surfaces should be discharged into energy dissipation structures, where required. These could be used to enhance the sense of place, if they are planted with indigenous vegetation. These energy dissipation structures should be placed in a manner that flows are managed prior to being discharged back into the natural water courses, thus not only preventing erosion, but also supporting the maintenance of natural base flows within these systems, i.e. hydrological regime (water quantity and quality) is maintained. The crossing point should also not trap any run-off, thereby creating inundated areas, but allow for free-flowing water courses. The stormwater structures and infrastructure should be maintained on a regular basis.		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
Emergency incidents and pollution	Site Clearing General construction activities		• Emergency plans must be in place in case of spillages onto road surfaces and water courses (Construction and Operational Phase). • Fuels used for construction and chemicals used for road surfacing must be stored safely on site and surrounded by bunds. Chemical storage containers must be regularly inspected so that any leaks are detected early (Construction Phase). • The construction camp and necessary ablution facilities meant for construction workers must be beyond the 32m buffer described previously and shown in Figure 6-4 (Construction Phase). • Littering and contamination of water sources during construction must be prevented by effective construction camp management (Construction Phase).		
Impacts to fauna	Site Clearing		• Mitigation with respect to minimising these roadkill incidents is minimal and not always practical. Therefore, awareness should be created during the staff induction programme. Staff should be made aware of the general		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
	General construction activities		speed limits as well the potential animals that may cross and how to react in these situations. • Furthermore, it is suggested that mountable kerbing be used, which allows for the movement of animals across any roads, especially the smaller species of rodent, tortoises, snakes and lizards.		

13 APPENDICES

13.1 Sensitive species lists

13.1.1 Flora

Table 12: Plant species of conservation concern and protected plants found in the study area (SANBI, 2012; Provincial Nature Conservation Ordinance (PNCO), 1974; National Forest Act (NFA, 1998)).

Family	Species	Threat status (SANBI 2012)	Protected status (PNCO 1974, NFA 1998)	Life form
AMARYLLIDACEAE	*Boophone disticha* (L.f.) Herb.	Declining	Protected	Geophyte
AMARYLLIDACEAE	*Cyrtanthus spiralis* Burch. ex Ker Gawl.	EN	Protected	Geophyte
AMARYLLIDACEAE	*Haemanthus coccineus* L.	LC	Protected	Geophyte
APOCYNACEAE	*Pachypodium bispinosum* (L.f.) A.DC.	LC	Protected	Succulent
ASPHODELACEAE	*Aloe africana* Mill.	LC	Protected	Succulent
ASPHODELACEAE	*Aloe humilis* (L.) Mill.	LC	Protected	Succulent
ASTERACEAE	*Euryops ericifolius* (Bél.) B.Nord.	EN		Dwarf shrub
ASTERACEAE	*Syncarpha recurvata* (L.f.) B.Nord.	EN		Shrub
CRASSULACEAE	*Crassula perfoliata* L. var. *coccinea* (Sweet) G.D.Rowley	LC	Protected	Succulent
CRASSULACEAE	*Crassula perfoliata* L. var. *minor* (Haw.) G.D.Rowley	LC	Protected	Succulent
EUPHORBIACEAE	*Clutia daphnoides* Lam.	LC	Protected	Shrub
EUPHORBIACEAE	*Euphorbia clava* Jacq.	LC	Protected	Succulent
EUPHORBIACEAE	*Euphorbia fimbriata* Scop.	LC	Protected	Succulent
EUPHORBIACEAE	*Euphorbia gorgonis* A.Berger	LC	Protected	Succulent
EUPHORBIACEAE	*Euphorbia ledienii* A.Berger var. *ledienii*	LC	Protected	Succulent
EUPHORBIACEAE	*Euphorbia meloformis* Aiton subsp. *meloformis*	NT	Protected	Succulent
EUPHORBIACEAE	*Euphorbia rhombifolia* Boiss.	LC	Protected	Succulent
FABACEAE	*Indigofera tomentosa* Eckl. & Zeyh.	NT		Herb
GERANIACEAE	*Pelargonium reniforme* Curtis subsp. *reniforme*	DDD		Dwarf shrub, geophyte
IRIDACEAE	*Babiana sambucina* (Jacq.) Ker Gawl. subsp. *sambucina*	LC	Protected	Geophyte
IRIDACEAE	*Freesia corymbosa* (Burm.f.) N.E.Br.	LC	Protected	Geophyte
IRIDACEAE	*Tritonia gladiolaris* (Lam.) Goldblatt & J.C.Manning	LC	Protected	Geophyte
MESEMBRYANTHEMACEAE	*Aptenia haeckeliana* (A.Berger) Bittrich ex Gerbaulet	LC	Protected	Succulent
MESEMBRYANTHEMACEAE	*Delosperma echinatum* (Lam.) Schwantes	LC	Protected	Succulent
MESEMBRYANTHEMACEAE	*Glottiphyllum longum* (Haw.) N.E.Br.	LC	Protected	Succulent
MESEMBRYANTHEMACEAE	*Rhombophyllum rhomboideum* (Salm-Dyck) Schwantes	EN	Protected	Succulent
MESEMBRYANTHEMACEAE	*Ruschia cymbifolia* (Haw.) L.Bolus	LC	Protected	Succulent
ORCHIDACEAE	*Acrolophia capensis* (P.J.Bergius) Fourc.	LC	Protected	Geophyte
RUTACEAE	*Agathosma gonaquensis* Eckl. & Zeyh.	CR		Dwarf shrub
RUTACEAE	*Agathosma stenopetala* (Steud.) Steud.	VU		Dwarf shrub
SAPOTACEAE	*Sideroxylon inerme* L. subsp. *inerme*	LC	Protected (NFA)	Tree

13.1.2 Fauna

Table 13:List of species recorded or likely to occur in the general study area, together with the conservation status. Where RDB = Red Data Book category SSC = Species of Special Concern, U = likely presence but unconfirmed Y = present and observed on site during assessment

Taxon	Common Name	RDB/SSC	Presence x
Amphibians			
Amietophrynus pardalis	Eastern Leopard Toad	PNCO, IUCN LC	U
Amietophrynus rangeri	Raucous Toad	PNCO, IUCN LC	U
Breviceps adspersus pentheri	Penther's Rain Frog	PNCO, IUCN LC	U
Cacosternum boettgeri	Common caco	PNCO, IUCN LC	U
Cacosternum nanum	Bronze Caco	PNCO, IUCN LC	U
Hyperolius marmoratus	Painted Reed Frog	PNCO, IUCN LC	U
Kassina senegalensis	Bubbling Kassina	PNCO, IUCN LC	Y
Semnodactylus wealii	Rattling Frog	PNCO, IUCN LC	U
Strongylopus fasciatus	Striped Stream Frog	PNCO, IUCN LC	U
Strongylopus grayii	Clicking Stream Frog	PNCO, IUCN LC	U
Tomopterna delalandii	Cape Sand Frog	PNCO, IUCN LC	U
Vandijkophrynus angusticeps	Cape sand Toad	PNCO, IUCN LC	U
Xenopus laevis	Common Platanna	PNCO, IUCN LC	U
Reptiles			
Acontias gracilicauda	Thin tailed legless skink	PNCO, IUCN LC	U
Acontias lineicauda	Algoa legless skink	PNCO, IUCN NT	U
Acontias meleagris orientalis	Eastern legless skink	PNCO, IUCNLC	U
Acontias percivali tasmani	Tasman's legless skink	PNCO, IUCN LC	Y
Agama atra	Southern rock agama	PNCO, IUCN LC	Y
Aspidelapse lubricus	Cape coral snake	PNCO, IUCN LC	U
Bitis arientans	Puff adder	PNCO, IUCN LC	Y (road fatality)
Bradypodion ventrale	Southern Dwarf Chameleon	PNCO, IUCN LC, CITIES 2	U
Causus rhombeatus	Night adder	PNCO, IUCN LC	U
Chersina angulata	**Angulate tortoise**	**PNCO, IUCN LC, CITIES 2**	**Y**
Cordylus cordylus	**Cape girdled lizard**	**PNCO, IUCN LC, CITIES 2**	**Y**
Cordylus tasmani	Tasman's girdled lizard	CITES 2 ,PNCO, IUCN VU	U
Crotaphopeltis hotamboeia	Herald snake	PNCO, IUCN LC	Y
Dasypeltis scabra	Rhombic egg eater	PNCO, IUCN LC	U
Dispholidus typus	Boomslang	PNCO, IUCN LC	U
Duberria lutrix	Slug eater	PNCO, IUCN LC	Y
Gerrhosaurus flavigularis	Yellow throated plated lizard	PNCO, IUCN LC	Y
Hemachatus haemachatus	Rinkhals	PNCO, IUCN LC	U
Hemidactylus mabouia	Tropical house gecko	PNCO, IUCN LC	Y
Homopus areolatus	**Parrot-beaked padloper**	**PNCO, IUCN LC, CITIES 2**	**Y (Shell only)**
Homorolapse lacteus	Harlequin snake	PNCO, IUCN LC	U
Lamprophis aurora	Aurora house snake	PNCO, IUCN LC	U
Lamprophis capensis	Brown house snake	PNCO, IUCN LC	U
Lamprophis fuscus	Yellow bellied house snake	PNCO, IUCN NT	U
Lamprophis inornatus	Olive house snake	PNCO, IUCN LC	U
Leptotyphlops nigricans	Black thread snake	PNCO, IUCN LC	U

Taxon	Common Name	RDB/SSC	Presence [x]
Lycodonomorphus rufulus	Brown water snake	PNCO, IUCN LC	U
Lycophidion capense	Cape wolf snake	PNCO, IUCN LC	U
Lygodactylus capensis	Cape dwarf gecko	PNCO, IUCN LC	Y
Naja nivea	Cape cobra	PNCO, IUCN LC	U
Nucras intertexta	Spotted Sandveld Lizard	PNCO	U
Nucras lalandii	Delalandes sandveld lizard	PNCO, IUCN LC	U
Pachydactylus maculatus	Spotted thick toed gecko	PNCO, IUCN LC	Y
Pedioplanis pulchella	Pulchell's sand lizard	PNCO, IUCN LC	U
Pelomedusa subrufa	Marsh terrapin	PNCO, IUCN LC	Y (especially transformed
Philothamnus hoplogaster	Green water snake	PNCO, IUCN LC	U
Philothamnus natalensis occidentalus	Natal green snake	PNCO, IUCN LC	U
Philothamnus semivariegatus	Spotted bush snake	PNCO, IUCN LC	U
Prosymna sundevallii	Sundevalle's shovel snout	PNCO, IUCN LC	U
Psammophis crucifer	Crossed –marked sand snake	PNCO, IUCN LC	U
Psammophis notostictus	Karroo whip snake	PNCO, IUCN LC	U
Psammophylax rhombeatus	Rhombic skaapsteker	PNCO, IUCN LC	U
Pseudaspis cana	Mole snake	PNCO, IUCN LC	U
Pseudocordylus m. microlepidotus	Cape crag lizard	PNCO, IUCN LC	U
Rhinotyphlops lalandei	Delalande's beaked blind snake	PNCO, IUCN LC	U
Scelotes anguineus	Algoa dwarf burrowing skink	PNCO, IUCN LC, Endemic	U
Scelotes caffer	Cape dwarf burrowing skink	PNCO, IUCN LC	U
Stigmochelys pardalis	**Leopard Tortoise**	**PNCO, IUCN LC CITIES 2**	**Y**
Tetradactylus fitzsimonsi	Fitzsimon's long tailed seps	PNCO, IUCN VU	U
Tetradactylus seps	Short legged seps	PNCO, IUCN LC	U
Trachylepis capensis	Cape skink	PNCO, IUCN LC	Y
Trachylepis homalcephala	Red sided skink	PNCO, IUCN LC	Y
Trachylepis varia varie	Variable skink	PNCO, IUCN LC	Y
Varanus albigularis	Rock Monitor	PNCO, IUCN LC CITIES 2	U
Varanus niloticus	Water Monitor	PNCO, IUCN LC CITIES 2	U
Mammals			
Amblysomus corriae	Fynbos golden mole	PNCO, IUCN NT	U
Amblysomus hittentotus	**Hottentot Golden Mole**	**PNCO, IUCN DD**	**Y**
Aonyx capensis	African clawless otter	PNCO, IUCN LC	U
Atilax paludinosus	Marsh mongoose	PNCO, IUCN LC	U
Caracal caracal	Caracal	PNCO, IUCN LC	U
Cercopithecus pygerythrus	Vervet monkey	PNCO, IUCN LC	Y
Chlorotalpa duthieae	Duthie's golden mole	PNCO, IUCN LC	U
Crocidura cyanea	Reddish-Grey Musk Shrew	PNCO, IUCN DD	U
Crocidura flavescens	Greater red musk shrew	PNCO, IUCN LC	U
Cryptomys hottentotus	African mole rat	PNCO, IUCN LC	Y
Cynictis penicillata	Yellow mongoose	PNCO, IUCN LC	Y
Dendromus melanotis	Grey climbing mouse	PNCO, IUCN LC	U
Dendromus mesomelas	Brant's climbing mouse	PNCO, IUCN LC	U
Felis cattus	Domestic cat	Alien	Y
Felis silvestris	African wild cat	PNCO, IUCN LC	U
Galerella pulverulenta	Cape grey mongoose	PNCO, IUCN LC	Y
Genetta genetta	Small spotted genet	PNCO, IUCN LC	U
Genetta tigrina	Large spotted genet	PNCO, IUCN LC	U
Georychus capensis	Cape mole rat	PNCO, IUCN LC	U
Graphiurus murinus	Woodland dormouse	PNCO, IUCN LC	U
Graphiurus ocularis	Spectacled dormouse	PNCO, IUCN LC	U
Herpestes ichneumon	Large grey mongoose	PNCO, IUCN LC	U
Hystrix africaeaustralis	Cape porcupine	PNCO, IUCN LC	Y
Ictonyx striatus	Striped pole cat	PNCO, IUCN LC	U
Lepus saxatilis	Scrub hare	PNCO, IUCN LC	Y

Taxon	Common Name	RDB/SSC	Presence [x]
Macroscelides proboscideus	Round eared elephant shrew	PNCO, IUCN LC	U
Mastomys natalensis	Natal multimammate mouse	PNCO, IUCN LC	U
Mellivora capensis	Honey badger	PNCO, IUCN CITES 3 NT	U
Micaelamys namaquensis	Namaqua rock mouse	LC	U
Mus minutoides	Pygmy mouse	LC	U
Mus musculus	House mouse	Alien	U
Myosorex varius	Forest Shrew	PNCO, IUCN DD	U
Neoromicia capensis	Cape serotine bat	PNCO, IUCN LC	U
Nycteris thebaica	Egyptian slit faced bat	PNCO, IUCN LC	U
Orycteropus afer	Aardvark	PNCO, IUCN LC	Y
Otocyon megalotis	Bat eared fox	PNCO, IUCN LC	U
Otomys irroratus	Vlei rat	PNCO, IUCN LC	Y
Otomys unisulcatus	Bush vlei rat	PNCO, IUCN LC	U
Panthera pardus	Leopard	PNCO, IUCN LC	U
Papio cynocephalus ursinus	Chacma baboon	PNCO, IUCN LC	U
Philantomba monticola	Blue duiker	PNCO, IUCN CITES2 VU	U
Poecilogale albinucha	African striped weasel	PNCO, IUCN VU	U
Potamochoerus larvatus	Bush pig	PNCO, IUCN LC	Y
Raphicerus campestris	Steenbok	PNCO, IUCNLC	U
Raphicerus melanotis	Grysbok	PNCO, IUCNLC	Y
Rattus rattus	House rat	PNCO, IUCN LC	U
Rhabdomys pumilio	Four striped grass mouse	PNCO, IUCN LC	Y
Saccostomus campestris	Pouched mouse	PNCO, IUCNLC	U
Suncus infinitesimus	Least dwarf shrew	PNCO, IUCN E	U
Sylvicapra grimmia	Common duiker	PNCO, IUCN LC	Y
Tragelaphus scriptus	Bush buck	PNCO, IUCN LC	Y
Vulpes chama	Cape Fox	PNCO, IUCN LC	U

13.1.3 Avifauna

Table 14: A list of Red Data species that could occur on the study sites (according to Harrison et al., 1997; Barnes, 2000). **Indicated are: conservation status, habitat preference, whether the species was observed. Conservation status:** E **= endangered,** V **= vulnerable,** NT **= near-threatened,** P **= protected,** Ra **= raptor or owl,** B **= Listed in Appendix II of the Bonn Convention,** WA **= listed in Annexure 2 of the African-Eurasian Waterbird Agreement, RL = IUCN Red List; SA = South African Red Data Book (Barnes 2000), DEA = Threatened and Protected Species Regulations (DEAT 2007).**

Common Name	Scientific Name	Conservation Status	Habitat
African Black Oystercatcher	*Haematopus moquini*	**NT** (RL,SA); **WA**	Beach
African Marsh-Harrier	*Circus ranivorus*	**V** (SA); **Ra**	Wetland
African Penguin	*Spheniscus demersus*	**E** (RL); **V** (SA); **B; WA**	Marine
African Sacred Ibis	*Threskiornis aethiopicus*	**WA**	Wetland
African Spoonbill	*Platalea alba*	**B; WA**	Wetland
Barn Owl	*Tyto alba*	**Ra**	Bontveld; Terrestrial
Black Harrier	*Circus maurus*	**V (**RL); **NT** (SA); **Ra**	Bontveld
Black Sparrowhawk	*Accipiter melanoleucus*	**Ra**	Thicket
Black-headed Heron	*Ardea melanocephala*	**WA**	Terrestrial

