Environmental Management Programme for the Proposed Newcastle Gas Engine Power Plant, KwaZulu-Natal

[EIA Ref: 14/12/16/3/3/2/2031]

Report Prepared for

Newcastle Energy (Pty) Ltd.

Report Number 566508/EMPr

Report Prepared by

srk consulting

June 2021

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[EIA Ref: 14/12/16/3/3/2/2031]

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June 2021

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Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa) (Pty) Ltd (SRK) by Newcastle Energy (Pty) Ltd. (Newcastle Energy). The opinions in this Report are provided in response to a specific request from Newcastle Energy to do so. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

List of Abbreviations

CV	Curriculum Vitae
DFFE	National Department of Forestry, Fisheries and Environment
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EO	Environmental Officer
GN	Government Notice
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEM:AQA	National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NEM:WA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
OHSA	Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)
S&EIR	Scoping and Environmental Impact Report
SRK	SRK Consulting (South Africa) (Pty) Ltd.

Glossary

Baseline	Information gathered at the beginning of a study which describes the environment prior to development of a project and against which predicted changes (impacts) are measured.
Community	Those people who may be impacted upon by the construction and operation of the project. This includes neighbouring landowners, local communities and other occasional users of the area
Construction Phase	The stage of project development comprising site preparation as well as all construction activities associated with the development.
Environment	The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group. These circumstances include biophysical, social, economic, historical and cultural aspects.
Environmental Authorisation	Permission granted by the competent authority for the applicant to undertake listed activities in terms of the NEMA EIA Regulations, 2014.
Environmental Impact Assessment	A process of evaluating the environmental and socio-economic consequences of a proposed course of action or project.
Environmental Impact Assessment Report	The report produced to relay the information gathered and assessments undertaken during the Environmental Impact Assessment.

Environmental Management Programme	A description of the means (the environmental specification) to achieve environmental objectives and targets during all stages of a specific proposed activity.
Fauna	The collective animals of a given region.
Flora	The collective plants of a particular region, habitat or geological period.
Fossil	Rare objects that are preserved due to unusual circumstances.
Heritage Resources	Refers to something, e.g. a building, an area, a ritual, etc. that forms part of a community's cultural legacy or tradition and is passed down from preceding generations.
Hydrology	(The study of) surface water flow.
Impact	A change to the existing environment, either adverse or beneficial, that is directly or indirectly due to the development of the project and its associated activities.
Independent ECO	An independent person with the appropriate qualifications and experience appointed by the Proponent to audit compliance with this EMPr on behalf of the Proponent.
Integrated Environmental Management	The practice of incorporating environmental management into all stages of a project's life cycle, namely planning, design, implementation, management and review.
Mitigation measures	Design or management measures that are intended to avoid and / or minimise or enhance an impact, depending on the desired effect. These measures are ideally incorporated into a design at an early stage.
Operational Phase	The stage of the works following the Construction Phase, during which the development will function or be used as anticipated in the Environmental Authorisation.
Watercourse	A natural freshwater feature, including pans.

1 Introduction and Purpose

Newcastle Energy (Pty) Ltd. (Newcastle Energy), a subsidiary of Vutomi Energy (Pty) Ltd. (Vutomi), own an 18.5 megawatt (MW) capacity gas fired cogeneration (stream and power) plant within to the Karbochem Industrial Complex in Newcastle, KwaZulu-Natal.

Through the Newcastle Gas Engine Power Plant (NGEPP) Independent Power Producer (IPP) project, Newcastle Energy proposes to increase its electricity generation capacity to approximately 100 MW. Figure 1-1 on the following page provides a locality map of the project site within the Karbochem Industrial Complex in Newcastle.

SRK Consulting (South Africa) (Pty) Ltd. (SRK) was appointed by Newcastle Energy to submit an application for Environmental Authorisation for the proposed development via a Scoping and Environmental Impact Reporting (S&EIR) process in terms of the Amendments to the 2014 Environmental Impact Assessment (EIA) Regulations, as published in Government Notice (GN) 326 on 07 April 2017.

The mitigation measures and recommendations identified during the course of the EIA process are included in this stand-alone document, to be disseminated to and used by Newcastle Energy employees and all appointed Engineers and Contractors undertaking any site designs or work on-site. By its very nature, the EMPr is a dynamic document and updating may be required.

The purpose of this EMPr is to ensure that the activities associated with the proposed Newcastle Energy development are undertaken in a controlled and organised manner, thereby managing and minimising potential environmental impacts during the various phases of the project.

Specific objectives of the EMPr include:

- Outline Newcastle Energy's environmental management commitments for the project.
- Establish impact management outcomes in order to enhance benefits and minimise adverse environmental impacts.
- Act as a performance standard that activities can be audited against.
- Describe actions required to achieve management outcomes.
- Outline roles and responsibility required to implement the EMPr.
- Ensure that appropriate monitoring and auditing is undertaken.

Newcastle Energy is responsible for ensuring adherence to the conditions detailed in the EMPr and the Environmental Authorisation issued by Department of Forestry, Fisheries and Environment (DFFE) (assuming such). All personnel undertaking work on site are bound to compliance with the EMPr and must use this document as a guide to minimise and manage environmental impacts.