Common Name	Scientific Name	Conservation Status	Habitat
Black-necked Grebe	*Podiceps nigricollis*	**WA**	Saltpan
Black-shouldered Kite	*Elanus caeruleus*	**Ra**	Terrestrial
Black-winged Stilt	*Himantopus himantopus*	**WA**	Saltpans; Wetland
Blue Crane	*Anthropoides paradiseus*	**V** (RL,SA); **WA**	Bontveld; Grassland
Booted Eagle	*Hieraaetus pennatus*	**Ra**	Bontveld; Terrestrial
Cape Cormorant	*Phalacrocorax capensis*	**NT** (RL,SA); **WA**	Marine; Saltpan
Cape Gannet	*Morus capensis*	**V (**RL,SA); **WA**	Marine
Cape Teal	*Anas capensis*	**WA**	Saltpans
Caspian Tern	*Sterna caspia*	**NT** (SA); **B**; **WA**	Saltpans; Coastal
Cattle Egret	*Bubulcus ibis*	**WA**	Grassland
Chestnut-banded Plover	*Charadrius pallidus*	**NT** (RL,SA); **WA**	Saltpans
Common Greenshank	*Tringa nebularia*	**B; WA**	Saltpans; Coega Mouth
Common Moorhen	*Gallinula chloropus*	**WA**	Fresh water
Common Ringed Plover	*Charadrius hiaticula*	**B; WA**	Saltpans
Common Tern	*Sterna hirundo*	**B; WA**	Saltpans; Coastal
Common Whimbrel	*Numenius phaeopus*	**B; WA**	Saltpans; Coega Mouth
Crowned Lapwing	*Vanellus coronatus*	**WA**	Bontveld; Grassland
Curlew Sandpiper	*Calidris ferruginea*	**B; WA**	Saltpans
Damara Tern	*Sterna balaenarum*	**E** (SA); **NT** (RL); **B**; **WA**	Coastal
Denham's Bustard	*Neotis denhami*	**V** (SA); **NT** (RL)	Bontveld; Grassland
Egyptian Goose	*Alopochen aegyptiaca*	**WA**	Wetland
Greater Flamingo	*Phoenicopterus ruber*	**NT** (SA); **B**; **WA**	Saltpan
Grey Heron	*Ardea cinerea*	**WA**	Saltpan; Coega River
Grey Plover	*Pluvialis squatarola*	**B; WA**	Saltpans; Coega Mouth
Grey-headed Gull	*Chroicocephalus cirrocephalus*	**WA**	Saltpans; Coega Mouth
Half-collared Kingfisher	*Alcedo semitorquata*	**NT (**SA)	Coega River
Hartlaub's Gull	*Chroicocephalus hartlaubii*	**WA**	Saltpans; Coega Mouth
Jackal Buzzard	*Buteo rufofuscus*	**Ra**	Bontveld; Terrestrial
Kelp Gull	*Larus dominicanus*	**WA**	Saltpans; Coastal
Kittlitz's Plover	*Charadrius pecuarius*	**WA**	Saltpans
Knysna Woodpecker	*Campethera notata*	**NT** (RL,SA)	Thicket
Lanner Falcon	*Falco biarmicus*	**NT** (SA); **Ra**	Terrestrial; Saltpan
Lesser Flamingo	*Phoenicopterus minor*	**NT** (RL,SA); **B**; **WA**	Saltpan
Little Egret	*Egretta garzetta*	**WA**	Saltpan; Coega Mouth
Little Grebe	*Tachybaptus ruficollis*	**WA**	Saltpan; Coega River
Little Stint	*Calidris minuta*	**B; WA**	Saltpans
Little Tern	*Sterna albifrons*	**B; WA**	Saltpans; Coastal
Marsh Sandpiper	*Tringa stagnatilis*	**B; WA**	Saltpans
Martial Eagle	*Polemaetus bellicosus*	**V** (SA); **NT** (RL); **Ra**	Bontveld; Terrestrial
Osprey	*Pandion haliaetus*	**B; Ra**	Saltpans; Coastal
Peregrine Falcon	*Falco peregrinus*	**NT** (SA); **B**; **Ra**	Terrestrial; Saltpan
Pied Avocet	*Recurvirostra avosetta*	**B; WA**	Saltpans
Purple Heron	*Ardea purpurea*	**WA**	Coega River
Red-billed Teal	*Anas erythrorhyncha*	**WA**	Fresh water
Red-knobbed Coot	*Fulica cristata*	**WA**	Fresh water
Rock Kestrel	*Falco rupicolis*	**Ra**	Terrestrial
Roseate Tern	*Sterna dougallii*	**E** (SA); **WA**	Coega Mouth
Ruddy Turnstone	*Arenaria interpres*	**B; WA**	Saltpans; Beach
Ruff	*Philomachus pugnax*	**B; WA**	Saltpans
Sanderling	*Calidris alba*	**B; WA**	Saltpans; Beach
Sandwich Tern	*Thalasseus sandvicensis*	**B; WA**	Saltpans; Coastal
Secretarybird	*Sagittarius serpentarius*	**V** (RL); **NT** (SA); **Ra**	Bontveld; Grassland
South African Shelduck	*Tadorna cana*	**WA**	Wetland
Southern Pale Chanting Goshawk	*Melierax canorus*	**Ra**	Bontveld; Thicket
Spotted Eagle-Owl	*Bubo africanus*	**Ra**	Thicket; Terrestrial
Spur-winged Goose	*Plectropterus gambensis*	**WA**	Overfly
Steppe Buzzard	*Buteo (buteo) vulpinus*	**Ra**	Bontveld; Terrestrial
Swift Tern	*Thalasseus bergii*	**B; WA**	Saltpans; Marine
Three-banded Plover	*Charadrius tricollaris*	**WA**	Wetland
White Stork	*Ciconia ciconia*	**B; WA**	Overfly
White-breasted Cormorant	*Phalacrocorax (carbo) lucidus*	**WA**	Wetland
Yellow-billed Duck	*Anas undulata*	**WA**	Fresh water
Yellow-billed Kite	*Milvus [migrans] aegyptius*	**Ra**	Terrestrial

13.10 Amended Operational Environmental Management Programme

OPERATIONAL ENVIRONMENTAL MANAGEMENT PROGRAMME (OEMPr)

BAY TERMINALS GROUP COEGA TANK FARM

DEDEAT Reference Number: ECm1/C/LN2/M/16-2018

Proponent:

Bay Terminals Group.

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DOCUMENT PROGRESS

Distribution List

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18/09/2018	21803_OEMPr_0	Internal	Internal Review
October 2018	21803_OEMPr_1	EAP – EIA process	Hard copy; Pdf
November 2019	21803-21928-OEMPr_1	Eastern Cape Department of Economic Development, Environment and Tourism (ECDEDEAT)	Hard copy; Pdf
November 2019	21803-21928-OEMPr_1	Public Review	Pdf

Amendments on Document

Date	Report Reference Number		Description of Amendment
November 2019	21803_CEMPR_1	21803_21928-CEMPR-1	Update to take into account Part 2 Amendments

INDEMNITY AND CONDITIONS RELATING TO THIS REPORT

The findings, results, observations, conclusions, and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and Prism Environmental Management Services and its staff reserve the right to modify aspects of the report including the recommendations if and when additional information becomes available from ongoing research or further work in this field or pertaining to this investigation.

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ACRONYMS

AQIA	*Air Quality Impact Assessment*
BTG	*Bay Terminals Group*
CDC	*Coega Development Corporation*
CEMPr	*Construction Environmental Management Programme*
COM	*Chief Operational Officer*
DEA	*Department of Environmental Affairs*
DEAT	*Department of Environmental Affairs and Tourism*
DEDEAT	*Department of Economic Development, Environmental Affairs and Tourism of the Eastern Cape*
EA	*Environmental Authorisation*
EAP	*Environmental Assessment Practitioner*
ECO	*Environmental Control Officer*
EIA	*Environmental Impact Assessment*
EMPr	*Environmental Management Programme*
EMS	*Environmental Management Systems*
HAZMAT	*Hazardous Materials*
IDZ	*Industrial Development Zone*
NEM: AQA	*Management: Air Quality Act*
NEMA	*National Environmental Management Act*
OEMPr	*Operation Environmental Management Programme*
PPE	*Personal Protective Equipment*
SDS	*Safety Data Sheet*
S&EIA	*Scoping and Environmental Impact Assessment*

1 INTRODUCTION

1.1 Overview

Bay Terminals Group (BTG) responded to a tender advertised by Coega Development Corporation (CDC) for a bulk petrochemical fuel storage facility in Zone 7 of the Coega SEZ and were subsequently awarded this tender by CDC. In line with the above, BTG plans to develop a new liquid bulk facility with piping, custody metering and numerous tanks and road tanker loading at a new facility in the Coega SEZ Zone 7, near Port Elizabeth, on Erf 351 of Coega. This new facility is referred to as the BTG Coega Tank Farm throughout this report.

An environmental authorisation process was undertaken in 2018 and the Environmental Authorisation (EA)(ECm1/c/LN2/M/16-2018) granted on 15 March 2019. As part of this, this Construction Environmental Management Programme (CEMPr) was submitted.

Subsequently, the CDC has received funding from the Department of Trade and Industry (DTI) to develop a solution for Orion Engineered Carbons (OEC) to receive Carbon Black Oil (CBO[1]) (a type of Heavy Fuel Oil or HFO) at the Port of Ngqura. OEC currently receives via Dom Pedro facility at the Port of Port Elizabeth. However, due to the intended closure of the Dom Pedro facility at the Port of Port Elizabeth there is a requirement for a new replacement facility for OEC at the Port of Ngqura.

As part of this and subsequent to the initial BTG design process, the CDC has approached BTG regarding a possible solution for OEC. As part of the solution, BTG has entered into an agreement with the CDC to permit CDC to construct the necessary tanks and pipeline extensions from the berth to receive and store HFO within the necessary timeframes. In order to provide the necessary infrastructure for OEC, the initially planned storage capacity of the BTG facility needs to be amended to take into account the requirements of OEC.

To take this into account, an amendment in term of Regulation 31 and 32 of the Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) is required. This CEMPr has been updated to take into account these amendments which are as follows:

- Update of the Site Development Plan;
- Extension of Bulk Liquid Pipelines from the Port of Ngqura Boundary (Battery Limit) to the OTGC tie-in and removal of Condition 3.3.1;
- Reduction in the combined storage of Diesel from 80 000 m^3 to 77 000 m^3;
- Reduction in the combined storage of Unleaded Petrol (ULP) from 80 000 m^3 to 77 000 m^3;

[1] *Please note that the chemical composition of CBO falls within the broad definition of HFO.*

- Increase in the combined storage of Heavy Fuel Oil (HFO) from 30 000 m^3 to 36 000 m^3;
- Update of the timeframes for construction within the project description in the EA as well as within Condition 3.1.2. relating to completion of all construction activities within 24 months from the start of construction; and
- Update of Condition 3.3.2. to clarify that TNPA will be responsible for reviewing and updating the Port Oil Spill Contingency Plan and Emergency Preparedness Plan.

1.2 Project Location

The proposed development occurs in the Coega SEZ 7, near Port Elizabeth, on Erf 351 of Coega, located along the Algoa Bay coastline to the north-east of the Port of Ngqura. The coordinates for the project are provided in Table 1.

Table 1: Centre Coordinates

	Coordinates	
Centre Point	33º46’24.67” S	25º 42’16.56” E

The Surveyor General 21-digit diagram number for Erf 351 of Coega Industrial Development Zone 7 is provided in Table 2 below.

Table 2: Surveyor General Diagram Number

Portion	**Surveyor General Diagram number**
Erf 351	C07600230000035100000

An overview of the location of the development is provided in Figure 1.

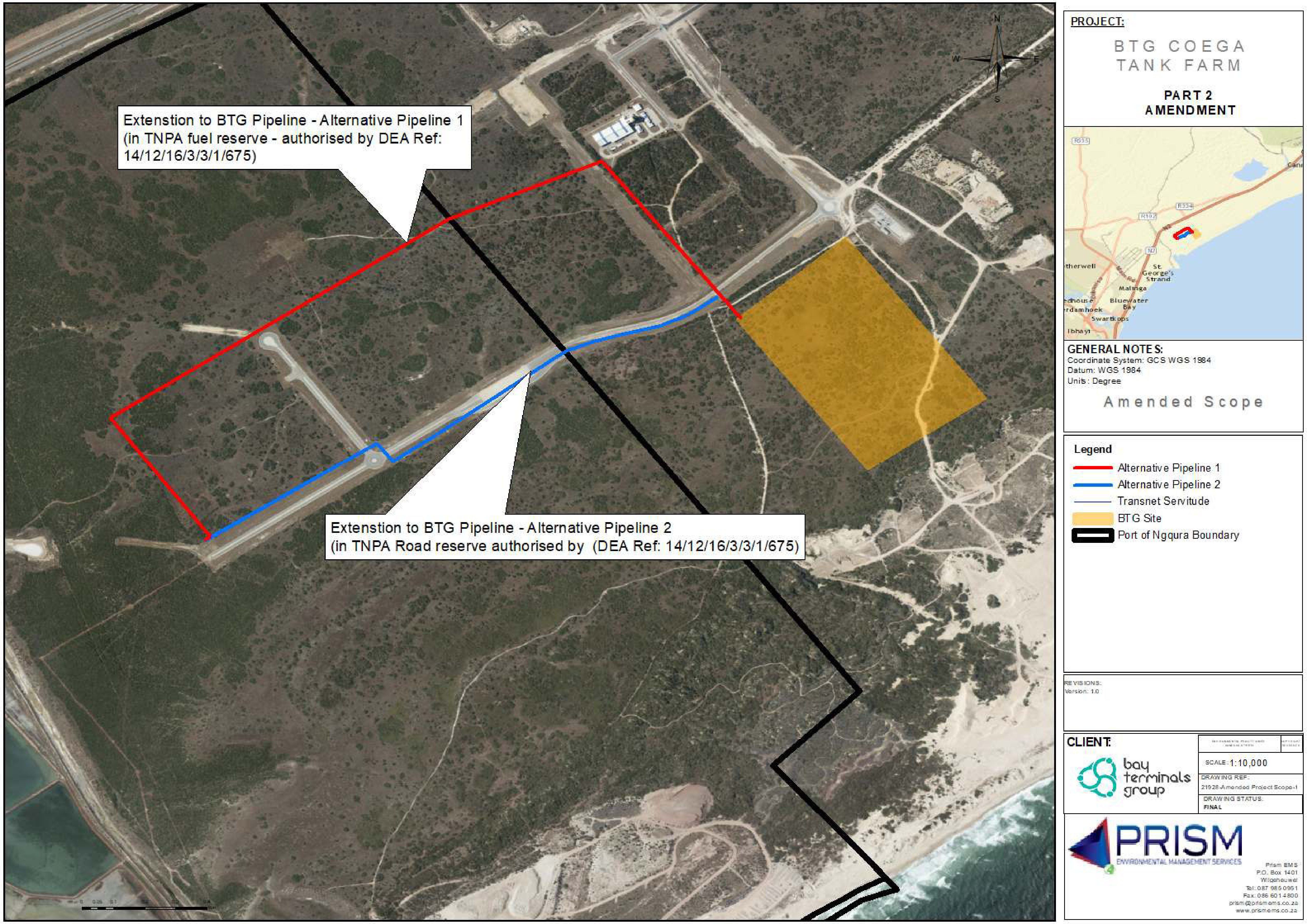

Figure 1: Aerial Locality Map

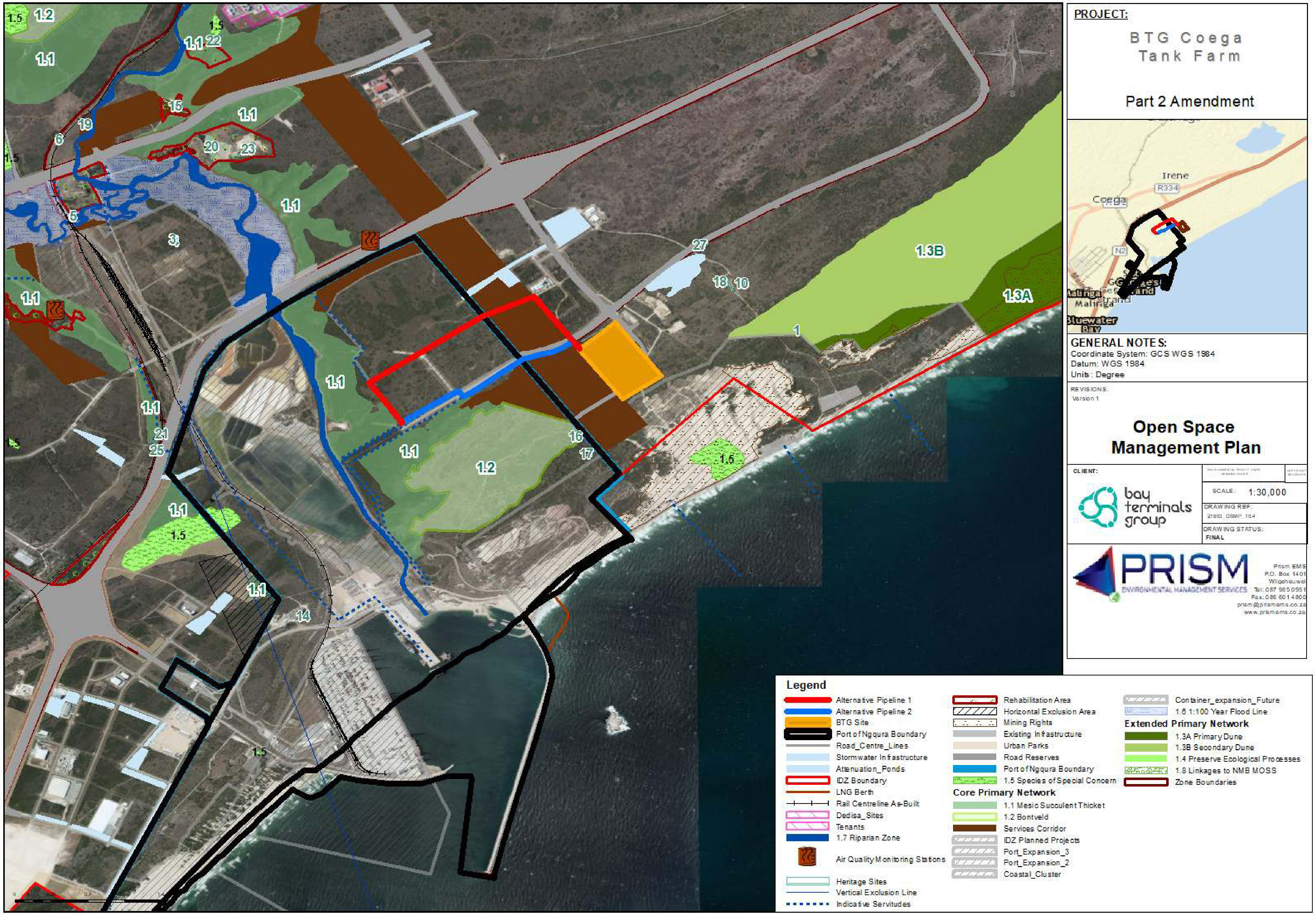

Figure 2: Pipeline Routes

2 EMPr REQUIREMENTS AND REPORT OUTLINE

The contents of this EMPr has been compiled according to the prescribed minimum legal requirements contained in Appendix 4 of the EIA Regulations, 2014 [as amended in 2017]. Refer to Table 3. Additional sections have been added to the report for purposes of best environmental practice.

Table 3: Contents of EMPr

Chapter Number	Chapter Name	Requirements included in Appendix 4 of 2014 EIA Regulations [as amended in 2017]
1.	Introduction	-
2.	OEMPr Requirements and Report Outline	-
3.	Details of EAP	(a) details of (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;
4.	Project Description and Operational Activities, Aspects, and Impacts	(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description.
5.	Environmental Sensitivity	(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 should be avoided, including buffers;
6.	Goals and Objectives	(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- (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;
7.	General Roles and Responsibilities	(i) an indication of the persons who will be responsible for the implementation of the impact management actions
8.	Environmental Awareness Plan	(m) an environmental awareness plan describing the manner in which- (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and

Chapter Number	Chapter Name	Requirements included in Appendix 4 of 2014 EIA Regulations [as amended in 2017]
		(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and
9.	Integrated Waste Water and Waste Management Plan	-
10.	Emergency Preparedness Plan/ Incident Management Plan	-
11.	Monitoring Plan	(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);
		(h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);
		(j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;
		(k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);
		(l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;
12.	EMPr review and amendment	-
13.	EMPr	(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 - (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;

3 DETAILS OF THE EAP

Prism EMS have been appointed to undertake the required Environmental Authorisation process in terms of the 2014 Environmental Impact Assessment (EIA) Regulations as amended in 2017. Details and expertise of the Environmental Assessment Practitioner (EAP) who prepared the OEMPr is provided in Table 4 and Curriculum Vitae is appended in Appendix 1 of the Environmental Impact Assessment Report.

Table 4: Details of the EAP

EAP:	Monica Niehof			
Company:	Prism Environmental Management Services			
Qualifications:	BSc. (Hons) Environmental Management			
Experience:	12 Years			
Address:	PO Box 1401, Wilgeheuwel, 1736			
Tel:	087 985 0951			
Fax:	086 601 4800			
Email:	monica@prismems.co.za			
Prism EMS Team				
Contact Details	Post: PO Box 1401, Wilgeheuwel, Johannesburg, 1736		Tel: 087 985 0951 Fax: 086 601 4800 Email: prism@prismems.co.za www.prismems.co.za	
Designation	**Name**	**Qualification**	**Professional Registration**	**Experience:**
Project Director	De Wet Botha	M.A. (Env.Man.) (PHED)	Founder Member of Environmental Assessment Practitioners Association of South Africa (EAPASA) Member of the International Association for Impact Assessors (IAIAsa)(1653) Member of the Gauteng Wetland Forum Member of the South African Wetland Society	16 Years
Project Principle	Vanessa Stippel	MSc. Ecology, Environment and Conservation	SACNASP– Pr. Sci. Nat.(116221).	8 Years

4 OPERATIONAL ACTIVITIES

4.1 Updated Process Description

4.1.1 Background information

This process description must be read in conjunction with the updated Site Development Plan (refer to **Error! Reference source not found.**) and the Process Flow Diagram [PFD] (**Error! Reference source not found.**). A separate PFD is also included for Phase 1 (i.e. HFO) in Figure 5.