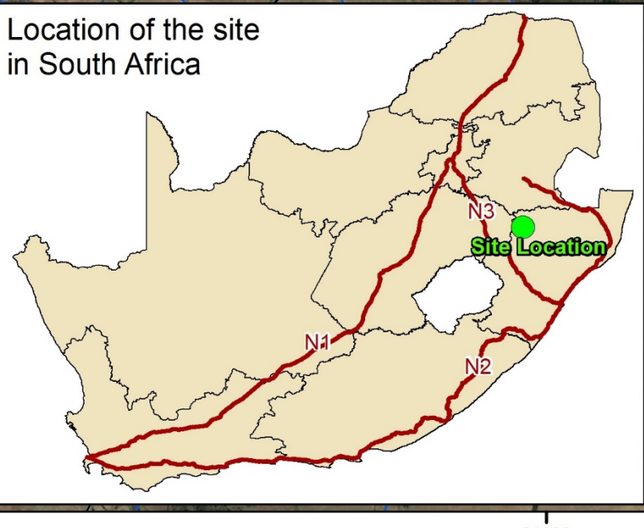
91000 96000 101000

-3070000 -3075000 -3080000

N

Memel Road
Allen Street
Allen Street
N11
Albert Wessels Drive
Asiphephe Drive
Madadeni
Newcastle CBD
Ladysmith Drive
Madadeni Road
Karbochem Road
Karbochem Spruit
Project site
Propose area for LNG Facilities

Location of the site in South Africa



Legend

- Place
- Non-Perennial River
- Perennial River
- Proposed area for LNG Facilities

OSM Roads

- National Freeway
- Main Road
- Arterial Route
- Secondary Road
- Street
- Newcastle Energy project site

0 0.5 1 2 Kilometers

Data Source: ESRI Basemap Imagery	
Scale: 1:50 000	
Projection: TM	Datum: HH94
Central Meridian/Zone: Lo 29	
Date: 09/10/2020	Compiled by: INBRO
Project No: 566508	Fig No: 1-1

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NEWCASTLE GAS ENGINE POWER PLANT

LOCALITY MAP

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Revision: A Date: 28 01 2020

2 Report Content

The legislated requirements for the content of an EMPr are specified in Appendix 4 of the Amendments to the 2014 EIA Regulations (GN 326, 07 April 2017). **Table 2-1** lists these requirements and provides a reference to the applicable section of this document where the specified information is provided.

Table 2-1: Legislated Requirements for the Content of an EMPr

Content Requirements (Appendix 4 of GN 326, 07 April 2017)	Reference in this Document
(1) An EMPr must comply with section 24N of the Act and include -	
(a) details of — (i) the EAP who prepared the EMPr. (ii) the expertise of the EAP to prepare an EMPr, including a curriculum vitae.	Chapter 3: The Environmental Assessment Practitioner
(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description.	Chapter 4: Activities and Aspects
(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.	Appendix B: Environmental Sensitivity Map
(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. (v) where relevant, operation activities.	Chapter 6: Environmental Management Programme
(e) [deleted]	N/A
(f) a description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (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. (iv) comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable.	Section 6: Environmental Management Programme
(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f).	Section 7.1: Implementation Monitoring
(h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f).	Section 7.1: Implementation Monitoring
(i) an indication of the persons who will be responsible for the implementation of the impact management actions.	Chapter 5: Roles and Responsibilities. Chapter 6: Environmental Management Programme
(j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented.	Chapter 6: Environmental Management Programme

Content Requirements (Appendix 4 of GN 326, 07 April 2017)	Reference in this Document
(k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f).	Section 7.2: Compliance Monitoring and Reporting
(l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations.	Section 7.2: Compliance Monitoring and Reporting
(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. (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment.	Chapter 8: Environmental Awareness Plan
(2) Where a government notice gazetted by the Minister provides for a generic EMPr, such generic EMPr as indicated in such notice will apply.	N/A

3 Environmental Assessment Practitioner

In accordance with Item 1(a) in Appendix 4 of GN 326, this chapter provides details of:

(i) The Environmental Assessment Practitioner (EAP) who prepared this report.

(ii) The expertise of the EAP, including a curriculum vitae.

3.1 SRK Consulting

SRK was established in South Africa in 1974 and has expanded over the years with the SRK Group Consulting Practices now employing approximately 1 400 professional staff operating from more than 45 established offices on six continents.

SRK offers expertise in a wide range of environmental and engineering disciplines whilst implementing rigorous quality assurance standards in accordance with SRK's International Standards Organisation (ISO) 9001 accreditation.

SRK's independence is ensured by the fact that it is strictly a consultancy organisation, not holding equity in any project and with ownership primarily by staff. SRK's senior technical staff also maintain independent accreditation with the relevant professional accreditation bodies. This permits its consultants to provide clients with conflict-free and objective support on crucial issues. SRK's fee for completing this report is based on its normal professional daily rates plus reimbursement of incidental expenses. The payment of that professional fee is not contingent upon the outcome of the report.

SRK Durban's Environmental Team has been practicing in KwaZulu-Natal since 1989 and has a distinguished track-record of managing a diverse range of large and complex projects.

3.2 Details of the EAP

The EAP for this application is Mr. Marius van Huyssteen, Principal Environmental Scientist at SRK.

Pertinent information relating to the expertise of the EAP is summarised below:

- BSc Honours Degree in Geography and Environmental Management (2003) from the University of Natal.
- 17 years of experience in the field of environmental management.
- Specialises in environmental assessment, environmental auditing and integrated environmental licencing for the industrial, waste management and mining sectors.
- A certified EAP with the Interim Certification Board for EAPs in South Africa (CEAPSA).

For further details, refer to the EAP curriculum vitae (CV) in **Appendix A.**

Contact details for the EAP are provided below:

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4 Activities and Aspects

In accordance with Items 1(b) and (c) in Appendix 4 of GN 326, this chapter provides a detailed description of the aspects of the project that are covered by the EMPr. A composite map of the plant layout and the environmental sensitivities surrounding the project area is also provided (refer to the map in **Appendix B**).

4.1 Project Location

The proposed NGEPP IPP plant has a development footprint of 1.26 hectare (ha) (12 600 m^2) and is proposed to be constructed within the 1.78 ha site located on the southwestern boundary of the Karbochem Industrial Complex. Other industries within the Karbochem Industrial Complex include/ed: African Amines (alkyl amines plant), Brother CISA (formerly Lanxess CISA) (chrome chemicals plant) and SA Calcium Carbide.

Details of the project location are as follows:

Country:	South Africa
Province:	KwaZulu-Natal
District:	Amajuba District Municipality
Municipality:	Newcastle Local Municipality
Town:	Newcastle
Zone:	Lease 1, Karbochem Industrial Complex
Address:	3 Karbochem Road, Newcastle
Erven:	1) Erf 15618 Newcastle (NGEPP site): - SG Code: N0HS02210001561800000 - 1.78 ha in extent 2) Remainder of Erf 13744 Newcastle (LNG facility): - SG Code: N0HS02210001374400000 - 50.12 ha in extent (total Erf), however, the LNG facility footprint is 0.361 ha of the total Erf area: o LNG dispensing Station: 0.052 ha. o LNG Tank Farm: 0.157 ha. o Regassification facility: 0.152 ha.

The coordinates of the boundary of the NGEPP site are provided in Table 4-1.

Table 4-1: Geographical Coordinates for corners of the NGEPP Site

Point (Fig. 4-1)	Longitude	Latitude
A	29° 58.170' E	27° 47.078' S
B	29° 58.112' E	27° 47.107' S
C	29° 58.218' E	27° 47.181' S
D	29° 58.245' E	27° 47.168' S

The coordinates of the approximate boundaries of the components of the LNG facility are provided in Table 4-2.

Table 4-2: Geographical Coordinates for the LNG facilities

Point (Fig. 4-1)	Longitude	Latitude
LNG Dispensing Station		
1	29° 58.216' E	27° 47.069' S
2	29° 58.218' E	27° 47.075' S
3	29° 58.192' E	27° 47.086' S
4	29° 58.189' E	27° 47.080' S
LNG Tank Farm		
5	29° 58.245' E	27° 47.091' S
6	29° 58.255' E	27° 47.111' S
7	29° 58.233' E	27° 47.121' S
8	29° 58.224' E	27° 47.102' S
Regassification facility		
9	29° 58.268' E	27° 47.129' S
10	29° 58.277' E	27° 47.146' S
11	29° 58.255' E	27° 47.155' S
12	29° 58.248' E	27° 47.139' S
LNG pipeline		
13	29°58.202' E	27°47.082' S
14	29°58.245' E	27°47.151' S

Refer to Figure 4-1 for a map showing an aerial view of the NGEPP project site and associated LNG facility.

29°58.0001'E
29°58.5'E
29°59.0001'E
29°59.5'E
27°46.5'S
27°47'S

Karbochem Industrial Complex containing NGEPP Project Site

N

Inset of NGEPP Project Site

LNG Dispensing Station
2100m^3 LNG Tank Farm (including pump station and bound area)
LNG pipeline system
Regas facility (including vaporizers and gas oderization system)
A
B
C
D
1
2
3
4
5
6
7
8
9
10
11
12
13
14

Legend

- Proposed area for LNG Facilities
- NGEPP Project Site
- Karbochem Industrial Complex

0 125 250 500 Meters

Data Source:	ESRI Basemap Imagery
Scale:	1:10 000
Projection: TM	Datum: HH94
Central Meridian/Zone:	Lo 29
Date:	Compiled by:
15/10/2020	INBRO
Project No:	Fig No:
566508	4-1

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NEWCASTLE GAS ENGINE POWER PLANT (NGEPP)

AERIAL VIEW OF NGEPP SITE

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Revision: A Date: 12 04 2021

4.2 Project Detail

The overall project would broadly involve the following components which are further described in the subsections that follow:

- Decommissioning, demolition and removal of the existing cogeneration plant (i.e. to make space for the NGEPP).
- Engineering, procurement, construction, commissioning and operation of the new 100 MW NGEPP and associated infrastructure.

4.2.1 Decommissioning and demolition of existing 18.5 MW Cogeneration Plant

The existing 18.5 MW cogeneration plant (Figure 4-2 (a)) consists of the following:

- Two gas Alstom/Siemens Tornado combustion turbines, two Aalborg supplementary gas fired heat recovery boilers, a single Siemens steam turbine, three gas engine generators, one Deutz 1.3 MW containerised engine (Figure 4-2 (b)).
- Two Janbacher (2 MW each) engines in acoustic hoods and inside a powerhouse, with external radiator cooling towers (Figure 4-2 (c)).
- Associated infrastructure within the Karbochem Industrial Complex, on the other side of the fence, but belonging to Newcastle Energy, will be left in place. This includes inter alia:
  - Water supply pipes.
  - Sewer infrastructure.
  - Gas supply pipeline.
  - Electricity grid tie in points for temporary power only.
  - Stormwater infrastructure.
  - Steam export infrastructure.
  - Entrance gate and existing fence of the complex.
  - Information and communications technology infrastructure.