4.1.2 Scope

BTG will be responsible for the pipeline from the BTG site boundary to the OTGC Tie-in. The scope of the application is therefore, the proposed Coega Tank Farm and the pipeline from the BTG site boundary up to the OTGC Tie-in is shown in **Error! Reference source not found.**.

It should be noted that TNPA confirmed that they will issue a wayleave for the construction of the HFO pipeline within their road reserve. Since this is the preferred route it is most likely that the HFO pipeline will follow the pipeline route indicated as Alternative Pipeline 2 (shown in blue in Figure 1. From the OTGC tie-in, the HFO pipeline will be constructed on a second pipe rack to the berth. Please note that the OTGC pipelines and servitudes are already authorised (ECDEDEAT Ref: ECm1/LN2/M/11-57) and the TNPA Fuel Reserve is already authorised (DEA Ref: 14/12/16/3/3/1/675), therefore all impacts related to the construction and operation have been assessed. The second pipe rack for the HFO will be similar to the pipe racks described in the OTGC EIA.

In contrast, the Phase 2 pipelines required by BTG (i.e. LPG and Multiproduct pipelines) will be constructed from the BTG facility to the OTGC tie-in, along the pipeline route indicated as Alternative Pipeline 1 (shown in red in **Error! Reference source not found.**). From the OTGC tie-in these pipelines will follow the approved OTGC pipeline servitude route and will be constructed and operated under the OTGC EA.

4.1.1 Site Overview

The Updated Site Development Plan (**Error! Reference source not found.**) shows the proposed BTG Coega tank farm layout, which has the following infrastructure components:

- 2,4m high security fence complete with truck entry / exit gates and emergency exits;
- Associated lighting and closed-circuit television (CCTV);
- Pigging Station;
- Import manifold;
- Four bunded storage areas containing;
    - 4 x Diesel tanks, combined working capacity 77 000 m^3;
    - 4 x ULP tanks, combined working capacity 77 000 m^3;

- 2 x HFO tanks, combined working capacity 36 000 m^3;
- 1 x JET tank working capacity 10 000 m^3;
- 1 x Paraffin tank, capacity 4 000m^3;

- A separate unbunded (open) area will contain 15 off LPG vessel vessels, with a combined working capacity of 15 000 m^3.
- Road Tanker loading pump bays as follows:
  - Diesel – 4 off 2000 l/m pumps (3 operating, 1 standby);
  - ULP – 4 off 2000 l/m pumps (3 operating, 1 standby);
  - HFO – 3 off 2000 l/m pumps (2 operating, 1 standby);
  - Jet – 2 off 2000 l/m pumps (1 operating, 1 standby);
  - Paraffin – 2 off 1 l/m pumps (1 operating, 1 standby);
- Fire Water Tank with Fire / Foam pump Station;
- Vapour Recovery Unit (VRU) (at loading gantry);
- Necessary Buildings:
  - Admin Building 684m^2;
  - Ablution and Rest Room 293 m^2;
  - Store Room 293 m^2;
  - Workshop 382 m^2;
  - Warehouse 302 m^2;
  - Electrical Sub Station 302 m^2;
  - Security Building 130 m^2;
  - Small laboratory for critical testing of the final product.
- Loading Gantries
  - 18 bays for liquid fuels (Diesel 3; ULP 3; HFO 2; JET 1; Paraffin 1);
  - 4 bays for LPG.
- Additive Bay
- Pump Bays
- Compressor Bay
- Generator Bay
- Boiler Room with Steam Reticulation System and dedicated Boiler Fuel Oil tank
- Tanker Wash Bay
- Effluent Handling
  - Drainage channels
  - Effluent Containment
  - Interceptor Oil-water Separator
- Slops Handling System:
  - 450m^3 Slops Tank (including freeboard);
- Pipe Racks, Pipe Bridges and interconnecting pipes from the BTG facility to the OTGC tie-in.
- Booster stations.
- Parking.

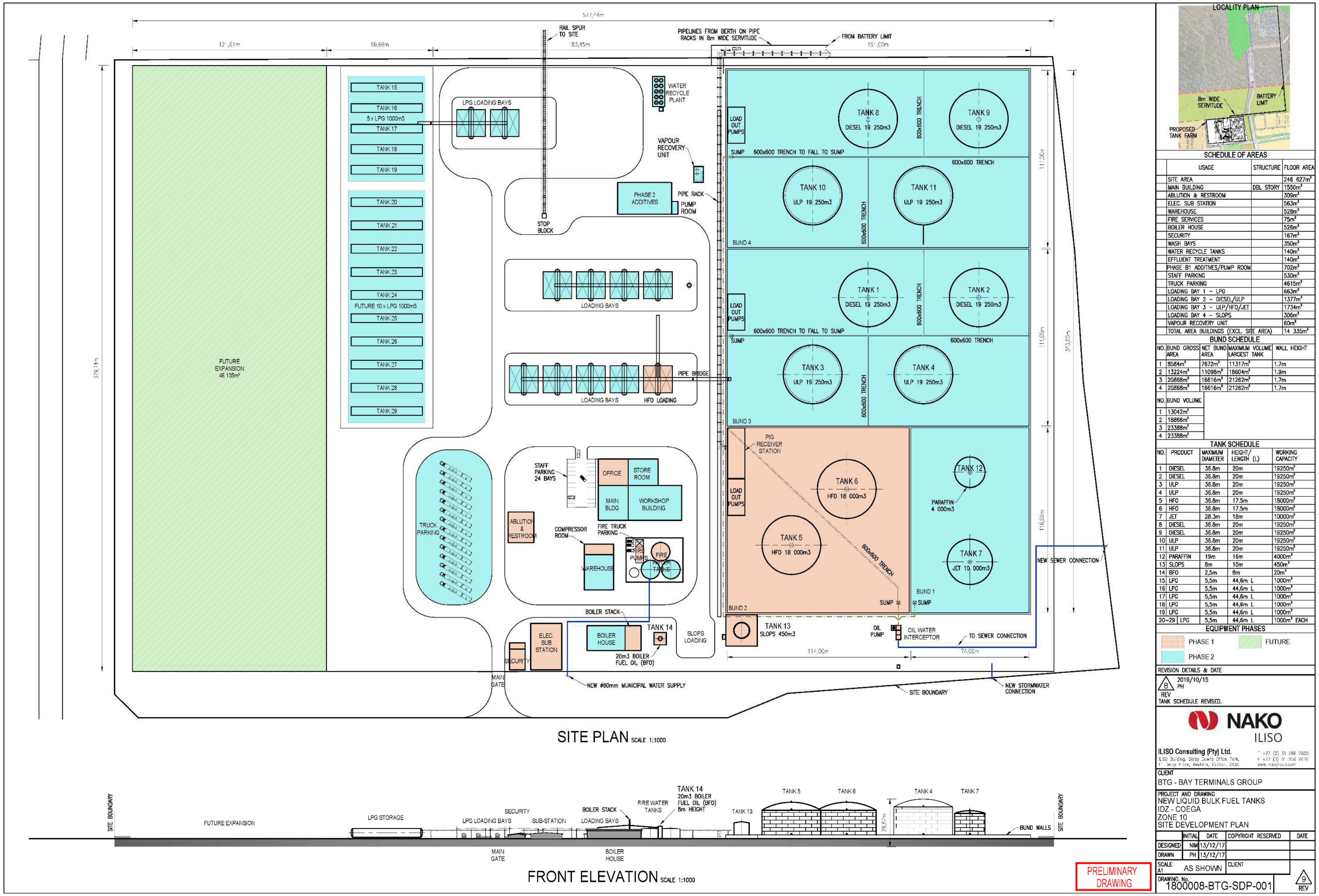

Figure 3: Updated Site Development Plan

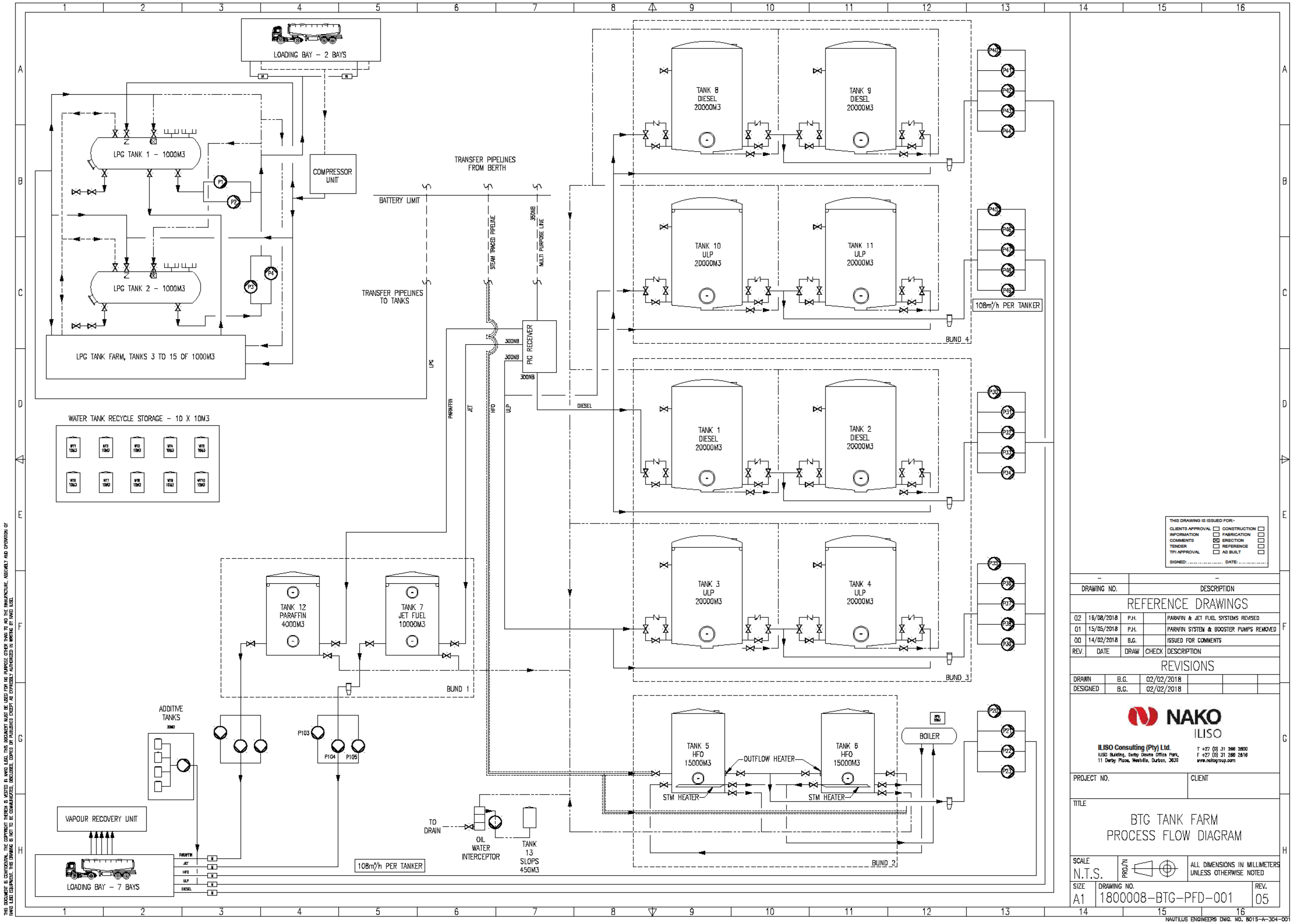

Figure 4: Proposed Coega Tank Farm Draft Process Flow Diagram

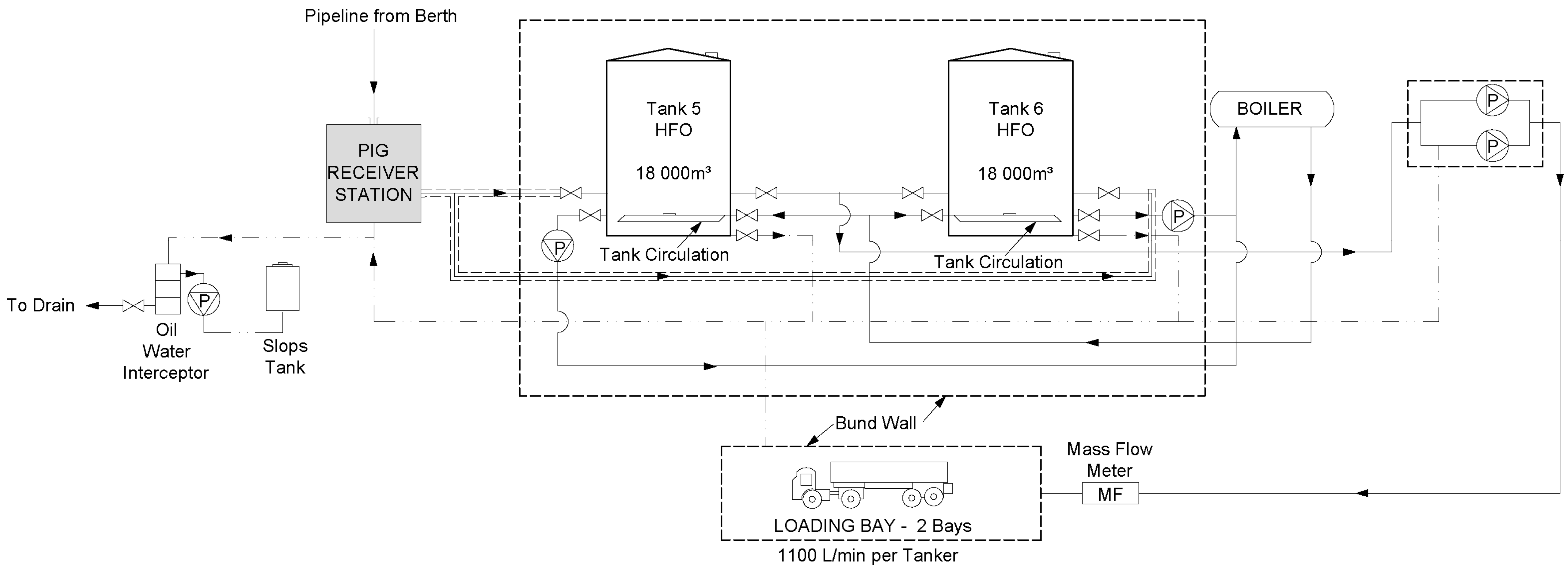

Figure 5: Phase 1 Process Flow Diagram

4.1.2 Project Activities

Bay Terminals Group (BTG) will be responsible for the pipeline from the BTG site boundary to the OTGC tie-in. The scope of the Operational Environmental Management Programme is therefore, for the operations on the proposed Coega Tank Farm and the pipeline from the BTG site boundary up to the OTGC tie-in. The operation of the facility will, as a basic requirement, include an EMS (Environmental Management Systems) containing operational management measures such as, amongst other, provisions for spill control, fire safety, and adequate infrastructure maintenance. Please refer to the Process Description attached in Figure 4 and 5.

5 GOALS AND OBJECTIVES

The **Operational EMPr** provides performance criteria required to address potential environmental impacts during the operational phase of the proposed development.

This document incorporates the relevant recommendations of the Scoping Report, Environmental Impact Assessment Report, and other environmental studies and ultimately aims to provide the following:

- Establish **management objectives** for the Development in order to enhance benefits and minimise adverse environmental impacts;
- Describe **actions** required to achieve management objectives; and
- Outline institutional structures and roles required to implement the Operational EMPr.

5.1 Key Objectives of the EMPr

The key objectives of this EMPr for the operational phase of the proposed Development are as follows:

- To ensure effective communication with stakeholders and regulatory authorities;
- To ensure good housekeeping practices and general neatness on site;
- To mitigate any possible negative impacts identified in the EMPr for the operational phase of the development;
- To prevent pollution, especially from hazardous materials to the receiving environment that may emanate directly or indirectly from the source (development activities) during the operational phase;
- To prevent or mitigate atmospheric emissions and associated impacts;
- To reduce/eliminate the risk of fire and or explosions as a result of operational activities;
- To preserve surrounding flora and fauna;
- To prevent excessive noise and associated impacts;
- To establish the various additional requirements in terms of required Environmental Management Systems (EMS's);
- Provide documentation requirements;
- To ensure benefits of the proposed development are maximised;
- Ensure that all environmental legislative requirements for the operation of the activity are met.

Finally, the OEMPr provides methods to ensure compliance, verification of compliance, and performance assessments to ensure that all the above-mentioned objectives are achieved or that appropriate protocol is established if the objectives are not / cannot be met.

5.2 Impact Management Outcomes

Through effective implementation of the environmental management measures, the following outcomes must be achieved:

- Correct protocol is followed in terms of the appointment of the required qualified personnel;
- Effective communication between relevant role players (such as the competent authority) must be ensured;
- Environmental awareness creation and training is undertaken throughout the operational phase to minimise environmental impacts and ensure compliance to relevant legislation and authorisations;
- A safe working environment for contractors/construction workers and the public is provided;
- Ensure access to sensitive environmental features is restricted and proper access control is in place;
- Minimal disturbances to traffic;
- Proper management of labour force is undertaken to ensure that:
    - There are no security-related issues or disturbance to tenants or landowners outside the construction footprint'
    - There is optimal use of local labourers;
    - There is no disturbance to sensitive environmental features on or around the study area;
- Minimise environmental impacts associated with ablution facilities;
- Waste separation and recycling must be undertaken as part of operation;
- Effective and safe management of hazardous and non-hazardous materials on site, in order to minimise the impact of materials on the environment;
- Ensure that all potential causes of pollution are mitigated as far as possible to minimise impacts to the surrounding environment;
- Prevent polluted water from entering the surface water;
- Minimise noise disturbance to surrounding areas;
- Control alien plants and noxious weeds;
- Minimal impact to surrounding fauna;
- Proper stormwater management as required by the Stormwater Management Plan to be implemented;
- To have no adverse impact on the historical inheritance of the area;
- Water conservation mechanisms to be implemented; and
- Energy conservation mechanisms to be implemented.

6 GENERAL ROLES AND RESPONSIBILITIES

It should be noted that, in addition to the BTG EA (ECm1/c/LN2/M/16-2018), a number of EAs exist in the Port and Coega SEZ environment which have bearing. A summary of these are visually represented in Figure 6 below. It is therefore clear that there are various role players that are involved and are responsible for environmental management in the Port and CDC environment. An overview of the applicable role players and institutional arrangements are provided in Figure 7. Information on each role player is then provided in the subsections below.

It should also be noted that a number of separate agreements are required and are in the process of being developed to ensure the various roles and responsibilities are well understood and determined for each party. As part of this, a number of 'in principle support" letters have been compiled and should be included in the Environmental file. All necessary agreements and/or wayleaves should be finalised prior to construction so that all roles and responsibilities can be confirmed.

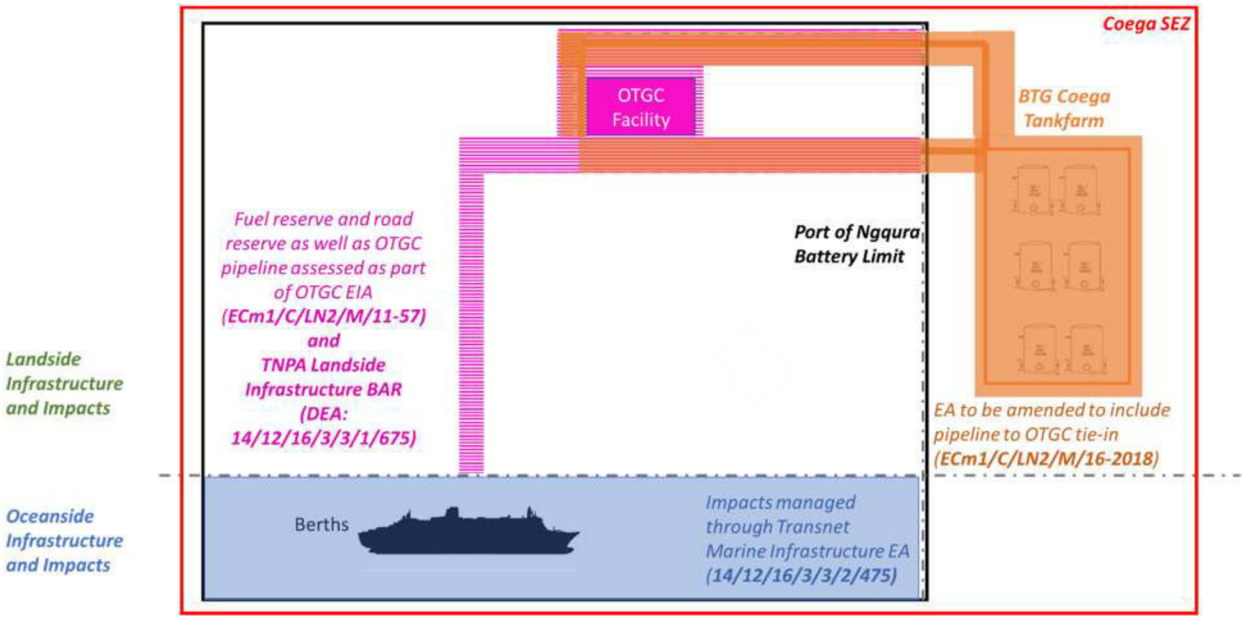

Figure 6: Visual representation of various applicable environmental authorisations in the Coega and Port environment

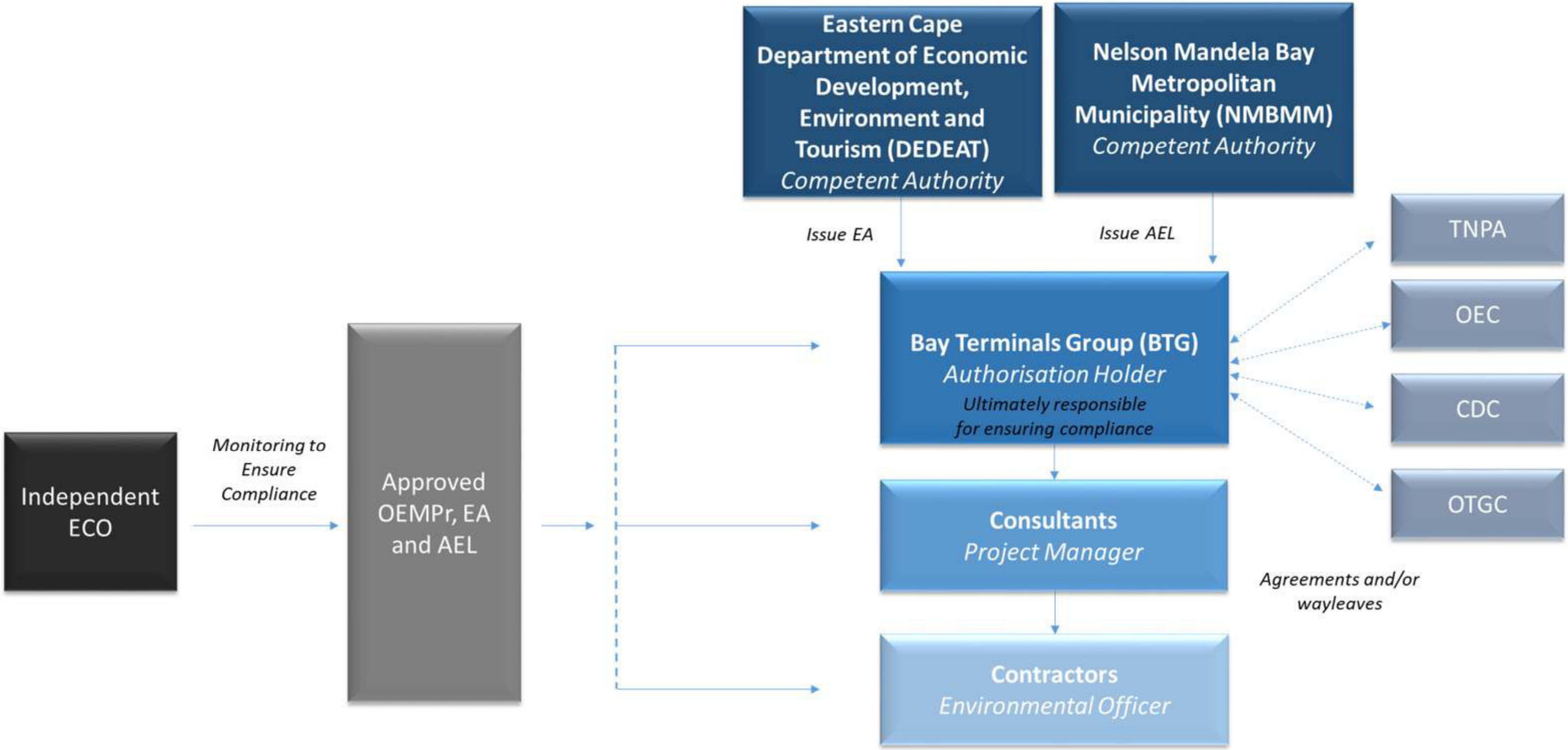

Figure 7: Roles and responsibilities

6.1 Competent Authorities

The following competent authorities are involved in the decision-making process:

- The Eastern Cape Department of Economic Development, Environmental Affairs and Tourism with reference to activities triggered in terms of the:
  - National Environmental Management Act, 1998 (Act No. 107 of 1998) [as amended] (NEMA); and
- The Nelson Mandela Bay Metropolitan Municipality with reference to activities in terms of the:
  - National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) [as amended] (NEMAQA).

Amendments may be required to the EMPr, based on adaptive management to the site conditions and the technical requirements of the project. These amendments will need to be approved by DEDEAT.

6.2 Authorisation Holder

Bay Terminals Group is the applicant in terms of NEMA and NEMAQA and is ultimately responsible for the development and implementation of the EMPr and ensuring that the conditions in the EA are satisfied. The liability for non-compliance also rests with the Authorisation Holder. Details of the Authorisation holder are contained in **Error! Reference source not found.**

Table 5: Details of the Applicant

Applicant:	Bay Terminals Group
Contact Person:	Ms. T Mjacu

6.3 Coega Development Corporation

CDC will remain the owners of the HFO tanks and pipeline. A tripartite agreement between CDC, BTG and OEC will remain in place throughout operation to ensure roles and responsibilities related to environmental management (amongst others) is defined.

6.4 OEC

OEC will be utilising the HFO tanks and will need to make use of this asset in line with the tripartite agreement between CDC, BTG and OEC.

6.5 Transnet National Port Authority

BTG will need to comply with the requirements of the Wayleave Agreements. Additionally, BTG must fulfil their obligations under the most up to date version of the TNPA Harbour Oil Spill Contingency Plan for the Port of Ngqura.

6.6 OTGC

Oiltanking Grindrod Calulo (Pty) Ltd (OTGC) is the terminal operator on behalf of TNPA. From the OTGC tie-in, OTGC will be responsible for the pipeline to the berths and this service will be provided to BTG through a mutually agreed Operations and Maintenance Agreement.

6.7 Consultants

6.7.1 Chief Operational Officer and Staff

The Chief Operational Officer and his/her department is responsible for the daily operations of the tank farm and is responsible for the handling of all hazardous materials. In order to ensure that the operation of the facility is as per the relevant designs and requirements, the Chief Operational Officer will be responsible for supervising the management of the environmental aspects during the operational phase of the project. The Chief Operational Officer will furthermore also be required to ensure that any environmental matters at the request of the External Environmental Auditor is attended to. The Chief Operational Officer shall ensure that the Internal Environmental Manager assists the External Environmental Auditor where necessary and shall have the following responsibilities in terms of the implementation of the Operational EMPr:

- Ultimately, it is the responsibility of the Chief Operational Officer (along with the Authorisation Holder) to ensure that the operation of the facility complies with all the conditions of the OEMPr, Environmental Authorisation (EA) and the Atmospheric Emissions Licence (AEL) (and other binding documentation). The Chief Operational Officer (along with the Authorisation Holder) must, therefore, with the assistance from the External Environmental Auditor receive and implement recommendations after evaluation of compliance with the conditions of this OEMPr;
- The Chief Operational Officer will ensure that he/she and his/her department and operational managers have the correct resources and training to implement the relevant environmental management actions and fulfil the requirements;
- Ensure regular site inspections are conducted by operational managers/supervisors;
- Reviewing and approving the Contractor's Method Statements and Standard Operating Procedures;
- Ensure the implementation of all Standard Operating Procedures and Contractor's Method Statements;
- Assisting the Internal Environmental Manager in finding environmentally responsible solutions to problems with input from the External Environmental Auditor where necessary; and
- Communicating all environmental issues to the External Environmental Auditor.

6.7.2 Internal Environmental Manager/Auditor

In order to ensure that the operation of the facility is as per the relevant designs and requirements, the Internal Environmental Manager and Auditor will be responsible for managing of the environmental aspects during the operational phase of the project. The Internal Environmental Manager and Auditor will furthermore also be required to tend to any environmental matters at the request of the External Environmental Auditor. The Internal Environmental Manager and Auditor shall assist the External Environmental Auditor where necessary and shall have the following responsibilities in terms of the implementation of the Operational EMPr:

- It is the responsibility of the Internal Environmental Manager and Auditor to ensure that the operation of the facility implements all the conditions of the OEMPr, Environmental Authorisation (EA) and the Atmospheric Emissions Licence (AEL) (and other binding documentation). The Internal Environmental Manager and Auditor must, therefore, with the assistance from the External Environmental Auditor receive and implement recommendations after evaluation of compliance with the conditions of this OEMPr;
- Regular site inspections;
- Reviewing and approving the Contractor's Method Statements and Standard Operating Procedures;
- Find environmentally responsible solutions to problems with input from the external Environmental Auditor, where necessary;
- Carry out periodic audits of the Operational Management Programme; and
- Communicating all environmental issues to the External Environmental Auditor.

More specifically, the Internal Environmental Manager and Auditor will maintain and check the following:

- Environmental Site file containing the following documents *inter alia*:
    - Operational EMPr;
    - Environmental Authorisation (EA);
    - Atmospheric Emissions License (AEL);
    - NEMA Risk Assessment;
    - Major Hazardous Installation (MHI) Risk Assessment;
    - Approved Air Quality Monitoring and Management Plan;
    - Environmental Impact Assessment Report;
    - Environmental Specialist Studies;
    - Stormwater management plan – approved;
    - Internal and External Audit Reports;
    - The public complaints register in which all complaints are recorded, as well as actions taken;
    - The record (incident register) of environmental incidents (spills, impacts, legal transgressions, etc.) as well as corrective and preventive actions taken;
    - Spill procedures;
    - Method statements;
    - Standard operating procedures;
    - Signed off as-built or construction designs;
    - Emergency response procedures;
    - Environmental monitoring results and reports;

  - Invasive species monitoring, control and eradication plan for the Coega SEZ;
  - Environmental awareness training plan and records (attendance registers etc.);
  - Safe Disposal Certificates from hazardous waste, used oil and general waste contractors;
  - Waste management register;
  - Water quality test results and any monitoring reports;
  - All applicable codes and standards that the tank farm must comply with; and
  - Proof of notification of Competent Authorities of commencement of construction.

In terms of Internal Audits, the Internal Environmental Manager and Auditor will be required to ensure the following:

- All documentation (e.g. audit/monitoring/compliance reports and notifications) required to be submitted to the Department in terms of the EA;
- That the authorisation holder submits environmental external audit reports to the Department within 30 days of the completion of any audits at intervals that will be determined by the EA;
- The Internal and External Environmental Audit Reports must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the EA conditions as well as the requirements of an approved EMPr;
- Records relating to monitoring and auditing must be kept on site and made available for inspection to any relevant and competent authority in respect of this development.

6.7.3 Resident Engineer

The resident engineer that is employed by the Authorisation Holder will be responsible for the technical and contractual implementation, control and maintenance of the works to be undertaken. The responsibilities of the Engineer in terms of environmental matters include, but are not limited to:

- Inspecting all infrastructure on the tank farm for any engineering problems that may give rise to environmental pollution or safety incidents;
- Supervise maintenance on any of the tank farm infrastructure;
- Assisting the internal environmental manager and auditor in making decisions and finding solutions to environmental issues and risks;
- Review method statements from Contractors and Standard Operating Procedures;
- Order the removal of persons and equipment that are not complying with engineering specifications and operating procedures.

6.7.4 External Contractors

All contractor/s employed by the developer in respect of the subject site will be bound by all and any agreement between the developer and the contractor, to ensure compliance with the Environmental Authorisation, the Atmospheric Emissions Licence (AEL), mitigating measures included in the Specialist

Studies, the Environmental Impact Assessment Report well as this OEMPr and any other binding documents. External Contractors may include, but are not limited to:

- Domestic cleaning contractor;
- Recyclables (paper, metal, timber etc.) removal contractors;
- Used oil removal contractor;
- Hazardous waste removal contractor; and
- General waste removal contractor.

The responsibilities of each external contractors include:

- Taking and accepting full responsibility for self, and/or employees;
- Be familiar with the contents, as well as the meaning of the contents, of the OEMPr and the specifications contained herein;
- Comply with the Environmental Specifications contained in the OEMPr and subsequent revisions;
- Confirm with legislative requirements and ensure that appropriate permissions and permits have been obtained before commencing activities;
- Prepare Method Statements, a programme of activities and drawings/plans for submission to the Internal and External Environmental Manager and Auditors when requested;
- Where applicable, undertake daily site inspections to monitor environmental performance and compliance with the Environmental Specifications and Standard Operating Procedures;
- Notify the Internal Environmental Manager and Auditor immediately in the event of any accident or infringements of the Environmental Specifications and Standard Operating Procedures and ensure appropriate remedial action is taken;
- Notify the Internal Environmental Manager and Auditor at least 10 working days in advance of any activity he has reason to believe may have significant adverse environmental impacts, with specific reference to blasting, so that mitigatory measures may be implemented timeously.

6.7.5 External Environmental Auditor

A competent and independent External Environmental Auditor must be appointed and will undertake inspections at an interval (to be established) that will satisfy the project specific needs. The aforementioned reports must be submitted to the Authorisation Holder and DEDEAT for their records.

In terms of Audits, the External Environmental Auditor will be required to ensure the following:

- All documentation (e.g. audit/monitoring/compliance reports and notifications) required to be submitted to the Department in terms of the EA;
- The holder of the EA must submit an external environmental audit report to the Department within 30 days of the completion of any audits at intervals that will be determined by the EA;

- The Environmental Audit Reports must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the EA conditions as well as the requirements of an approved EMPr;
- Records relating to monitoring and auditing must be kept on site and made available for inspection to any relevant and competent authority in respect of this development.

7 ENVIRONMENTAL AWARENESS PLAN

Training aims to create an understanding of environmental management obligations and prescriptive measures governing the execution of the project. It is generally geared towards project team members that require a higher-level of appreciation of the environmental management context and implementation framework for the project. In contrast, **Environmental Awareness Creation** strives to foster a general attentiveness amongst the workforce to sensitive environmental features and an understanding of implementing environmental best practices. The Environmental Awareness Plan for the Development incorporates both training and environmental awareness to ensure that the proposed development is implemented in line with the requirements of the EMPr and that environmental sensitivities on site are managed correctly.

As part of this, Bay Terminals Group is committed to remaining responsible and accountable for environmental practices on site. Being accountable for environmental practices undertaken during working tasks and activities remain the responsibility of both employer and employee awareness of the potential environmental impacts that could result from these activities.

All potential incidents to the environment may be effectively minimised through effective training and awareness of the employees using any of the following methods:

- Supervisory meetings (weekly);
- Induction training (annually);
- EMPR Training (annually); and
- External environmental and/or health and safety courses (when applicable).

These methods are discussed below in more detail.

7.1 Meetings

Weekly supervisory meetings are ideal to facilitate awareness of specific environmental dangers pertaining to each week. Various topics may be discussed during these meetings and must be recorded or logged. All attendees at each meeting must sign an attendance register, these records must be kept on file at the administration office. Topics for discussion may include:

- Topics applicable to the entire operation;

- Area specific topics (e.g. heritage); and
- General environmental awareness:
    - Waste and waste water management;
    - Spillages;
    - Saving water;
    - Electricity consumption;
    - Dust control;
    - Noise generation;
    - Housekeeping;
    - Indigenous Vegetation;
    - Fauna;
    - Alien vegetation; and
    - Fire-making.

Should issues be identified by the Internal Environmental Manager, these can also be addressed during these weekly meetings.

7.2 EMPr Training

Aspects of the EMPr must be selected and discussed at training workshops at least annually or when a new employee is employed or contractor contracted. Such training topics may be focused around the incidents that are frequently reported during the previous year or specific to the work of the employee or contractor and may be focused around the following:

- Hydrocarbon spillages;
- Stormwater control;
- Waste management;
- Monitoring protocols; and
- Safety topics.

Workers should be informed that they may refuse work that is harmful to human health and/or the environment.

7.3 Induction Training

All new employees are required to undergo induction training prior to commencement of work. Returning and existing employees must undergo repeat induction training at least annually. Environmental awareness training must form part of the induction and must include the basic topics relating to the environment:

- Main environmental legislation (e.g. NEMA, NEMAQA; NEM:WA[2] or NWA[3]);
- Constitutional right pertaining to the environment;
- Waste management hierarchy;
- Environmental, social and economic concerns;
- Sensitive environmental features; and
- Prevention of poaching.

[2] National Environmental Management Waste Act (NEM:WA), 2008 (Act No. 59 of 2008)

[3] National Water Act (NWA), 1998, (Act No. 36 of 1998)

8 EMERGENCY PREPAREDNESS PLAN/ INCIDENT MANAGEMENT PLAN

8.1 Potential Emergencies

The following potential emergencies that may occur on site include:

- Environmental Incidents:
    - Fuel and hydrocarbon spillages;
    - Sewage spillages from the ablution facilities and sewer pipelines; and
    - Fire Hazards;
    - Explosion Hazards.
- Safety Incidents:
    - Injuries related to operation of heavy machinery;
    - Driving related accidents and incidents from Trucks on site during operation;
    - Criminal incidents such as theft or potential violent crime during construction and operation.

8.2 Emergency Plan

8.2.1 Emergency Assemblage Area

A central area on site must be demarcated with appropriate signage for the gathering of all employees and visitors on site in the event of an emergency.

8.2.2 Emergency Procedures

The following procedures must be compiled in order for the identified potential emergencies to be managed effectively:

- Drill and evacuation procedure for any emergency related incidents containing information on the following:
    - Reporting structure for all incidents;
    - Emergency contact information (e.g. telephone numbers);
    - Procedure to be followed for the specific emergency;
    - First Aid information;
- Spillages of fuel and hydrocarbons:
    - Immediate action plan (e.g. use of spill kits) to prevent spill for spreading;
    - Reporting of incident to manager and supervisor to advise on next steps;
- Procedure for theft and crime:
    - Details on security system on site;
    - Emergency response units;

- Panic alarms;
- Details of community response units.

8.2.3 Emergency Contact Information

A list of potential emergency contact centers specific to the area must be drawn up and displayed on common notice boards for all employees to access. The following emergency centers must be sourced:

- Nationwide emergency response;
- Cell phone Emergency;
- Ambulance;
- Hospitals;
- Fire Response; and
- Police.

This list must be checked and updated at least weekly to ensure that the information remains up to date.

9 INTEGRATED WASTE AND WASTE WATER MANAGEMENT PLAN

In order to ensure waste is properly dealt with, waste management is included in the EMPr. In addition, a **Waste Management Plan** is discussed below.

9.1 Legal Requirements

Section 16 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), as amended states that –

"A holder of waste must, within the holder's power, take all reasonable measures to –

- *Avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;*
- ***Reduce, reuse, recycle and recover waste;***
- *Where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;*
- *Manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts;*
- *Prevent any employee or any person under his or her supervision from contravening this Act;*
- *Prevent the waste from being used for any unauthorised purpose.*

Only temporary storage of waste is allowed (once of storage of waste for a period less than 90 days). The volume of material should be limited to less than 100m^3 of general waste and less than 80m^3 of hazardous waste. Should this be exceeded the Norms and Standards for the Storage of Waste will need to be complied with.