The methodology for demolition will be devised with the assistance of demolition contractors.

Where practicable, equipment and materials with value will be sold and removed from the site. All other equipment will be demolished and disposed of on-site. Equipment with scrap or salvage value will be removed from the plant and stored either in a salvage yard or in a facility designated for this purpose during the demolition period.

Typical closure and demolition actions will include:

- All power and water services to be deenergised, disconnected and cut back to designated location and certified as safe prior to commencement of any demolition works.
- All remaining inert equipment and demolition debris will be sent to nearest general waste disposal facility.
- Salvageable equipment (including capital plant/equipment) will be removed and transported offsite prior to the commencement of demolition.
- All fittings, fixtures and equipment within buildings will be dismantled and removed to designated temporary disposal yards.
- All tanks, pipes and sumps containing hydrocarbons to be flushed or emptied prior to removal to ensure no hydrocarbon/chemical residue remains.
- All above ground electrical, water and other service infrastructure and equipment to be removed and placed designated temporary salvage yards.
- All underground pipes, cables and steel structures will be removed to an appropriate depth as specified by the design team to allow for new gas engine concrete foundations.
- Non-hazardous concrete slabs and footings will be broken up and disposed of.

- All on-site power lines, above ground pipelines, will be removed or demolished and the areas rehabilitated.
- The yard areas (e.g. platforms created for buildings, laydown areas, salvage yards, and other disturbed areas) will be closed and re-graded to control storm water runoff and erosion. Once the structures and foundations are demolished, removed, or buried, the yard areas will be inspected for any areas of hydrocarbon contamination.

Following the decommissioning and demolition of the existing cogeneration plant, the site will require clearing and levelling.

Figure 4-2(a): View of cogeneration plant

Figure 4-2(b): Deutz containerised engine

Figure 4-2(c): Powerhouse containing Jenbacher engines

srk consulting	**NEWCASTLE GAS ENGINE POWER PLANT** PHOTOGRAPHS OF THE EXISTING COGENERATION PLANT	Project No. 566508

Figure 4-2: Photographs of the existing cogeneration plant

4.2.2 NGEPP and associated infrastructure

The proposed NGEPP project entails the construction of a gas fired open cycle thermal power generating plant, with a nominal generation capacity of approximately 100 MW. The 100 MW capacity will be achieved via 13 Rolls-Royce (Bergen B3540V20) reciprocating gas engines of 8.8 MW each. These engines will be four-stroke medium-speed (750 rpm) gas fuelled engines that will dive 11 kV electrical generators. Radiators will be used for the engines' cooling systems.

[Note: Although the directly calculated output would be around 121 MW, one engine will always be on stand-by while the 12 others will output the nominal 100 MW, with allowance made for a 2.5% parasitic plan loss which would bring the output capacity down to approximately 100 MW.]

The fuel interface point for the new plant will be located at the existing gas metering station supplying methane rich gas to the existing cogeneration plant (i.e. Spring Lights Gas /Sasol Gas transported via Lily Pipeline). For the electricity produced, the connection to the grid is proposed to be via the existing 132 kV switchyard located within the Karbochem Industrial Complex where it interconnects with the external Eskom Grid system, making use of existing servitudes

[Note: The capacity of using the existing electrical infrastructure to export electricity produced from the NGEPP is still to be confirmed. Should any additional infrastructure need to be constructed, and should such infrastructure development trigger any EIA Listed Activities not included in this process (Table 4-2), Environmental Authorisation will be applied for via a separate EIA Application and Basic Assessment or Scoping and EIA process as applicable.]

Water and effluent systems will be supplied by Karbochem and all these plant interfaces are existing.

The overall project would broadly involve the following components:

1) Main gas station, including gas distribution piping to gas engines at 4 to 6 bar pressure and gas flow meters.
2) Portable water supply.
3) Raw water supply points.
4) Fire water supply, including underground fire water ring main, fire hydrants, fire hose reels.
5) Demineralised water supply points.
6) Engine house, including:
   - Rolls-Royce Gas Engines 13 X 8.8 MW B35:40V20AG2 (N+1) coupled to 11kV/50Hz alternators fitted on a main frame and suspended on rubber vibration damping mountings.
   - Noise supressing sheet metal powerhouse structure.
   - 5 000 kg crane to run along the length of the engine house to facilitate maintenance activities.
   - Engines main gas supply piping.
   - Compressed air system for starting the engines including 30 bar receiver, starting air module and piping.
   - Silencers (45 dBA) and exhaust stacks with 33 m height. The stacks are grouped together to support each other and to reduce construction cost. There will be 13 such exhaust stacks (i.e. one for each engine).
   - Engines oil cooling system.
   - Engines oil filling system.
   - Oil storage area for new oil.
   - Oil storage area for used oil.
   - Engines intercooler and jacket water cooling radiators fitted with electric fan motors mounted at ground level so as to optimize construction cost and to facilitate maintenance activities.
   - Header tanks at normal atmospheric pressure with a surface area of approximately 1 m^2, to facilitate coolant level maintenance.
   - Air intake system with filtration elements.
   - Air ventilation system to remove heat generated by air flow through the alternators and radiation from other hot surfaces from the powerhouse.
   - Fire protection system.
   - Gas and fire detectors.
   - Offloading bay.
7) High voltage (HV) yard to step up from 11 kV to 132 kV, including interconnecting transformers, line feeders and grid tie in point.
8) HV Substation, including switchgear, synchronising breakers, uninterrupted power supply and direct current (DC) systems.
9) Compressor room with 30 bar starting air compressors.