9.2 Waste Hierarchy

Management objectives provided in this EMPr are aligned to the waste management hierarchy indicated in Figure 8.

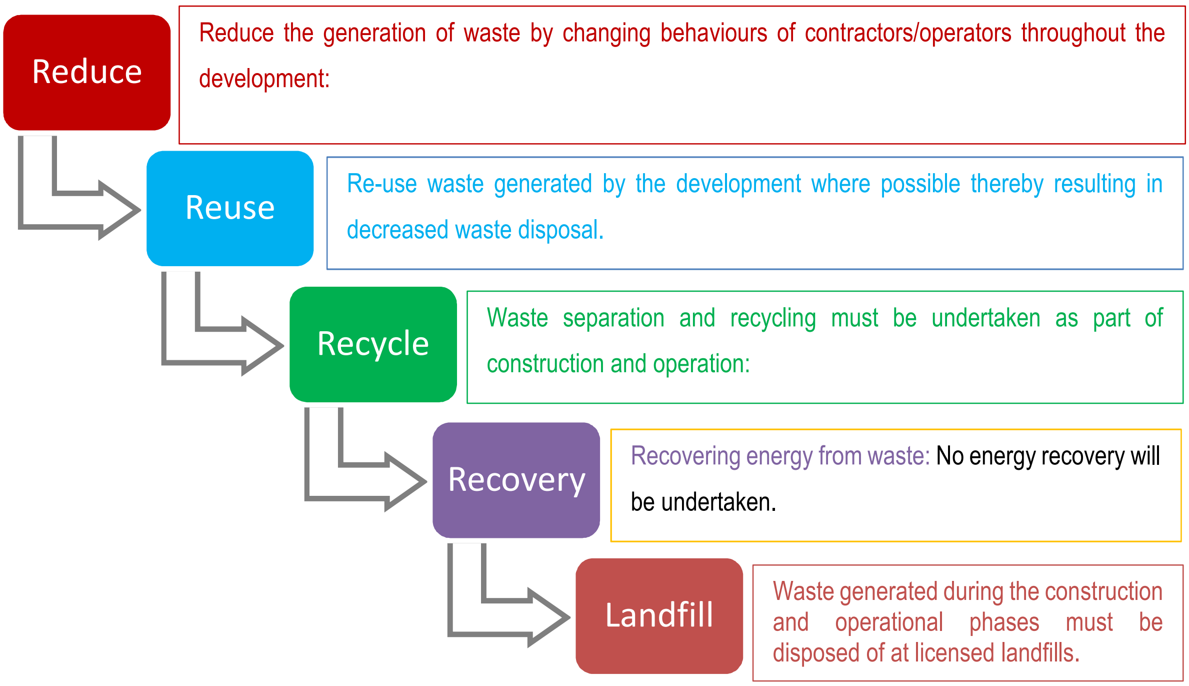

Figure 8: Waste Hierarchy

9.3 Waste Management Actions

The following waste management actions must be implemented in order to ensure the objectives included in the waste hierarchy above are met.

9.3.1 Waste Avoidance and Reduction

Avoidance and reduction should be practiced wherever possible. Recommended actions include: but are not limited to:

- Bulk buying of materials to reduce the volume of packaging required;
- Avoidance of materials/items/brands that are heavily packaged, have a short lifespan or are low quality;
- Buying items that last longer and can be repaired;
- Buying items in refillable containers;

- Environmental awareness training should focus on management of waste and all construction workers should be aware of the importance of waste minimisation and avoidance.

9.3.2 Recycling

Recycling should be practiced whenever waste prevention or reuse is not possible, provided that any such recycling is cost effective, taking into consideration environmental benefits, financial costs and community interests.

Potential priority recyclable waste streams include:

- Used Oil;
- Paper;
- Glass;
- Tyres;
- Plastics;
- Timber;
- Building rubble; and
- Electronic waste.

The following actions must be implemented:

- To reduce or avoid the need for sorting after collection, the categories of distinctively marked waste receptacles must be provided in order to receive waste as it is generated.
- These receptacles shall be fitted with a tight cover;
- All types of waste collection receptacles shall be clearly marked with the type of waste they are receiving;
- Obtain and label recycling containers for office waste, aluminium, steel, glass, ferrous metals, nonferrous metals, waste timber;
- Locate these containers within office buildings and trailers;
- Establish a recycled material collection schedule; and
- Arrange full bins to be hauled away.

9.3.3 Waste Disposal

The contractor is responsible for removal of all waste from the site, generated through the contractor's activities. The contractor shall ensure that all waste is removed to an appropriately licensed waste management facilities (the following source may be utilised – www.sawic.org.za). During operation, waste that is not collected for recycling must be collected by the municipality or by a municipality approved 3rd party collector.

In addition, it should be noted that the classification of waste determines the handling methods and the ultimate disposal of the material. All **hazardous waste** that may be generated by operational activities must be managed as follows:

- Characterise the waste to determine if it is general or hazardous (Use the Appendix 1 of the Norms and Standards for the Classification of Waste for landfill to determine whether additional classification is required);
- Obtain and provide an acceptable container with a label;
- Place hazardous waste material in the container;
- Inspect the container on a regular basis;
- Haul the full container to the licenced and correct disposal site;
- Provide documentary evidence of proper disposal of the waste.

In addition, the following actions must also be undertaken:

- Provide waste skips on site. These skips should be sufficient in number, the skip storage area should be kept clean, skips should be emptied and replaced before overflowing or spillage occurs;
- Skips should be covered to prevent waste blowing away;
- Vermin / weatherproof bins will be provided in sufficient numbers and capacity to store domestic waste. These bins must be kept closed to reduce odour build-up and emptied regularly to avoid overfilling and other associated nuisances;
- Ensure that solid waste is transported to avoid waste spills en-route;
- No waste shall be buried or burned anywhere on the site;
- Permits to transport/dispose of waste must be in place.

9.3.4 Waste Water Management

9.3.4.1 Process water

Process wastewater (oily water) will consist mainly of tank bottom draining, and contaminated stormwater runoff, including water from tank leaks and spills that collect in the oil water interceptor containment sump. Oily water will be channeled via the oily water sewer to the oil-water INTERCEPTOR separator. Recovered oil will be pumped to the Slops Tank, and water from the separator will be sampled to ensure compliance with the requirements of the Water Quality Act prior to release to the sewer water system.

9.3.4.2 Domestic waste water

Wastewater generated from the toilet facilities, ablutions and domestic use will be disposed of into the municipal sewer system.

9.3.4.3 Stormwater

It is envisaged that the site will be separated into three stepped platforms, each with a slight slope falling to the north-east. Generally, the surface water will be directed towards the roadways, which will act as the principal stormwater collectors. Where necessary, surface water will be collected in catch pits and piped below the surface to the nearest municipal stormwater system. Recycled water will be treated for re-use or discharged to the sewer system if no longer required.

Areas that could become [potentially] contaminated are contained, in the main tank area Bunds, and low bunded loading areas – tank bunds and loading areas are isolated with sumps and valves, and drained separately to the oil water interceptor, that discharges to sewer under controlled conditions by opening a value under supervision according to the SOP and EMS. Loading areas and wash bays will be covered to reduce the risk to contaminated storm water and reduce these volumes to be handled.

Clean paved areas not subject to process spillages shall be contoured to ensure run-off is directed away from potentially contaminated areas to the storm water sewer system.

All contaminated areas will be drained to the Interceptor per SANS 10089-1. Parking will be drained to standard stormwater system per SANS 0252.

9.3.4.4 Slops Handling

Slops is hazardous chemical or petrochemical contaminated “oily” water. This must be handled responsibly and treated to correct effluent management policies. These must be written into the EMS for the site. Standard operating procedures (SOP) must be drafted, with appropriate staff training for the handling and operations around both the effluent discharges and slop oil and sludges. These liquids contain petrochemical traces and out of specification contaminated water to be removed from site for on-processing as required. This is by specialist waste oil companies approved by the local and national authorities. Where tank cleaning sludge is solid this must be inerted and disposed of responsibly to High Hazard solid waste systems. Solids skips and inerting materials must be used for solid wastes. Spill kits and booms must be available for emergency procedures.

Where required slops may be removed from site by approved specialist waste oil operators, who are typically ROSE foundation members. This will be loaded into tankers in the allocated bay. Only temporary storage of waste is allowed (once of storage of waste for a period less than 90 days). The volume of material should be limited to less than $100m^3$ of general waste and less than $80m^3$ of hazardous waste. Should this be exceeded the Norms and Standards for the Storage of Waste will need to be complied with.

The slops handling facility on site have a capacity to hold 450 m^3 of potentially hazardous waste and therefore, the Norms and Standards for the Storage of Waste is applicable to the proposed development and should be implemented by the Authorisation Holder. The Norms and Standards are attached in Appendix B of the OEMPR.

10 MONITORING PLAN

Monitoring is required to ensure that the receiving environment at the proposed development is suitably safeguarded against the identified potential impacts during the operational phase, and to ensure that the environmental management requirements are adequately implemented and adhered to throughout the project.

A method of monitoring, with the goal to ensure environmental compliance will be constructed. The method will indicate whether the inspection is to be Internal, External, or third party related. Furthermore, the method will chronologically display the frequencies of monitoring to take place as well as the entity responsible to check that corresponding management objective and ensure its outcome.

10.1 Compliance Monitoring and Auditing

10.1.1 Environmental Audits

The mechanism for monitoring compliance with the management and mitigation measures stipulated within the EMPr must include an audit undertaken by an External (Independent) Environmental Auditor.

<u>The objective of the environmental audit is to:</u>

- Report on the level of compliance with the conditions of the environmental authorisation and the management and mitigation measures stipulated within the OEMPr;
- The extent to which the avoidance, management and mitigation measures provided in Section 12 achieve the objectives and outcomes in Section 5;
- Identify and assess new impacts and risks as a result of undertaking the activities;
- Evaluate the effectiveness of the management and mitigation measures generated in the OEMPr;
- Identify shortcomings in the OEMPr;
- Identify the need for any changes to the avoidance, management and mitigation measures provided for in the OEMPr.

The conditions of the Environmental Authorisation and Atmospheric Emissions Licence may also require that internal environmental audits be conducted periodically, usually more frequent than external audits, and require the audit reports to be submitted to the Department.

10.1.2 Procedure

The following methodology or procedure is suggested for the assessment of the management and mitigation measures of the OEMPr:

- Pre-site preparation: prior to the site inspection a review of the management measures contained in the OEMPr, and a checklist must be drawn up;
- Site inspection: The site must be traversed on foot and must include an assessment of each major component of the facility.
- Documentation review: after the site inspection a documentation review must be undertaken by requesting specific key documentation relating to the proposed development.

10.1.3 Evaluation Criteria

During evaluation of the EMPr, the following criteria must be used:

- Management measures stipulated in the plan;
- Environmental monitoring required;
- Legal requirements; and
- Best practice observations.

10.1.4 Reporting

All inspections undertaken as part of internal / external auditing must be provided in the form of a report. External audits will be submitted to the competent authority as required by the EIA Regulations, 2014 [as amended in 2017]. The Environmental audit report must provide for recommendations regarding the need to amend the EMPr. The Competent Authorities may require that internal be conducted and audit reports be submitted as well, usually more frequent than external audits.

Objectives of the environmental audit report as per the EIA Regulations, 2014 [as amended in 2017] is to:

(a) report on-
  (i) The level of compliance with the conditions of the environmental authorisation;
  (ii) The extent to which the avoidance, management and mitigation measures provided for in the EMPr, and where applicable, the closure plan achieve the objectives and outcomes of the EMPr;
(b) identify and assess any new impacts and risks as a result of undertaking the activity;
(c) evaluate the effectiveness of the EMPr;
(d) identify any shortcomings in the EMPr;
(e) identify the need for any changes to the avoidance, management and mitigation measures provided for in the EMPr.

Content of environmental audit reports

(1) An environmental audit report prepared in terms of the Regulations must contain-

(a) Details of the-
- (i) Independent person who prepared the environmental audit report; and
- (ii) Expertise of the independent person that compiled the environmental audit report;

(b) A declaration that the independent auditor is independent in a form as may be specified by the competent authority;

(c) An indication of the scope of, and the purpose for which, the environmental audit report was prepared;

(d) A description of the methodology adopted in preparing the environmental auditor report;

(e) An indication of the ability of the EMPr to-
- (i) Sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity on an ongoing basis;
- (ii) Sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the closure of the facility; and
- (iii) Ensure compliance with the provisions of environmental authroisation and EMPr;

(f) A description of any assumptions made, and any uncertainties or gaps in knowledge;

(g) A description of any consultation process that was undertaken during the course of carrying out the environmental audit report;

(h) A summary and copies of any comments that were received during any consultation process; and

(i) Any other information requested by the competent authority.

10.1.5 Penalties

In order to ensure that there is adequate motivation for the contractor to comply with the conditions set out in the OEMPr, the following applies with regards to penalties:

- The Contractor and / or employees will comply with the environmental requirements on an ongoing basis, and any failure on their part to do so will entitle the Chief Operational Officer, in consultation with the Internal Environmental Manager, to certify the imposition of a fine subject to the details set out in the OEMPr;
- The Chief Operational Officer, Internal Environmental Manager and Auditor and any other specific personnel as designated by the Chief Operational Officer may alter the Schedule of Fines for this specific project;
- Fines may be issued per incident at the discretion of the Chief Operational Officer. Such fines will be issued in addition to any remedial costs incurred as a result of non-compliance with the requirements of the OEMPr and documents supporting thereof. Fines may be omitted from construction guarantees as supplied by the contractor.

- The Chief Operational Officer and Internal Environmental Manager and Auditor will be the judge as to what constitutes a transgression in terms of the above clause. Further, note that in the event that transgressions continue to an unacceptable level the client may cancel the contract of any contractors or employees;
- Where the Contractor/employee inflicts non-repairable damage upon the environment or fails to comply with any of the environmental requirements, he will be liable to pay a penalty fine over and above any other contractual consequence. This may also lead into a Rectification Application in terms of Section 24G of the NEMA, which could lead to certain fines and / or prosecution.
- The Contractor/employee is deemed NOT to have complied with this specification if:
  - Within the boundaries of the site, site extensions and access roads there is evidence of contravention of the requirements of the EMPr;
  - Environmental damage ensues due to negligence;
  - The Contractor/employee fails to respond adequately to complaints from the public;
  - Legal action is instituted against the authorization holder in terms of Environmental laws due to any action / activities undertaken by the Contractor/employee;
- Payment of any fines in terms of the contract will not absolve the offender from being liable from prosecution in terms of any law; and
- A record of penalties will be maintained within the procurement department and may influence later commissions awarded to the contractor.

11 OEMPR REVIEW AND AMENDMENT

The section within this document is dedicated, hereon, to indicate amendments, additions, and changes to the OEMPr. An adaptive strategy must be followed in terms of the OEMPr requirements, to ensure, regardless of any reasonable circumstance, the best possible outcomes and management of the environment.

This is the second draft OEMPr in regard to the application. The document has been amended to take into account the necessary Part 2 Amendments,

12 OPERATIONAL ENVIRONMENTAL MANAGEMENT PROGRAMME

Mitigation measures for all activities related to operation of the facility are provided below. The mitigation measures from various specialist studies and technical studies have been included. Management actions are linked to a specific impact, project activity and overall management objective. Information on the institutional responsibilities and the frequency of the actions is provided as well.

The objective of the following OEMPr management measures is to prevent and or mitigate all potential impacts on the environment potentially caused by the operational phase of the proposed activity. The

OEMPr also aims to provide a tool to monitor the continuous compliance of the operational phase of the facility in terms of all envisioned environmental aspects. The recommended actions regarding the management, in relation to the specific project activity, of the facility's operation are provided below. The recommended actions were, determined by the following listed related specialist and technical studies. Management actions are linked to a specific impact and overall management objective.

Furthermore, third-party verification in terms of compliance with all the conditions contained herein are recommended, including methodology, frequency and responsibilities. Lastly, although great care has been taken to ensure that this OEMPr considers all the necessary aspects to ensure environmental compliance, an added input may be required to ensure that a best practice approach (and the most preferred outcomes) is established. Environmental Management Systems should also be developed at commissioning of the activity and Standard Operating Procedures before operation starts.

The following specialist studies and technical studies were consulted in the compilation of this OEMPr, especially in terms of the recommended mitigation measures:

- Draft Engineering Process Description Report;
- AQIA (Air Quality Impact Assessment) Report;
- Ecological Impact Assessment Report;
- NEMA Risk Assessment Report; and
- Traffic Impact Assessment Report.

Table 6: Management measures to be implemented before the operational phase

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
LEGISLATIVE REQUIREMENTS AND DOCUMENT CONTROL							
General requirements	Commissioning of the tank farm operations including, storage, handling and transfer of fuel.	All relevant authorisations, licences and approvals are in place prior to the commencement of operation.	• Approvals to be in place prior to operational phase.	Copies of approvals (EA, MHI Risk Assessment) AEL) available in environmental site file (hard copy or electronic).	Maintaining environmental site file.	Once off prior to operational phase.	Chief Operational Officer
	Commissioning of the tank farm operations including, storage, handling and transfer of fuel.	A formal document control system is in place to ensure all relevant documents are in place prior to commencement.	An environmental file/document control system must be designed and put in place. • Prior to the operational phase, the following documents must be included in the file: ○ Operational EMPr; ○ Environmental Authorisation (EA); ○ Atmospheric Emissions License (AEL); ○ NEMA Risk Assessment; ○ Major Hazardous Installation (MHI) Risk Assessment; ○ Approved Air Quality Monitoring and Management Plan; ○ Environmental Impact Assessment Report; ○ Environmental Specialist Studies; ○ Stormwater management plan – approved; ○ Internal and External Audit Reports; ○ The public complaints register in which all complaints are recorded, as well as actions taken; ○ The record (incident register) of environmental incidents (spills, impacts, legal transgressions, etc.) as well as corrective and preventive actions taken; ○ Spill procedures; ○ Method statements; ○ Standard operating procedures; ○ Signed off as-built or construction designs; ○ Emergency response procedures; ○ Environmental monitoring results and reports; ○ Invasive species monitoring, control and eradication plan for the Coega SEZ; ○ Environmental awareness training plan and records (attendance registers etc.);	An environmental file/document control system are in place on site.	Maintaining environmental site file, preferably electronically.	Once off prior to operational phase and maintaining documents and file throughout the operational phase.	Internal Environmental Manager and Auditor Chief Operational Officer

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
			○ Safe Disposal Certificates from hazardous waste, used oil and general waste contractors; ○ Waste management register; ○ Water quality test results and any monitoring reports; ○ All applicable codes and standards that the tank farm must comply with; and ○ Proof of notification of Competent Authorities of commencement of construction.				
	Commissioning of the tank farm operations including, storage, handling and transfer of fuel.	Nelson Mandela Metropolitan Municipality (NMBM) requirements regarding notification have been met.	• NMBM should be notified of the commencement of operation.	Proof of notification in environmental site file.	Maintaining environmental site file, preferably electronically.	Once off prior to operational phase	Internal Environmental Manager and Auditor Chief Operational Officer
	Commissioning of the tank farm operations including, storage, handling and transfer of fuel.	Eastern Cape Department of Economic Development, Environment and Tourism (EC DEDEAT) requirements regarding notification have been met.	• EC DEDEAT should be notified of the commencement of operation.	Proof of notification in environmental site file.	Maintaining environmental site file, preferably electronically.	Once off prior to operational phase	Internal Environmental Manager and Auditor Chief Operational Officer
	Commissioning of the tank farm operations including, storage, handling and transfer of fuel.	Site specific method statements from external contractors are compiled and approved.	• Based on the EMPr, the external contractors must compile specific method statements which must be approved by the Chief Operational Officer prior to operation. At a minimum this should include: ○ Method statement for domestic cleaning; ○ Method statement for hazardous waste removal; ○ Method statement for general waste removal; ○ Method statement for removal of recyclables (paper, metal, timber etc.) removal contractors; ○ Method statement for used oil removal.	Method statements signed off by the Chief Operational Officer in environmental site file.	Maintaining environmental site file, preferably electronically.	Once off prior to operational phase	Chief Operational Officer
	Commissioning of the tank farm operations including, storage, handling and transfer of fuel.	Site specific method statements are compiled and approved.	• Based on the EMPr, Internal Environmental Manager and Auditor must compile specific method statements which must be approved by the Chief Operational Officer prior to operation. At a minimum this should include: ○ Method statement regarding waste and wastewater management;		Maintaining environmental site file, preferably electronically.	Once off prior to operational phase	Internal Environmental Manager and Auditor

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
			o Method statement to show procedures for dealing with possible emergencies that can occur, such as fire and accidental leaks and spillage of carbon fuels and oils; o Method Statement for air quality control; o Method statement for the storage and handling of hazardous substances; o Method statement for controlling alien invasive species and noxious weeds.				
	Commissioning of the tank farm operations including, storage, handling and transfer of fuel.	Site specific Standard Operating Procedures	• Based on the EMPr and MHI Risk assessment, the Chief Operational Officer must compile specific Standard Operating Procedures, which must be approved by the relevant authorities.	Standard Operating Procedures and approval thereof occurring in the site file.	Maintaining environmental site file.	Once-off prior to operation.	Chief Operational Officer Internal Environmental Manager and Auditor
	Commissioning of the tank farm operations including, storage, handling and transfer of fuel.	Approval of installation of all tank farm and pipeline infrastructure	• Based on the as-built engineering drawings and MHI risk assessment, the Resident Engineer, Design Engineers and MHI Risk assessor must inspect and approve the installation of all tank farm infrastructure and pipelines.	Signed off as-built drawings.	Maintaining environmental site file.	Once-off prior to operation.	Chief Operational Officer Resident Engineer
ENVIRONMENTAL AWARENESS CREATION – INDUCTION							
General Requirements	Commissioning of the tank farm operations including, storage, handling and transfer of fuel.	Environmental awareness creation and training is undertaken prior to operation commencement to minimise environmental impacts and ensure compliance to relevant legislation and authorisations.	• Internal Environmental Manager and Auditor to induct relevant external contractor managers and employees of the tank farm at the start of the project. This induction should provide an overview of the authorisation and the OEMPr. The environmental awareness training course for management shall include all management and foremen; • The external contractors must arrange that all of his employees and those of his sub-contractor go through the project specific environmental awareness induction before the commencement of operation and as and when new staff or sub-contractors are brought on site; • A system must be in place to ensure all new employees have received training; • All attendees shall remain for the duration of the course and sign an attendance register that clearly indicates participant's names on completion.	A copy of the attendance registers is to be retained within the environmental site file.	Maintain environmental site file. Spot checks by Chief Operational Officer	Prior to operation and thereafter, at least bi-annually and with every new employee at the tank farm.	Internal Environmental Manager and Auditor Chief Operational Officer

Table 7: Management measures to be implemented during the operational phase

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
ATMOSPHERIC EMISSIONS							
Emissions from vehicles and equipment (CO^2, NO_x, SO_x, VOC's etc.)	Operation of machinery on site and driving of trucks on local, provincial and national roads to transport fuel to retailers.	All vehicles and machinery on site must be properly maintained to reduce emission sources.	• All vehicles and machinery will be maintained such as to operate efficiently. Idling times of vehicles and machinery to be minimised; • In terms of transportation of workers and materials, collective transportation arrangements should be made to reduce individual car journeys where possible; • All vehicles and other machinery should comply with road worthy requirements and comply with legislation in terms of allowable emissions.	Signed, up to date maintenance schedules of all machinery and vehicles available on request.	Documentation review, maintaining site file.	Daily and as required by maintenance schedule	Internal Environmental Manager and Auditor Operations Manager and/ or Chief Operational Officer.

Point source emissions from HFO boiler including SO_2; PM10; NO_2 and CO may alter air quality.	Operation of the HFO Boiler/s.	Reduce emissions from HFO Boilers and associated impacts on air quality.	• Use low sulphur content Heavy Fuel Oil (HFO) as energy source to Boiler, as prescribed by the NMBM as specified in AEL;
			• Develop and maintain environmental management system for emission control as per Atmospheric Emissions License;
			
			• Monitoring:
			  o Manual emissions measurements as per Annexure A of Government Notice No. 831 of 2013 (Declaration of a small boiler as a controlled emitter and establishment of emission standards;
			  o 3 measurements measured over a minimum sample period of 60 minutes;
			  o Parameters: Particulate Matter (PM10), Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2) and Carbon monoxide (CO).
				Safety Data Sheet /product sheet for HFO received by supplier indicating low Sulphur content of the HFO.
				
				Monitoring sampling results and air quality monitoring report with emissions below the emissions standards.
					Documentation review, maintaining site file.	Monthly
						
						Ongoing
						
						Annually
							Internal Environmental Manager and Auditor
							
							Operations Manager and/ or Chief Operational Officer.

Area source emissions including Volatile Organic Compounds (VOCs) (BTEX), from the whole site during operation may alter air quality and impact on surrounding land	Handling of fuel, especially at the loading bays. Storage of fuel.	Reduce emission from VOC's and associated impacts.	• ULP and JET fuel tanks should have a fixed dome roof with internal floating roof. • Diesel tanks – should have a fixed dome roof with facility of nitrogen-inerting for vapour space. • Vapour Recovery Unit (VRU) - A vapour recovery system to be included at the loading gantry to alleviate pressure differences while loading product. The vapour recovery shall extract vapour from the road tankers and re-liquefy through a compressor to pump back to the tanks. A vapour recovery system will be in place to recover vapours displaced during filling activities at the storage tanks as well as at the road tanker filling facilities. The VRU processes surplus vapours providing both an ecological and economic aspect of	Ground-level concentrations should be below the concomitant air quality standards.	Fence-line VOC monitoring system	Continuous	Internal Environmental Manager and Chief Operational Officer

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
uses and sensitive species.			recovering products, with an average 1,5 litres/m3 of hydrocarbon vapours. The vapour recovery system will most probably be a Membrane Technology system, or a Carbon Technology system. The liquified hydrocarbons are then pumped to the Slops Tank. • As is required by GN893, all fuel transfer points will be serviced by vapour recovery units which must have a minimum efficiency of 95%. • Emission testing should be conducted as per Schedule A of • Government Notice 248. • Environmental Management System to be developed as per the Atmospheric Emissions Licence Application.				
Noise nuisance to surrounding land owners and animals.	General operational activities, vehicles speeding or operation of vehicles of machinery that are in poor condition.	Ensure that noise disturbance to surrounding areas are minimised and that construction activities comply with the Noise Control Regulations and the provisions of South African National Standards; Environmental, Health and Safety (EHS) Guidelines, World Health Organisation (WHO, 2002).	• The provisions of SANS 10103:2008 will apply to all areas within audible distance of residents or adjacent landowners; • Equipment and/or machinery which will be used must comply with the manufacturer's specifications on acceptable noise levels; • When required noise mufflers should be utilised to reduced noise; • It is important to keep an open channel of communication between all stakeholders and keep record of any concerns raised.	Noise mufflers are in use. Complaints register in file and should any noise complaints be recorded should also describe how it has been resolved. Compliance with SANS 10103:2008.	Noise monitoring as spot checks. Maintaining complaints register.	Daily and when complaints are received.	Internal Environmental Manager and Auditor Chief Operational Officer
WATER IMPACTS (SURFACE AND GROUNDWATER)							
Liquid waste including sewage may cause stormwater and groundwater pollution if not managed and disposed of correctly.	Storage and handling of waste water and contaminated stormwater. Maintenance of infrastructure (e.g. sewer pipelines).	Activities are managed correctly to ensure no negative impacts to water quality is incurred. This includes proper management of ablution facilities and waste water.	• Management of Ablution Facilities: o Adequate ablution facilities to be provided and maintained to the permanent staff and clients. • Management of waste water: o Ensure that clean run-off water is diverted away from potentially contaminated areas of the construction site; • Safe disposal of liquid waste; • Waste and waste water management plan as per this EMPr (Section) to be implemented.	Ablution facilities are kept in a hygienic condition and are in good working order. No visible spillages or leaks form internal or external sewer pipelines. Safe disposal certificates in the site file.	Spot checks	Daily	Internal Environmental Manager and Auditor Chief Operations Manager

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
Diversion and increased velocity of surface water flows – Changes to the hydrological regime and increased potential for erosion.	Stormwater management on site.	Reduce the impacts associated with infrastructure to be constructed as part of the proposed development such as roads and pipelines and stormwater management structures.	• Approved stormwater management plan to be implemented; • Stormwater and any runoff generated by the hard surfaces should be discharged into energy dissipation structures, where required. These could be used to enhance the sense of place, if they are planted with indigenous vegetation. These energy dissipation structures should be placed in a manner that flows are managed prior to being discharged back into the environment, thus preventing erosion.	Approved stormwater management plan implemented and maintained. No signs of erosion or loss of vegetation as a result of stormwater emanating from the site or from the pipeline reserve and service road.	Inspection of stormwater infrastructure and along the pipeline reserve and around the site.	Monthly and after rain	Internal Environmental Manager and Auditor Chief Operational Officer
Diversion and increased velocity of surface water flows – reduction in permeable surfaces.	Stormwater management on site.	Reduce the impacts associated with infrastructure to be constructed as part of the proposed development such as roads and pipelines and stormwater management structures.	• Approved stormwater management plan to be implemented; • Stormwater and any runoff generated by the hard surfaces should be discharged into energy dissipation structures, where required. These could be used to enhance the sense of place, if they are planted with indigenous vegetation. These energy dissipation structures should be placed in a manner that flows are managed prior to being discharged back into the environment, thus also supporting the maintenance of natural base flows within these systems, i.e. hydrological regime (water quantity and quality) is maintained; • The stormwater structures and infrastructure should be maintained on a regular basis.	Approved stormwater management plan implemented and maintained. No signs of erosion, loss of vegetation or drying out of areas as a result of stormwater emanating from the site or form the pipeline reserve and service road.	Inspection of stormwater infrastructure and along the pipeline reserve and around the site.	Monthly and after rain	Internal Environmental Manager and Auditor Chief Operational Officer
Impact of changes to water quality through operational materials such as sediments and hydrocarbon spillages, may pose a threat to the instream and adjacent vegetated areas, if by chance it is dispersed via surface run-off or allowed to	Storage and handling of fuel. General operational activities. Maintenance of infrastructure. Stormwater management on site.	Ensure no spillages through proper management of storage and handling of fuel. Ensure stormwater is properly managed. Effective and safe management of hazardous materials on site, to minimise the impact of materials on the environment by following approved Standard Operating Procedures full	• Littering and contamination of water sources during operation must be prevented by effective waste and waste water management and prevention of spills; • Spill procedures must be in place in case of spillages onto road surfaces; • Implement approved method statements for managing of waste and waste water and removal; • Implement approved standard operating procedures for waste and waste water management; • Implement approved standard operating procedures for handling of fuel/product; • Maintain tank farm and pipeline infrastructure in a good condition; • Maintain silt traps, sumps and oil separators as part of the Stormwater Management System; • Ensure that clean run-off water is diverted away from potentially contaminated areas of the construction site;	No signs of hydrocarbon spillages. No sign of contaminated water within the municipal stormwater system or clean stormwater areas or release into the environment. Spill procedure and standard operating procedure present in the site file and included in environmental awareness training plan.	Maintain environmental site file. Spot checks	Daily	Internal Environmental Manager and Auditor Chief Operational Officer Resident Engineer

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
permeate groundwater.		compliance with relevant standards and codes.	• Safe disposal of liquid waste; • Waste and waste water management plan as per this EMPr (Section 9) to be implemented.	Incident register maintained with any incidents of spillages and mitigating actions taken recorded.			
WASTE GENERATION							
Increased generation of hazardous waste by the activity put strain on service delivery institutions.	Cleaning of fuel storage tanks. General operational activities.	Effective and safe management of hazardous materials on site, to minimise the impact of materials on the environment by following approved Standard Operating Procedures full compliance with relevant standards and codes.	• The classification of waste determines the handling methods and the ultimate disposal of the material. The contractor shall manage hazardous waste that are anticipated to be generated by his operations as follows: o Characterise the waste to determine if it is general or hazardous (Use the Appendix 1 of the Norms and Standards for the Classification of Waste for landfill to determine whether additional classification is required); o Obtain and provide an acceptable container with a label; o Place hazardous waste material in the container; o Inspect the container on a regular basis; o Haul the full container to the licenced and correct disposal site; o Provide documentary evidence of proper disposal of the waste. • Only temporary storage of waste is allowed (once of storage of waste for a period less than 90 days). The volume of material should be limited to less than 80m^3 of hazardous waste. Should this be exceeded the Norms and Standards for the Storage of Waste will need to be complied with; • Containers must be emptied frequently before reaching capacity; • All hazardous waste must be disposed of at the nearest hazardous landfill; • Waste may not cause any nuisance (e.g. contamination) • Records of waste manifest documents must be retained at the administration office; • Certificates of registration must be retained for transporters of hazardous waste and retained in record at the administration office; • Safe disposal of hazardous waste; • Valid contract with external contractor in place and maintained; • Approved external contractor method statement implemented;	Safe disposal certificates in the site file. Valid contract for the removal of hazardous waste available in site file. Approved Standard Operating Procedure for the slops handling facility available in the site file. Approved method statement available in site file.	Maintain environmental site file. Spot checks	Daily Weekly	Internal Environmental Manager and Auditor Chief Operational Officer

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
			• Implementing approved Standard Operating Procedure for hazardous waste management; • Implementing the Norms and Standards for the storage of waste, if above 80 m^3 of hazardous waste is stored onsite; • Waste and waste water management plan as per this EMPr (Section) to be implemented.				
Increased generation of general waste by the activity put strain on service delivery institutions.	Office activities. General operational activities. Utilising and maintaining ablution and wash-up facilities.	General waste must be managed properly to ensure minimal impacts.	• Safe disposal of waste; • Valid contract with external contractor for removal of waste in place and maintained; • Approved external contractor method statement implemented; • Approved Standard Operating Procedure for waste management implemented; • Waste and waste water management plan as per this EMPr (Section) to be implemented; • Waste recycling to be put in place. • Domestic waste must be stored in containers labelled or colour coded for general waste; • Vermin / weatherproof bins will be provided in sufficient numbers and capacity to store domestic waste; • Containers must be emptied frequently before reaching capacity; • Solid waste shall only be stored in the designated general waste storage area which must be enclosed and impermeable; • No waste shall be buried or burned anywhere on the site; • All solid waste shall be disposed of by a certified contractor, off-site, at an approved landfill site if no municipal services is available; • Avoidance, reduction and reuse should be practiced wherever possible – see Section 10; • Waste may not cause any nuisance (e.g. odour) • Records of waste manifest documents must be retained at the administration office.	Safe disposal certificates in the site file. Valid contract for the removal of general waste available in site file. Approved Standard Operating Procedure for waste management available in the site file. Approved method statement available in site file. Waste manifest documents available.	Maintain environmental site file. Spot checks	Daily Weekly	Internal Environmental Manager and Auditor Chief Operational Officer
Solid waste from operational activities may cause visual impacts if not managed and disposed of correctly.	Waste management	All waste must be stored and managed properly to ensure minimal impacts.	• Safe disposal of waste; • Valid contract with external contractor for removal of waste in place and maintained; • Approved external contractor method statement implemented; • Approved Standard Operating Procedure for waste management implemented; • Waste and waste water management plan as per this EMPr (Section) to be implemented.	Waste storage area are maintained in a hygienic and neat condition. Safe disposal certificates in the site file.	Maintain environmental site file. Spot checks	Daily Weekly	Internal Environmental Manager and Auditor • Chief Operational Officer

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
				Valid contract for the removal of general waste available in site file. Approved Standard Operating Procedure for waste management available in the site file. Approved method statement available in site file.			
SOIL ALTERATION							
Loss of topsoil and erosion through inefficient landscaping and landscaping maintenance, as well as poor stormwater management and maintenance of infrastructure.	Landscaping and landscaping maintenance. Stormwater management. Maintenance of stormwater and road infrastructure.	Effective management of topsoil, stormwater and roads, in order to minimise the impact.	• During landscaping practices, topsoil and subsoil must be stripped separately from each other and must be stored separately from spoil material for later use; • Topsoil should be protected from wind and rain, as well as contamination from diesel, concrete or wastewater; • Topsoil should be used in landscaping and rehabilitation where possible.	Topsoil and subsoil stored separately. Topsoil stockpiles are protected from wind and contamination. Topsoil are re-used.	Spot checks Visual inspection	As and when landscaping is taking place.	Internal Environmental Manager and Auditor.

Liquid waste including sewage may cause soil pollution if not managed and disposed of correctly.	Maintenance of sewer pipelines and ablution facilities.
	
	Maintenance of slops handling facility and tanks.
	
	Stormwater and waste water management on site.
		Ensure that all possible causes of soil pollution are mitigated as far as possible to minimise impacts to the site and surrounding environment	• Management of Ablution Facilities:
			  o Adequate ablution facilities to be provided and maintained to the permanent staff and clients.
			• Management of waste water:
			  o Ensure that clean run-off water is diverted away from potentially contaminated areas of the construction site;
			• Safe disposal of liquid waste;
			• Waste and waste water management plan as per this EMPr (Section) to be implemented.
				Ablution facilities are kept in a hygienic condition and are in good working order.
				
				No visible spillages or leaks form internal or external sewer pipelines.
				