10) Effluent management infrastructure, including sump and electric pump and piping to Karbochem.
11) Main gate security office, including toilets.
12) Road access and storm drainage.
13) Office block, including:
    - Admin office.
    - Power plant manager office.
    - CEO office.
    - Board room.
    - Control room including layout plan.
    - Library/documentation centre.
    - Storeroom.
    - Kitchen.
    - Toilets.
    - Staff parking.
    - Visitors parking.
14) Maintenance workshop, including:
    - Working and tool areas.
    - Offices.
    - Spares storeroom.
    - Kitchen.
    - Toilets.

A conceptual block diagram showing what infrastructure will be within the site boundary (i.e. inside battery limits (IBL)) and what infrastructure will be outside of the site boundary (i.e. outside battery limits (OBL)) is shown in Figure 4-3.

A provisional general arrangement layout for the above is shown in Figure 4-4.

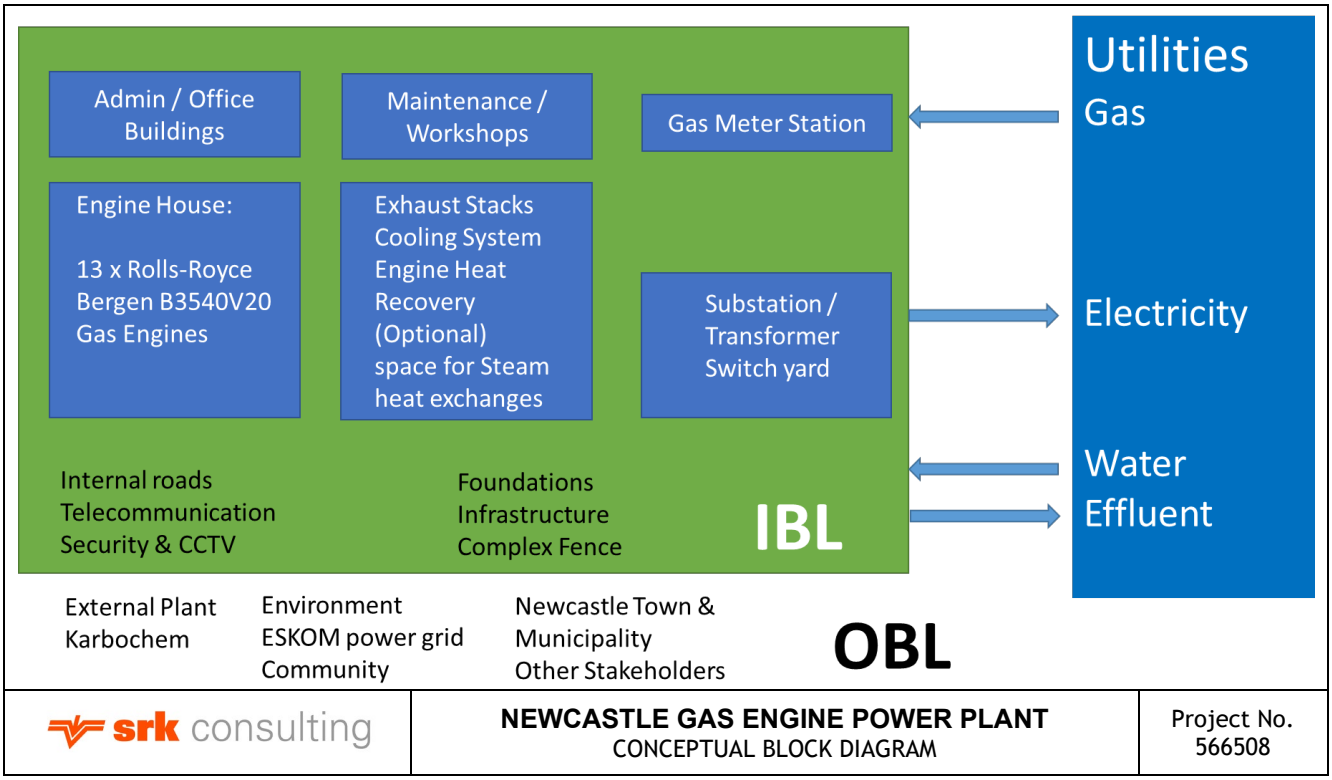
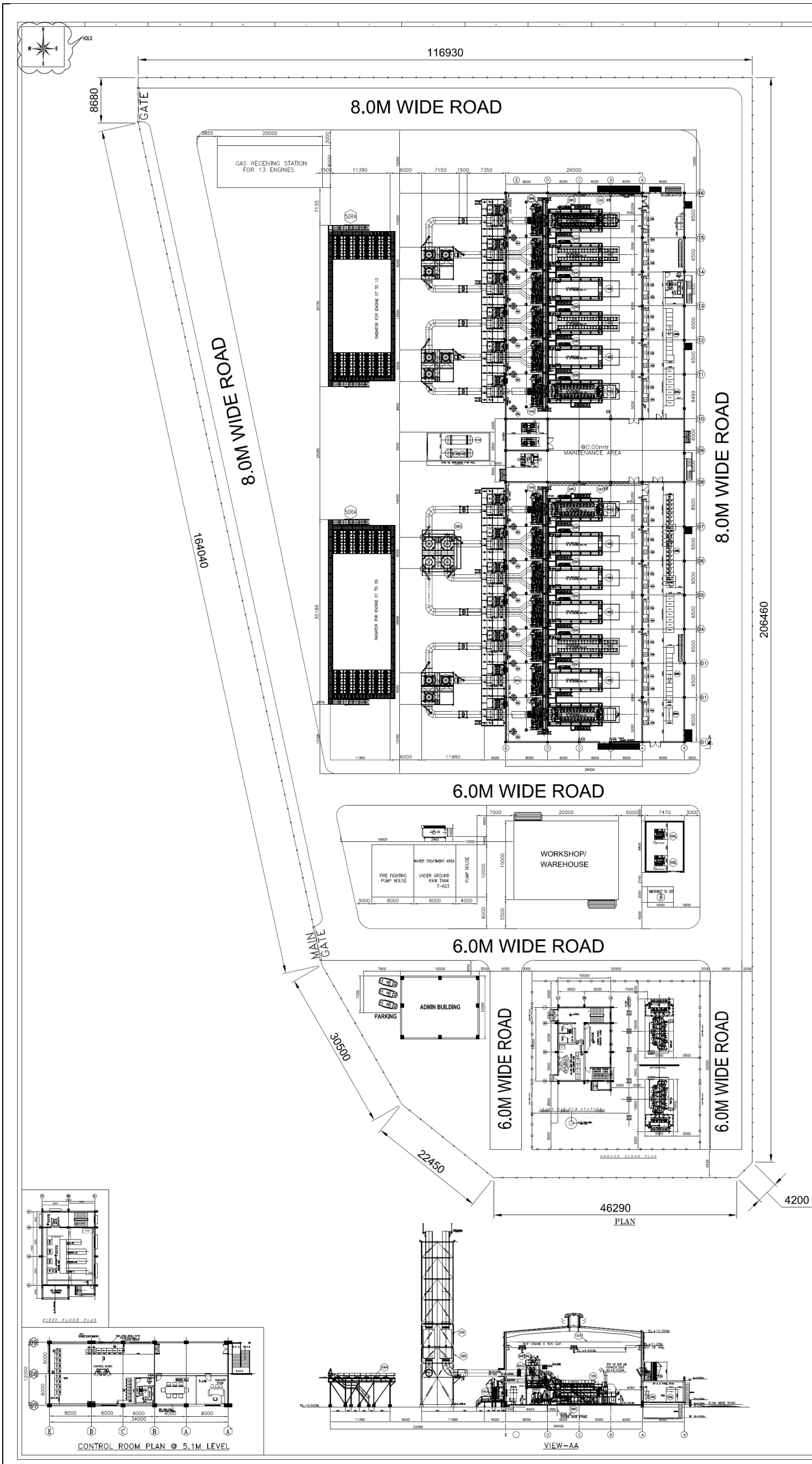


Figure 4-3: Conceptual block diagram



NOTES:-

1. All dimensions are in mm, Elevations are in metres, unless otherwise specified.
2. Elevation 0.00m corresponds to Finished Floor Level (FFL) of Engine hall.
3. Outside Engine hall floor FGL (-) 0.500m minimum.
4. North direction to be confirmed depends on site location.(Indicated Tentatively)
5. Explosion Relief Valve location Qty decided during engineering.

SCHEDULE OF MECHANICAL EQUIPMENT

Tag. No.	EQUIPMENT DESCRIPTION	QTY.	WT/Unit, kg
11EN	ENGINE B35:40V20AG1	13 NOS.	
12PM	AUXILIARY MODULE	13 NOS.	
13CR	EOT CRANE ENGINE HALL (5TON)	01 NO.	
14CR	EOT CRANE WORKSHOP (2TON)	01 NO.	
14VA	VENTILATION UNIT	13 SET	
30SA	STARTING AIR COMPRESSOR	02 NOS.	
43LO	LUBE OIL TRANSFER PUMP	01 NO.	
44LO	USED LUBE OIL DRAIN TRANSFER PUMP	01 NO.	
50RA	RADIATOR-02 Nos/Engine	13 SET	
51EX	EXHAUST SILENCER	13 NOS.	
54CA	CHARGE AIR FILTER (BUILT IN WITH SILENCER)	13 NOS.	
59EX	EXHAUST CHIMNEY STRUCTURES	13 NOS.	
84SA	START AIR BOTTLE 3000 Ltrs	13 NOS.	
84LT	LT EXPANSION TANK	13 NOS.	
84HT	HT EXPANSION TANK	13 NOS.	
86LO	CRANKCASE VENTILATION UNIT	13 NOS.	
90EX	PRE-VENTILATION SYSTEM	13 NOS.	
90FG	FUEL GAS MODULE	13 NOS.	
94SA	CONTROL AIR MODULE	06 NOS.	
100SA	MOUNTING PLATE	13 NOS.	
ERV	EXPLOSION RELIEF VALVE	26 NOS.	
-	GAS RECEIVING STATION	01 NO.	
68FG	SLAM SHUT OFF VALVE	01 NO.	
77FG	BLEED OFF VALVE	01 NO.	
99FG	MAIN GAS FILTER	01 NO.	
T-301	LUBE OIL MAKE UP TANK-10KL	01 NO.	
T-302	USED LUBE OIL TANK-10KL	01 NO.	
T-303	LUBE OIL MAINTENANCE TANK-10KL	01 NO.	
T-304	USED LUBE OIL DRAIN TANK-1KL	01 NO.	
T-802	POTABLE WATER TANK 20KL=	01 NO.	
T-803	RAW WATER TANK UNDERGROUND	01 NO.	
T-804	MAKE UP WATER TANK-2KL /06 ENGINE	02 NOS.	