				Safe disposal certificates in the site file.
					Spot checks	Daily	Internal Environmental Manager and Auditor
							
							Chief Operations Manager

Soil pollution through contamination	Storage and handling of fuel.	Ensure no spillages through proper	• Littering and contamination of soil during operation must be prevented by effective waste and waste water management and prevention of spills;	No signs of hydrocarbon spillages.	Maintain environmental site file.	Daily	Internal Environmental

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
with hazardous substances.	Maintenance of infrastructure containing hazardous substances. Cleaning of trucks. Parking areas runoff. Stormwater and waste water management.	management of storage and handling of fuel. Ensure stormwater is properly managed. Effective and safe management of hazardous materials on site, to minimise the impact of materials on the environment by following approved Standard Operating Procedures full compliance with relevant standards and codes.	• Spill procedures must be in place in case of spillages onto road surfaces; • Implement approved method statements for managing of waste and waste water and removal; • Implement approved standard operating procedures for waste and waste water management; • Implement approved standard operating procedures for handling of fuel/product; • Maintain tank farm and pipeline infrastructure in a good condition; • Maintain silt traps, sumps and oil separators as part of the Stormwater Management System; • Ensure that clean run-off water is diverted away from potentially contaminated areas of the construction site; • Safe disposal of liquid waste; • Waste and waste water management plan as per this EMPr (Section 9) to be implemented.	No signs of contaminated soil on and around the study area and along the pipeline reserve to the battery limit. Spill procedure and standard operating procedure present in the site file and included in environmental awareness training plan. Incident register maintained with any incidents of spillages and mitigating actions taken recorded.	Spot checks		Manager and Auditor Chief Operational Officer Resident Engineer
RESOURCE CONSUMPTION							
Electricity consumption	General operations including office activities.	Electricity reduction mechanisms to be implemented.	• Enforce electricity reduction strategies; • Environmental awareness training.	Signed attendance registers of environmental awareness training including electricity use reduction strategies available on request.	Maintaining environmental site file with records of electricity reduction strategies and attendance registers of environmental awareness training.	Ongoing	Internal Environmental Manager and Auditor Chief Operational Officer
Water consumption	General operations including domestic activities. Management of ablution facilities. Management of water and waste water.	Water conservation mechanisms to be implemented.	• Enforce water saving strategies including design of recycling and reuse, rainwater harvesting etc.; • Environmental awareness training.	Signed attendance registers of environmental awareness training including water conservation as topic available on request.	Maintaining environmental site file with records of water conservation strategies and attendance registers of environmental	Ongoing	Internal Environmental Manager and Auditor Chief Operational Officer

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
	Water recycling facility. Washing trucks/vehicles on site.				awareness training.		
EFFECTS ON BIODIVERSITY							
Loss of vegetation and open space management habitat.	Imposing on adjacent undisturbed areas or entering no-go areas.	No loss of habitat outside the approved footprint. Ensuring that no employees/vehicles enter adjacent sensitive areas as per the Open Space Management Plan.	• The natural areas surrounding the tank farm site and the pipeline reserve should be declared 'no-go' area's and all efforts must be made to prevent access to these areas from workers, clients, machinery and the general public.	No persons or vehicles from the BTG tank farm imposing on adjacent natural areas.	Spot checks Visual inspection	Daily	Internal Environmental Manager and Auditor and Chief Operational Officer
Loss of species of special concern and their habitats.	Imposing on adjacent undisturbed areas or entering no-go areas.	No loss of habitat outside the approved footprint. Ensuring that no employees/vehicles enter adjacent sensitive areas as per the Open Space Management Plan.	• The natural areas surrounding the tank farm site and the pipeline reserve should be declared 'no-go' area's and all efforts must be made to prevent access to these areas from workers, clients, machinery and the general public.	No persons or vehicles from the BTG tank farm imposing on adjacent natural areas.	Spot checks Visual inspection	Daily	Internal Environmental Manager and Auditor and Chief Operational Officer
Increased risk of alien plant invasion.	Landscaping and landscaping maintenance.	To ensure alien plants are eradicated and controlled, to prevent invasion.	• A condition of the Environmental Authorisation issued by the Department of Environmental Affairs to the Coega Development Corporation for the removal of vegetation within the Coega IDZ area indicate that an Alien Invasive Species monitoring and control plan must be implemented. The CDC has such a plan, called "Invasive species monitoring, control and eradication plan for the Coega SEZ", dated 9 February 2017. This plan must be implemented on site and along the pipeline reserve.	"Invasive species monitoring, control and eradication plan for the Coega SEZ", occurring in environmental site file. No signs of alien or invasive plants occurring on or around the tank farm site and along the pipeline reserve.	Visual inspection	Monthly	Internal Environmental Manager and Auditor Chief Operational Officer
Loss of faunal species community composition and diversity.	Permanent barriers along the pipelines and site.	Minimal disturbance to fauna occurs.	• No hunting trapping and killing of animals are allowed. This aspect should be dealt with as part of Environmental Awareness Training; • Comply with the requirements of the National Environmental Management: Biodiversity Act (No. 10 of 2004), Natal Nature	No signs of animals being poached observed.	Documentation review	Ongoing	Internal Environmental Manager and Auditor

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
	Loss of fauna through poaching etc.		Conservation Ordinance 15 of 1974 and Animal Protection Act (No. 71 of 1962); • All domesticated animals are forbidden within the entire site and along the pipeline reserve (especially feral cats); • The use of "migratory friendly" property borders, such as palisade fencing or wire fencing with large gaps, should be considered along the pipeline, as this will allow for the ongoing survival of most species presently inhabiting the property. This will allow for the free movement of small mobile organisms (such as rodents).	Signed attendance registers of environmental awareness training including animals as topic available on request.	Maintain environmental site file Visual inspection		Chief Operational Officer
Hunting, trapping and killing of animals.	Illegal activities during operational phase. Environmental Awareness Training.	Minimal disturbance to fauna.	• No hunting trapping and killing of animals are allowed. This aspect should be dealt with as part of Environmental Awareness Training; • Comply with the requirements of the National Environmental Management: Biodiversity Act (No. 10 of 2004), Natal Nature Conservation Ordinance 15 of 1974 and Animal Protection Act (No. 71 of 1962); • The use of "migratory friendly" property borders, such as palisade fencing or wire fencing with large gaps, should be considered along the pipeline, as this will allow for the ongoing survival of most species presently inhabiting the property. This will allow for the free movement of small mobile organisms (such as rodents).	No signs of animals being poached observed. Signed attendance registers of environmental awareness training including animals as topic available on request.	Documentation review Maintain environmental site file Visual inspection	Ongoing	Internal Environmental Manager and Auditor Chief Operational Officer
Increased animal road mortality.	Vehicles speeding or driving recklessly. Permanent barriers along the pipelines and around the site, with no other way for animals to migrate than to cross roads.	Ensure no accidental deaths of fauna on the roads.	• The use of "migratory friendly" property borders, such as palisade fencing or wire fencing with large gaps, should be considered along the pipeline, as this will allow for the ongoing survival of most species presently inhabiting the property. This will allow for the free movement of small mobile organisms (such as rodents); • Speed limits must be adhered to by all workers and visitors to the tank farm; • This aspect should be included in the Environmental Awareness Training Manual; • Clearly visible traffic signs indicating speed limits and other traffic signs to occur on site and along the pipeline reserve.	No signs of accidental deaths of animals on the nearby roads and no incidents of animal road deaths recorded in the incident register. Signed attendance registers of environmental awareness training including animal road mortality as topic available on request.	Spot checks Visual inspection Documentation Review	Ongoing	Internal Environmental Manager
Changes to migration corridors.	Permanent barriers along the pipelines and around the site.	Ensure that minimal disturbance of ecological systems and natural corridors takes place during operation.	• Comply with the requirements of the National Environmental Management: Biodiversity Act (No. 10 of 2004), Natal Nature Conservation Ordinance 15 of 1974 and Animal Protection Act (No. 71 of 1962); • The use of "migratory friendly" property borders, such as palisade fencing or wire fencing with large gaps, should be considered along	Inspection of the site and pipeline reserve security fences.	Visual inspection	Ongoing	Internal Environmental Manager and Auditor Chief Operational Officer

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
			the pipeline, as this will allow for the ongoing survival of most species presently inhabiting the property. This will allow for the free movement of small mobile organisms (such as rodents).				
Cumulative impact on marine ecology.	Increased numbers of vessels carrying hydrocarbon cargoes as a direct consequence of the commissioning of the BTG facilities in combination with other tank farm operations within the Coega IDZ and berth activities in the Port of Ngqura.	Reduce likelihood of acute and chronic effects on marine and avian communities.	• Ensure that the authorisation holder contributes to Transnet's/third party oil spill contingency plan of the harbour and pipelines. • Ensure signed memorandum of understanding are confirmed by a signed contract with the third party/ and or Transnet.	Proof of contribution to third party / Transnet's oil spill contingency plan for the harbour and pipelines. Signed, detailed contract with Transnet / third party for the provision of services to BTG.	Documentation review	During internal environmental audits	Chief Operations Manager Authorisation Holder Internal Environmental Manager and Auditor
Destruction and or major disruption of marine communities within the Port of Ngqura.	Accidental hydrocarbon spills and or major release of fuels and or products within the Port of Ngqura harbour.	Reduce the risk and / or disruption of marine communities within the Port of Ngqura as a result of catastrophic release of hydrocarbons in the Port of Ngqura.	• Ensure that the authorisation holder contributes to Transnet's/third party oil spill contingency plan of the harbour and pipelines. • Ensure signed memorandum of understanding are confirmed by a signed contract with the third party/ and or Transnet.	Proof of contribution to third party / Transnet's oil spill contingency plan for the harbour and pipelines. Signed, detailed contract with Transnet / third party for the provision of services to BTG.	Documentation review	During internal environmental audits	Chief Operations Manager Authorisation Holder Internal Environmental Manager and Auditor
Destruction and or major disruption of marine communities within Algoa Bay.	Accidental hydrocarbon spills and or major release of fuels and or products within Algoa Bay.	Reduce the risk and / or disruption of marine communities within Algoa Bay as a result of catastrophic release of hydrocarbons.	• Ensure that the authorisation holder contributes to Transnet's/third party oil spill contingency plan of the harbour and pipelines. • Ensure signed memorandum of understanding are confirmed by a signed contract with the third party/ and or Transnet.	Proof of contribution to third party / Transnet's oil spill contingency plan for the harbour and pipelines. Signed, detailed contract with Transnet / third party for the provision of services to BTG.	Documentation review	During internal environmental audits	Chief Operations Manager Authorisation Holder Internal Environmental Manager and Auditor

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
INCIDENTS, ACCIDENTS AND POTENTIAL EMERGENCY SITUATIONS							
Health and safety incidents e.g. injury to workers or visitors to the site.	Driving of vehicles. General operational activities including office activities. Storage and handling of fuels.	Reducing the risk of health and safety incidents occurring.	• Personal Protective Equipment (or PPE) must always be issued to all employees and be worn at all times; • The 'Occupational Health and Safety Act' must be complied with; • Safety signs according to the installed onsite and along the pipeline reserve where relevant and clearly visible and in good condition. Safety signs need to comply with SANS 1186-1:2015 Symbolic safety signs; • Appropriate Signage (warning and caution signs) must be visible at all appropriate and required locations on-site; • This includes the visible display of all relevant emergency contact numbers in case of an emergency; • Furthermore, the contact details of all relevant management and applicable authorities must be displayed; • Occupational Health and Safety Act and regulations to be complied with; • Storage and handling of fuels and chemicals on site to comply with the relevant method statements, safety data sheets, standard operating procedures and designs and approvals.	Safety signs comply with SANS 11861:2015 standard and are clearly visible. Employees wearing PPE Environmental site file updated with proof of issuing of PPE to each employee and any incidents of non-compliance and disciplinary action recorded in the register. Approved Standard Operating Procedures based on safety standards, safety data sheets, method statements, designs and approvals.	Visual inspection Review of SANS 1186-1:2015 standard	Ongoing	Chief Operations Manager Internal Environmental Manager and Auditor Resident Engineer
Spills resulting from overfilling of the storage tanks at the tank farm.	Filling of storage tanks through pipelines.	Prevent overfilling of the storage tanks and associated impacts.	• Handling of fuels and chemicals on site to comply with the relevant method statements, safety data sheets, standard operating procedures and designs and approvals.	No signs of spillages as a result of overfilling storage tanks. No incidents of spillages as a result of overfilling storage tanks occur within the incident register. Relevant SDS's, SOP's, method statements, designs and approvals available in the environmental site file.	Visual inspection Documentation review Maintaining Environmental Site file	Daily	Internal Environmental Manager and Auditor Chief Operational Officer
INCIDENTS, ACCIDENTS AND POTENTIAL EMERGENCY SITUATIONS - RISK ASSESSMENT							
Impacts caused by loss of containment of hazardous liquid	Transfer of hazardous liquid materials from the	• Prevent or reduce the risk of the loss of containment of hazardous liquid	• The conditions of the Major Hazard Installation risk assessment, which have been based on the final approved designs, and completed by a competent person, must be implemented.	MHI Risk Assessment and approval present in site file. Approved process hazard analysis (such as a HAZOP	Document review Visual inspection	Annually / depending on recommendations	Authorisation Holder

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
materials from the pipelines between the battery limit and the tank farm (fires and explosions).	battery limit to the tank farm. Maintenance of pipelines and associated infrastructure.	materials and, if containment is lost, prevent fires and explosions.		study, FMEA, etc.) present in site file. Approval by Risk Assessor MHI Risk Assessment approved by Competent Authority No accidents and incidents recorded within the incidents register No signs of spillages or any non-compliance with relevant documents as stipulated.		of the MHI Risk assessment.	Chief Operational Officer Internal Environmental Manager and Auditor Resident Engineer
Impacts caused by loss of containment of hazardous liquid materials from the pipelines between the battery limit and the tank farm. (liquid material spillages onto the ground or into surface and ground water).	Transfer of hazardous liquid materials from the battery limit to the tank farm. Maintenance of pipelines and associated infrastructure.	Prevent or reduce the risk of the loss of containment of hazardous liquid materials and, if containment is lost, prevent spillages onto ground and into surface and groundwater.	• The conditions of the Major Hazard Installation risk assessment, which have been based on the final approved designs, and completed by a competent person, must be implemented.	MHI Risk Assessment and approval present in site file. Approved process hazard analysis (such as a HAZOP study, FMEA, etc.) present in site file. Approval by Risk Assessor MHI Risk Assessment approved by Competent Authority No accidents and incidents recorded within the incidents register No signs of spillages or any non-compliance with relevant documents as stipulated.	Document review Visual inspection	Annually / depending on recommendations of the MHI Risk assessment.	Authorisation Holder Chief Operational Officer Internal Environmental Manager and Auditor Resident Engineer

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
Impacts caused by loss of containment of LPG materials from transportation pipelines between the battery limit and the tank farm (formation of fires and explosions).	Transfer of LPG materials from the battery limit to the tank farm. Management and maintenance of LPG transfer pipelines.	Prevent or reduce the risk of the loss of containment of LPG and, if containment is lost, prevent fires and explosions.	• The conditions of the Major Hazard Installation risk assessment, which have been based on the final approved designs, and completed by a competent person, must be implemented.	MHI Risk Assessment and approval present in site file. Approved process hazard analysis (such as a HAZOP study, FMEA, etc.) present in site file. Approval by Risk Assessor MHI Risk Assessment approved by Competent Authority No accidents and incidents recorded within the incidents register No signs of spillages or any non-compliance with relevant documents as stipulated.	Document review Visual inspection	Annually / depending on recommendations of the MHI Risk assessment.	Authorisation Holder Chief Operational Officer Internal Environmental Manager and Auditor Resident Engineer
Impacts caused by loss of containment of hazardous liquid materials from the bulk atmospheric storage at the tank farm and road gantry (formation of fires and explosions).	Management and maintenance of tank farm infrastructure. Storage and handling of hazardous liquid materials. Filling road tankers with hazardous liquid materials.	Prevent or reduce the risk of the loss of containment of hazardous liquid materials and, if containment is lost, prevent fires and explosions.	• The conditions of the Major Hazard Installation risk assessment, which have been based on the final approved designs, and completed by a competent person, must be implemented.	MHI Risk Assessment and approval present in site file. Approved process hazard analysis (such as a HAZOP study, FMEA, etc.) present in site file. Approval by Risk Assessor MHI Risk Assessment approved by Competent Authority No accidents and incidents recorded within the incidents register	Document review Visual inspection	Annually / depending on recommendations of the MHI Risk assessment.	Authorisation Holder Chief Operational Officer Internal Environmental Manager and Auditor Resident Engineer

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
				No signs of spillages or any non-compliance with relevant documents as stipulated.			
Impacts caused by loss of containment of hazardous liquid materials from the bulk atmospheric storage at the tank farm and road gantry (liquid materials spillages onto the ground or into surface and ground water).	Management and maintenance of tank farm infrastructure. Storage and handling of hazardous liquid materials. Filling road tankers with hazardous liquid materials.	Prevent the loss of containment of fuel products and, if containment is lost, prevent spillages onto ground and into surface and groundwater.	The conditions of the Major Hazard Installation risk assessment, which have been based on the final approved designs, and completed by a competent person, must be implemented.	MHI Risk Assessment and approval present in site file. Approved process hazard analysis (such as a HAZOP study, FMEA, etc.) present in site file. Approval by Risk Assessor MHI Risk Assessment approved by Competent Authority No accidents and incidents recorded within the incidents register No signs of spillages or any non-compliance with relevant documents as stipulated.	Document review Visual inspection	Annually / depending on recommendations of the MHI Risk assessment.	Authorisation Holder Chief Operational Officer Internal Environmental Manager and Auditor Resident Engineer
Loss of containment of LPG materials from the bulk atmospheric storage at the tank farm and road gantry (formation of fires and explosions).	Management and maintenance of LPG materials storage infrastructure. Storage and handling of fuel. Filling of road tankers with LPG.	Prevent or reduce the risk of the loss of containment of LPG materials and, if containment is lost, prevent fires and explosions.	• The conditions of the Major Hazard Installation risk assessment, which have been based on the final approved designs, and completed by a competent person, must be implemented.	MHI Risk Assessment and approval present in site file. Approved process hazard analysis (such as a HAZOP study, FMEA, etc.) present in site file. Approval by Risk Assessor MHI Risk Assessment approved by Competent Authority	Document review Visual inspection	Annually / depending on recommendations of the MHI Risk assessment.	Authorisation Holder Chief Operational Officer Internal Environmental Manager and Auditor Resident Engineer

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
				No accidents and incidents recorded within the incidents register No signs of spillages or any non-compliance with relevant documents as stipulated.			
SOCIAL							
Safety and security: Potential influx of work seekers. Unauthorised access.	Access control	Proper management of labour force and clients and / or any visitors to the tank farm and pipeline reserve is undertaken to ensure that there are no security-related issues or disturbance to tenants or landowners outside the site footprint.	• 24-hour access control to the site and 24-hour security. • Workers found to be engaging in activities such as consumption of alcohol, drug use or selling of any such items on site must be disciplined.	Proper access control at all times Access control security book used with copies of signatures of all visitors to the study area. Records of any incidents recorded in the incident register.	Visual inspection Documentation review	Daily Weekly	Internal Environmental Manager Chief Operational Officer
Increased traffic due to the operational activities of the proposed tank farm.	Trucks collecting fuel for transport to retailers. External contractors such as waste removal contractors servicing the tank farm. Permanent employees commuting to and from the tank farm.	Reducing unnecessary trips by heavy vehicles smaller vehicles.	• Any vehicles relating to any part of the facility and its operation shall avoid (to a reasonable extent), operation during peak traffic hours; • Detailed planning to be implemented to avoid unnecessary trips; • In terms of transportation of workers and materials, collective transportation arrangements should be made to reduce individual car journeys where possible.	No traffic delays during peak time traffic	Visual inspection Documentation	Ongoing	Chief Operational Officer
Impact on road safety due to heavy vehicles.	Trucks collecting fuel for transport to retailers.	No accidents or incidents occurring on roads.	• Speed limits to be clearly marked and adhered to on and around the study area. Environmental awareness training to all workers and visitors to the site, especially drivers to include this aspect;	No records of any accidents on the road involving visitors, clients or employees of BTG,	Documentation review Visual inspection	Weekly	Internal Environmental Manager and Auditor

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
	External contractors such as waste removal contractors servicing the tank farm.		• Report any poorly visible signs or when no signs occur to the relevant authority.	recorded in the incident register. Traffic warning and speed signs are clearly visible along the roads and if not, proof that it was reported to the relevant authority.			Chief Operational Officer
Impact on road infrastructure due to heavy vehicles.	Trucks collecting fuel for transport to retailers. External contractors such as waste removal contractors servicing the tank farm.	Minimal disturbances to road infrastructure.	• Detailed planning to be implemented to avoid unnecessary trips; • In terms of transportation of workers and materials, collective transportation arrangements should be made to reduce individual car journeys where possible.	No signs of damage to road infrastructure	Visual inspection	Ongoing	Internal Environmental Manager and Auditor Chief Operational Officer
ECONOMIC							
Increase in economy	Operation of the tank farm	Ensure local communities benefit from the operations of the tank farm.	• Preferential use of local contractors and suppliers; • Preferential use of local labour force.	Proof that local labour is utilised and proof provided when local labour is not used due to unavailability (e.g. highly skilled positions).		Annually	Authorisation Holder Chief Operational Officer
Employment opportunities	Operation of the tank farm External contractors requiring additional employees to service the tank farm. Fuel transport companies/	Ensure local communities benefit from the operations of the tank farm.	• Preferential use of local labour force.	Proof that local labour is utilised and proof provided when local labour is not used due to unavailability (e.g. highly skilled positions).		Annually	Authorisation Holder Chief Operational Officer

Potential Impact	Project Activities	Management Objectives	Proposed Mitigation Measures/ Management Actions	Performance Indicator	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
	distributors requiring additional employees to transport fuel from the tank farm to the retailers.						