SCHEDULE OF ELECTRICAL EQUIPMENT

TAG NO	EQUIPMENT DESCRIPTION	QTY.	WT/Unit, kg
10EL	MV PANEL BOARD	01 NO	-
20EL	BATTERY CHARGER	01 NO	-
21EL	220V DC BATTERY BANK	01 NO	-
30EL	ENGINE CONTROL CABINET (ECC)	13 NOS	-
31EL	ENGINE MOTOR CONTROL CABINET (EMCC)	13 NOS	-
50EL	NEUTRAL GROUNDING TRANSFORMER (NGT)	13 NOS	-
60EL	PLANT CONTROL CABINET (PCC)	02 NOS	
70EL	UTILITY CONTROL CABINET (U1)	02 NOS	-
71EL	BATTERY CONTROL CABINET (B1)	07 NOS	-
80EL	GENERATOR CONTROL CABINET (G1)	13 NOS	-
91EL	EMERGENCY PUSH BUTTON	04 NOS	-
98EL	AUXILIARY TRANSFORMER	02 NOS	-
99EL	BLACK START D.G SET	01 NO	-
101EL	PCCP	01 NO	-
-	SSDG DISTRIBUTION PANEL	01 NO	-
-	MLDB	01 NO	-
-	MPDB	01 NO	-
-	NETWORK SWITCH PANEL	01 NO	
-	WEATHER STATION PANEL	01 NO	

AREA REQUIRED : 19732.00 Sqmtr / 4.86 Acres

NOTES & LEGENDS FOR 132KV GIS SUB-STATION:-

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
2. THE PHYSICAL APPEARANCE AND THE DIMENSIONS OF ALL PANELS ARE INDICATIVE ONLY, THE EXACT DIMENSIONS SHALL BE INCORPORATED AFTER THE APPROVAL OF GA DRAWINGS OF THE RESPECTIVE EQUIPMENTS OR PANELS.
3. THIS DRAWING SHALL BE REFERED ONLY FOR PANEL ARRANGEMENT PURPOSE TO CHECK ADEQUATE CLEARANCES.
4. HEIGHT OF ACID PROOF TILEING SHALL BE UP TO 2.1 MTR. IN BATTERY ROOM
5. DOORS IN SWITCHGEAR ROOM/CABLE VAULTS/BATTERY ROOM SHALL BE FIRE RATED FOR 2 HOURS.
6. BATTERY ROOM FLOOR SHALL BE WITH ACID PROOF TILES.
7. 132KV LA FOR TRANSFORMER TO BE FITTED ALONG WITH BUSHING.

LEGENDS :-

PANEL NO.	PANEL DESCRIPTION
1CRP	O/G-1 CONTROL & RELAY PANEL
2CRP	BUS PT
T1CRP	TRAFO.1 CONTROL & RELAY PANEL
T2CRP	TRAFO.2 CONTROL & RELAY PANEL
RT1	RTCC PANEL TRAFO.-1
RT2	RTCC PANEL TRAFO.-2
SCP	SCADA PANEL
BC	BATTERY CHARGER

FOR TENDER PURPOSE ONLY
PRELIMINARY ISSUE

Rev.	Date:	Revision Note:	Drawn By:	Checked By:	Approved By:
0	13.10.2020	PRELIMINARY ISSUE	N.S	G.S	BHASKAR

CUSTOMER : VUTOMI - NEW CASTLE - SOUTH AFRICA

PROJECT : 13 X B35:40 V20 AG GAS BASED ENGINE 100MW COMBINED CYCLE POWER PLANT

Title: POWER PLANT LAYOUT

Rolls Royce Power System Bergen Engines | Reference: XXXXXX | Originator: Rolls-Royce | Date: 13.10.2020 | Scale: 1:235 | Format: A0 | Sheet: 01/02 | Mass (Kg): NA | Drawing No: 13ST-11-001 | Revision: 1

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NEWCASTLE GAS ENGINE POWER PLANT
PLANT GENERAL ARRANGEMENT LAYOUT

Project No. 566508

Figure 4-4: Plant general arrangement layout (Source: Rolls Royce)

4.2.3 Gas Engine Overview

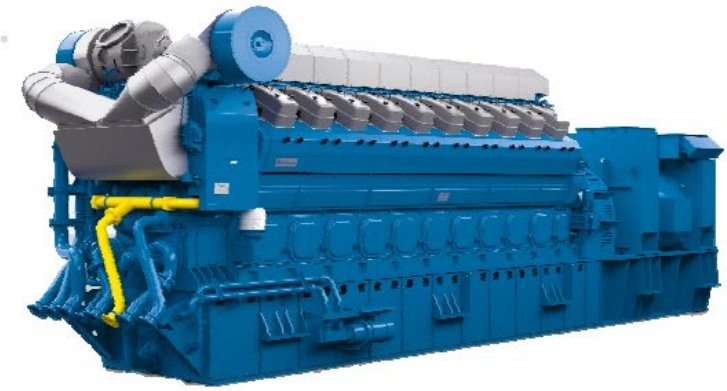
Bergen Engines supplies medium-speed engines for marine and power generation applications, and for the oil and gas industry. Marine engines are marketed through the Rolls-Royce Marine sales organization while engines for the power and for the oil and gas industry via the Rolls-Royce Power Systems sales organization. Since 1984, Rolls-Royce have developed, manufactured and installed more than 600 lean-burn gas engines for industrial power stations and municipal uses. The B-gas engine's design philosophy is to achieve increasingly stringent exhaust emission standards, industry leading electrical and heat recovery efficiency and high and dependable power levels to suit present and future applications.