Table 8: Applicable Management measures to be implemented during operation – from TNPA Landside Infrastructure BAR Biodiversity Assessment

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
Extended Pipelines within TNPA approved servitudes					
Impact to sensitive vegetation and habitats	Site Clearing General construction activities	Impacts related to the operation of pipelines within approved reserves/servitudes takes into account the requirements of the specialist	• It is understood that Transnet currently holds an Alien Vegetation Management Plan for the Port of Ngqura, which needs to be implemented for the proposed project. This plan must be updated if required. The plan needs to include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.	Ongoing	Authorisation Holder Chief Operational Officer
Erosion and sedimentation	Site Clearing General construction activities		• Erosion and sedimentation into water bodies must be minimised through the effective stabilisation (such as silt traps, gabions and Reno mattresses or similar suitable stabilising structures) and the re-vegetation of any disturbed areas (Operational Phase). • Install silt traps, sumps and oil separators as part of the Stormwater Management System, where required (Operational Phase). • The Subsequent Environmental Impact Report for the Port of Ngqura explains that “slopes exceeding a 1:3 gradient should ideally not be developed but were development does take place the slopes must be stabilised and rehabilitated” (CES, 2000, page 83). In the case of this project, areas with slopes of 1:3 or greater are unavoidable as a result of the proposed access road. As a result, it is recommended that suitable stabilizing structures and erosion prevention controls be implemented during the operational phase. • It is understood that there is an existing Storm Water Management Plan in place. Transnet need to ensure that this plan is updated to cater for this proposed project development. Gabion structures and rocks should be used where appropriate. It is recommended that stormwater and any runoff generated by the hard surfaces should be discharged into energy dissipation structures, where required. These could be used to enhance the sense of place, if they are planted with indigenous vegetation. These energy dissipation structures should be placed in a manner that flows are		

Potential Impact	Project Activities	Management Objective	Proposed Mitigation Measures/Management Actions	Frequency	Institutional Responsibility
			managed prior to being discharged back into the natural water courses, thus not only preventing erosion, but also supporting the maintenance of natural base flows within these systems, i.e. hydrological regime (water quantity and quality) is maintained. The crossing point should also not trap any run-off, thereby creating inundated areas, but allow for free-flowing water courses. The stormwater structures and infrastructure should be maintained on a regular basis.		
Emergency incidents and pollution	Site Clearing General construction activities		• Emergency plans must be in place in case of spillages onto road surfaces and water courses (Construction and Operational Phase).		
Impacts to fauna	Site Clearing General construction activities		• Mitigation with respect to minimising these roadkill incidents is minimal and not always practical. Therefore, awareness should be created during the staff induction programme. Staff should be made aware of the general speed limits as well the potential animals that may cross and how to react in these situations. • Furthermore, it is suggested that mountable kerbing be used, which allows for the movement of animals across any roads, especially the smaller species of rodent, tortoises, snakes and lizards.		

13.11 Impact Assessment

13.12 TNPA correspondence regarding use of Road reserve

Fincham, Jacqui

From:	Nico Walters Transnet National Ports Authority JHB <Nico.Walters@transnet.net>
Sent:	Thursday, 31 October 2019 10:27
To:	Andrew Pike; Loganathan, Roland; Fincham, Jacqui; Tandi Lebakeng Transnet National Ports Authority NGQ; Nandi Oliphant Transnet National Ports Authority JHB; Nozipho Booi Transnet National Ports Authority NGQ; Justin Uren Transnet National Ports Authority PLZ; Eggert, Christian; Arnold, Tobias; Gong, Sungdo; Duane Mouton; Maria van Zyl; Keith Buhr; Deidre Penfold; Jody Kennedy Transnet National Ports Authority NGQ; jan.beute@oiltanking.com; Nokuthula Mokoena Transnet National Ports Authority JHB; Anne McAllister; Melissa Strydom; Elisha Mandari-Chetty Transnet National Ports Authority Jhb HQ; Peter Balfour [Transnet NPA DBN]; Mfundo Piti; Andrea Shirley
Subject:	RE: Port of Ngqura Solution [BG-DbnActive.FID58197]

Hi All

Apologies for the delay in providing feedback. Please note the following re the two outstanding matters.

#2
CDC Pipeline within the OTGC servitude
TNPA is comfortable to grant consent to OTGC to allow for the construction of the CDC pipeline within the OTGC servitude utilising the OTGC EA. We are also satisfied that the CDC pipeline can be constructed on a separate piperack. Granting consent to OTGC is subject to the required TNPA governance approvals.

#3
Wayleave pipeline routing
TNPA is comfortable that the pipeline routing beyond the OTGC battery limit to the port boundary can follow the route alongside the road. However, the following will apply:

1. *The wayleave costs for construction/design will be for CDC's account, including any costs incurred that may disrupt either OTGC activities or TNPA activities in the area.*
2. *CDC will not be granted any ownership rights of the wayleave area in terms of the wayleave agreement.*
3. *The wayleave will provide for only one pipeline and product, i.e. carbon black.*
4. *The wayleave does not constitute an undertaking by the TNPA to allow more products to have access through the wayleave and it remains TNPA's right to utilise the wayleave for any other products in future as may become necessary.*
5. *The granting of the wayleave agreement remains subject to consent in accordance with the required governance approvals and notice and comment procedure as envisaged in the Promotion of Justice Administrative Action Act.*
6. *The wayleave will only be concluded once CDC/OEC has successfully concluded their agreement(s) for the construction of the CDC pipeline and the necessary O&M Agreement as applicable for the OTGC operation at the berth and maintenance of the pipeline.*

We will send the marked up commitment letter shortly.

Regards

From: Andrew Pike [mailto:andrew.pike@bowmanslaw.com]
Sent: 29 October 2019 09:25 AM
To: Nico Walters Transnet National Ports Authority JHB <Nico.Walters@transnet.net>; Loganathan, Roland <roland.loganathan@orioncarbons.com>; Fincham, Jacqui <Jacqui.Fincham@wsp.com>; Tandi Lebakeng Transnet

National Ports Authority NGQ <Tandi.Lebakeng@transnet.net>; Nandi Oliphant Transnet National Ports Authority JHB <Nandi.Oliphant@transnet.net>; Nozipho Booi Transnet National Ports Authority NGQ <Nozipho.Booi@transnet.net>; Justin Uren Transnet National Ports Authority PLZ <Justin.Uren@transnet.net>; Eggert, Christian <christian.eggert@orioncarbons.com>; Arnold, Tobias <tobias.arnold@orioncarbons.com>; Gong, Sungdo <sungdo.gong@orioncarbons.com>; Duane Mouton <Duane.Mouton@coega.co.za>; Maria van Zyl <Maria.vanZyl@coega.co.za>; Keith Buhr <Keith.Buhr@coega.co.za>; Deidre Penfold <deidre.penfold@caia.co.za>; Jody Kennedy Transnet National Ports Authority NGQ <Jody.Kennedy@transnet.net>; jan.beute@oiltanking.com; Nokuthula Mokoena Transnet National Ports Authority JHB <Nokuthula.Mokoena@transnet.net>; Anne McAllister <anne.mcallister@bowmanslaw.com>; Melissa Strydom <melissa.strydom@bowmanslaw.com>; Elisha Mandari-Chetty Transnet National Ports Authority Jhb HQ <Elisha.Mandari-Chetty@transnet.net>; Peter Balfour [Transnet NPA DBN] <Peter.Balfour@transnet.net>; Mfundo Piti <Mfundo.Piti@coega.co.za>; Andrea Shirley <Andrea.Shirley@coega.co.za>
Subject: RE: Port of Ngqura Solution [BG-DbnActive.FID58197]

Apologies: in addition to the two documents requested below, we are also awaiting **TNPA's** final comments on the commitment letter.

Kind regards, Andrew

From: Andrew Pike
Sent: Tuesday, 29 October 2019 9:20 AM
To: 'Nico Walters Transnet National Ports Authority JHB' <Nico.Walters@transnet.net>; Loganathan, Roland <roland.loganathan@orioncarbons.com>; Fincham, Jacqui <Jacqui.Fincham@wsp.com>; Tandi Lebakeng Transnet National Ports Authority NGQ <Tandi.Lebakeng@transnet.net>; Nandi Oliphant Transnet National Ports Authority JHB <Nandi.Oliphant@transnet.net>; Nozipho Booi Transnet National Ports Authority NGQ <Nozipho.Booi@transnet.net>; Justin Uren Transnet National Ports Authority PLZ <Justin.Uren@transnet.net>; Eggert, Christian <christian.eggert@orioncarbons.com>; Arnold, Tobias <tobias.arnold@orioncarbons.com>; Gong, Sungdo <sungdo.gong@orioncarbons.com>; Duane Mouton <Duane.Mouton@coega.co.za>; Maria van Zyl <Maria.vanZyl@coega.co.za>; Keith Buhr <Keith.Buhr@coega.co.za>; Deidre Penfold <deidre.penfold@caia.co.za>; Jody Kennedy Transnet National Ports Authority NGQ <Jody.Kennedy@transnet.net>; jan.beute@oiltanking.com; Nokuthula Mokoena Transnet National Ports Authority JHB <Nokuthula.Mokoena@transnet.net>; Anne McAllister <anne.mcallister@bowmanslaw.com>; Melissa Strydom <melissa.strydom@bowmanslaw.com>; Elisha Mandari-Chetty Transnet National Ports Authority Jhb HQ <Elisha.Mandari-Chetty@transnet.net>; Peter Balfour [Transnet NPA DBN] <Peter.Balfour@transnet.net>; Mfundo Piti <Mfundo.Piti@coega.co.za>; Andrea Shirley <Andrea.Shirley@coega.co.za>
Subject: RE: Port of Ngqura Solution [BG-DbnActive.FID58197]

Dear All,

Following our conversation on Monday we were expecting:

1. The two piperack matrix plus costs schedule from **OTGC** by cob yesterday; and

2. The advice from **TNPA** legal as to whether a second piperack may be constructed in the fuel reserve under the EA. This was to happen within a day or two i.e. by today.

Please can you let us have these as soon as possible.

Kind regards, Andrew

From: Nico Walters Transnet National Ports Authority JHB <Nico.Walters@transnet.net>
Sent: Monday, 28 October 2019 8:58 AM
To: Loganathan, Roland <roland.loganathan@orioncarbons.com>; Fincham, Jacqui <Jacqui.Fincham@wsp.com>; Tandi Lebakeng Transnet National Ports Authority NGQ <Tandi.Lebakeng@transnet.net>; Nandi Oliphant Transnet National Ports Authority JHB <Nandi.Oliphant@transnet.net>; Nozipho Booi Transnet National Ports Authority NGQ <Nozipho.Booi@transnet.net>; Justin Uren Transnet National Ports Authority PLZ <Justin.Uren@transnet.net>; Eggert, Christian <christian.eggert@orioncarbons.com>; Arnold, Tobias <tobias.arnold@orioncarbons.com>; Gong,

Sungdo <sungdo.gong@orioncarbons.com>; Duane Mouton <Duane.Mouton@coega.co.za>; Maria van Zyl <Maria.vanZyl@coega.co.za>; Keith Buhr <Keith.Buhr@coega.co.za>; Deidre Penfold <deidre.penfold@caia.co.za>; Jody Kennedy Transnet National Ports Authority NGQ <Jody.Kennedy@transnet.net>; jan.beute@oiltanking.com; Nokuthula Mokoena Transnet National Ports Authority JHB <Nokuthula.Mokoena@transnet.net>; Anne McAllister <anne.mcallister@bowmanslaw.com>; Melissa Strydom <melissa.strydom@bowmanslaw.com>; Elisha Mandari-Chetty Transnet National Ports Authority Jhb HQ <Elisha.Mandari-Chetty@transnet.net>; Peter Balfour [Transnet NPA DBN] <Peter.Balfour@transnet.net>; Andrew Pike <andrew.pike@bowmanslaw.com>; Mfundo Piti <Mfundo.Piti@coega.co.za>; Andrea Shirley <Andrea.Shirley@coega.co.za>
Subject: RE: Port of Ngqura Solution

Hi

My apologies – we had a phone and network failure this morning. Please dial 011 774 1555 PIN 64450#

-----Original Appointment-----
From: Nico Walters Transnet National Ports Authority JHB
Sent: 24 October 2019 11:54 AM
To: Nico Walters Transnet National Ports Authority JHB; Loganathan, Roland; Fincham, Jacqui; Tandi.Lebakeng@transnet.net; Nandi Oliphant Transnet National Ports Authority PLZ (Nandi.Oliphant@transnet.net); Nozipho Booi Transnet National Ports Authority NGQ; Justin Uren Transnet National Ports Authority PLZ; Eggert, Christian; Arnold, Tobias; Gong, Sungdo; Duane Mouton; Maria van Zyl; Keith Buhr; Deidre Penfold; Jody Kennedy Transnet National Ports Authority NGQ; jan.beute@oiltanking.com; Nokuthula Mokoena Transnet National Ports Authority JHB; Anne McAllister; Melissa Strydom; Elisha Mandari-Chetty Transnet National Ports Authority Jhb HQ; Peter Balfour [Transnet NPA DBN]; Andrew Pike; Mfundo Piti; Andrea Shirley
Subject: Port of Ngqura Solution
When: 28 October 2019 09:00 AM-10:00 AM (UTC+02:00) Harare, Pretoria.
Where: 011 774 1555 - Pin 64450#

13.13 Timeline of consultations

ECm1/c/LN2/M/16-2018

Part 2 Amendment Application

Table 1: Timeline of Significant Meetings in relation to the proposed BTG Facility in the SEZ at Coega

Date	Venue	Attendees							Discussion Items
		BTG	CDC	OEC	OTGC	TNPA	CAIA	DEDEAT	
June/July 2019	Electronic Correspondence	✓			✓				Discussions regarding tie-in options to the OTGC pipelines. Correspondence covers the displacement methodology, pigging design and methodology, drawings, details and specifications.
29/7/19	CDC Offices		✓	✓			✓		Discuss the proposed involvement of CDC as project delivery solution following proposed DTI funding. Identified potential to use BTG EA.
01/8/19	Yacht Club CT	✓	✓						In principle agreement for CDC to utilise the BTG EA.
15/8/19	Teleconference			✓	✓				High level discussion regarding the principle of entering into a Commercial Agreement between OTGC and CDC and the implications of the Concession Agreement.
22/8/19	CDC Offices	✓	✓						CDC and BTG HoA issues were discussed. With Respect to the BTG – Phase 1 for OEC, the EA re-assignment was discussed and agreed. BTG indicated their desire to be the operators of the facility.
26/8/19	OTGC Offices		✓	✓	✓		✓		Discuss OTGC role at the berth and the terminal. Discussion regarding management and control of the pipeline within the parameters of OTGC's obligations as operator of the facility. Agree OTGC requirements for CDC in relation to the CBO pipeline. OTGC stated what they would require to see in any agreement. OEC and CDC agreed to draft Commercial Agreement between CDC and OTGC with respect to OTGC being the Berth Operator for the CBO line.
6/9/19	Teleconference		✓	✓	✓		✓		Draft Agreement OTGC and CDC was circulated before the conference call and discussed. Meeting concluded that it was critical to know TNPA's position before

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									any Agreement is finalised. Deidre Penfold agreed to engage TNPA at Senior Executive level.
9/9/19	TNPA Office JHB					✓	✓		CAIA engaged with TNPA discussing the significance of the OEC project, the potential role CDC can play as a project proponent and the role OTGC will play as the operator. Potential solutions were considered.
10/9/19	Teleconference		✓	✓		✓			TNPA indicated they want to get all parties together to find an option for OEC. Presented three options: a) CDC build pipeline b) TNPA build pipeline c) OTGC to develop their tank farm and provide pipeline to their battery limit and CDC complete balance of pipeline. TNPA to issue a 'Wayleave Agreement' to construct a pipeline within the fuel reserve. Scheduled meeting for 13/9/19 where preferred option will be tabled following TNPA EXCO discussions.
10/9/19 & 11/9/19	CDC Vulindela Village		✓	✓					OEC and CDC discuss potential Commercial Agreement. Proposed and developed a Term Sheet.
13/9/19	Transnet Port Terminal Ngqura		✓	✓	✓	✓	✓		Preferred solution is 'c' above. Provides a two part solution, OTGC is currently the only player with an Agreement to Operate within the Port secured through an open tender process. OTGC EA to be utilised for the construction of the CBO line from the Berth to the OTGC Battery limit. TNPA then will provide a 'Wayleave Agreement' to CDC to construct the remainder of the CBO pipeline under an amended BTG EA.
17/9/19	Teleconference		✓	✓					Discuss: • Term sheet • OEC-CDC Project and Storage Service Agreement • OEC-CDC-BTG Tripartite Agreement (dealing with EA and other matters) • CDC-BTG O&M Agreement

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18/9/19	CDC Office	✓	✓	✓					Discussed the urgency of the project. Agreed roles and responsibilities. Identified the need for the Part 2 Amendment process to commence urgently.
20/9/19	Transnet Port Terminal Ngqura	✓	✓	✓	✓	✓	✓		CDC will construct the tanks and pipeline to enable a solution for CB feedstock at the Port of Ngqura. EA extension – Part 1 to deal with extending the timelines to meet the substantive conditions submitted 10/9/2019; EA extension – Part 2 for the “missing link” between port boundary and OTGC battery limit must be completed by March 2020. Construction and project timelines discussed. Agreements Required were discussed: Wayleave between TNPA and CDC CDC/BTG EA consent agreement to utilise BTG EA for construction OTGC/CDC/BTG/OEC – OTGC consent to utilise OTGC EA for construction of carbon black feedstock within the OTGC servitude
20/9/19	DEDEAT Reception	✓	✓					✓	Informal discussion to introduce the proposed Part 2 Amendment project, and explain CAIA and WSP’s role in the process
27/9/19	Transnet Port Terminal Ngqura	✓	✓	✓	✓	✓	✓		Part 1 Amendment application acknowledgment received. DEDEAT require more supporting information. Part 2 Amendment application: Discussed what information was required to facilitate the quick turnaround of the Concept Designs will be issued to the EAP 4/10/2019. Progress on Agreements Discussed.
27/9/19	DEDEAT Offices		✓	✓			✓	✓	Discussed information needs for Part 1 Amendment to include a summary of meetings conducted on project. Part 2 Amendment, discussed and agreed project description and the requirement by DEDEAT to include all 4 lines from OTGC battery limit to the Port Boundary. Potentially exclude LPG if required for technical and risk reasons.

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27/9/19	Transnet Port Terminal Ngqura	✓			✓				Discussing the pipeline tie-in for the multi product lines and LPG.
04/10/19	Transnet Port Terminal Ngqura	✓	✓	✓	✓	✓	✓		Feedback from Technical Team, Review if Quad Agreement.
10/10/2019	Conference Call		✓	✓			✓		Discussions regarding the project design details, potential change in routing of the pipeline along the road reserve, programming and EA conditions
11/10/19	Conference Call		✓			✓			Discuss the Oil Spill Contingency Plan
11/10/19	Transnet Port Terminal Ngqura	✓	✓	✓	✓	✓	✓		Feedback from Technical Team. Legal review of the following Agreements: - OEC/CDC/OTGC/TNPA Framework Agreement - OTGC Commitment Letter - TNPA Commitment Letter Discuss and seek 'in principle' agreement from TNPA for proposed routing of pipeline along the Road Reserve
14/10/2019	Conference Call	✓	✓						Discussion regarding conditions of the current Environmental Authorisation with respect to the proposed EPC constrict.
17/10/2019	15 on Orange, Cape Town	✓		✓					Discuss OEC/BTG Agreement and Part 2 Amendment application progress
17/10/2019	OTGC Office, Cape Town		✓	✓	✓				Discuss CDC/OTGC O&M Agreement
18/10/19	Transnet Port Terminal Ngqura	✓	✓	✓	✓	✓	✓		Seek 'In Principle' Agreement from TNPA for the proposed pipeline route along the road reserve. Concerns raised regarding the risks of the CDC pipeline on the OTGC piperack and CDC pipeline on separate piperack. Team tasks to undertake risk assessments and develop contingency plans.

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25/10/19	Transnet Port Terminal Ngqura	✓	✓	✓	✓	✓	✓		Continue to pursue and assess the risks of the CDC pipeline on the OTGC piperack and CDC pipeline on separate piperack. Review of risk register from CDC and OTGC.
28/10/19	Conference Call		✓	✓	✓	✓			Discussed: - Two piperack matrix plus costs schedule from OTGC - Advice from TNPA legal as to whether a second piperack may be constructed in the fuel reserve - TNPA's comments on the Commitment Letter
31/10/19	OTGC Office, Cape Town			✓	✓				Discuss CDC/OTGC O&M Agreement.