The B-gas engine produces low emissions of Nitrogen oxides (NOx), Carbon monoxide (CO) and UHC combined, due to its efficient combustion technology that is aimed at minimum environmental impact coupled with improved performance. Their lean-burn gas engines are based on Otto principle, using Miller cycle in combination with Variable Turbine Geometry to achieve optimized combustion. By using a strong ignition source and an optimized pre-chamber, the gas-air mixture in the cylinder can effectively be 'leaned-out' to reduce emissions and achieve improved engine performance. These improvements include higher efficiency, lower emissions (particularly of nitrous oxides) and significantly increased specific power.

Newcastle Energy and Rolls Royce have selected the Bergen B35:40V20 natural gas engine as the engine of choice for the project (i.e. an Open Cycle Reciprocating Engine (OCRE)). The performance data for selected engine is shown in Figure 4-5.

Performance data

Bergen B35:40V20AG2



Engine Type	Length [mm]	Width [mm]	Height [mm]	Weight dry [kg]	Bore / Stroke [mm]	Engine Speed [rpm]		Exhaust gas emissions 5%O2 [mg/nm³]		
B35:40V20AG2	11650	3490	4690	105500	350 / 400	750	NOx	CO	NMHC	
							500	750	225	
Engine Load						**Unit**	**100 %**	**75 %**	**50 %**	**25 %**
Mechanical output						kW	9050	6790	4525	2265
Alternator efficiency, cos ϕ = 0,9						%	97,70	97,60	96,80	95,00
Frequency						Hz	50	50	50	50
Electrical output						kW	8840	6625	4380	2150
Nom. el. Efficiency						%	47,1	46,1	43,1	36,5
Fuel gas and LO consumption						**Unit**	**100 %**	**75 %**	**50 %**	**25 %**
Specific fuel gas consumption (guidance only)						kJ/kWh	7465	7615	8090	9375
Fuel gas consumption						kW	18765	14360	10165	5895
Lub.oil consumption						g/kWh	0,4	0,4	0,3	0,3
Heat dissipation						**Unit**	**100 %**	**75 %**	**50 %**	**25 %**
Charge air cooler LT						kW	605	445	310	180
Charge air cooler HT						kW	1730	950	370	-60
Lub.oil cooler						kW	1065	950	845	665
Jacket water cooler						kW	1320	1015	765	425
Exhaust mass						kg/h	49900	37600	26600	15400
Exhaust gas temperature						°C	375	405	435	470
Cooling water data						**Unit**				
LT Inlet temp to charge air cooler (max)						45	°C			
Normal cooling water LT flow to charge air cooler						120	m³/h			
Reference site conditions							**Unit**			
Altitude above sea level (max)						1200	m			
Turbocharger air intake temp (max)						35	°C			
Turbocharger air intake temp (min)						5	°C			
Relative Humidity (max)						60	% (at 35 °C)			
Exhaust back pressure (max)						400	mmWG			
Reference fuel specification							**Unit**			
Minimum fuel gas pressure to fuel gas module						4,5	bar(g)			
Lower heating value						32,5	MJ/m³n			
Methane number						80	MN			

- All technical data are valid at 100% load, incl. two engine driven pumps (lub. oil and jacket water).
- Engine power definitions and fuel gas consumption are acc. to ISO 3046-1 (ICFN).
- Generator rating and performance in accordance with IEC 60034-1.
- Electrical efficiency may vary dependent upon alternator.
- Data for heat dissipation and exhaust gas are based on a tolerance of ± 5%, turbocharger air suction temp. 25°C.
- Due to continuous development, some data may change.

Rolls-Royce Group
bergen.rolls-royce.com

srk consulting | **NEWCASTLE GAS ENGINE POWER PLANT** ENGINE PERFORMANCE DATA | Project No. 566508

Figure 4-5: Engine performance data (source: Rolls-Royce)

4.2.4 Merits of Gas Engine Generation

Newcastle Energy have noted that there are several advantages and disadvantages of gas engine power generation. These are as outlined below:

- Advantages:
  - Lower lead time to construction.
  - Limited number of service parts and items.
  - Lower environmental impact than coal fired stations.
  - Lower capital cost.
  - Well-established and experienced service network worldwide.
  - Location closer to gas source and grid tie-in.
  - Long-Term Service Agreements provide flexible options to match all customers' priorities.
  - [Note: A site specific advantage is that there is existing infrastructure at the NGEPP site (e.g. gas source and grid tie in points).]
- Disadvantages:
  - Gas price volatility and cost of fuel.
  - Growing concerns over global and local gas supply.

4.2.5 Primary Fuel Supply

The primary fuel Newcastle Energy are proposing to supply the power plant with is Methane Rich Gas (MRG) via the existing gas pipeline.

A preliminary MRG specification from Spring Lights Gas has been provided by Vutomi Energy as detailed in Figure 4-6. The pressure is 20 bar downstream of the Sasol pressure reducing station at Karbochem site.

The power plant will include a new high-pressure gas receiving and metering station within the site. This gas receiving station will reduce the pressure of the gas from the pipeline to the approximately 4.5 bar required by the gas engines.

1. TYPICAL COMPOSITION

Component	Volume %
• Methane (CH_4)	88,6
• Hydrogen (H_2)	2,6
• Carbon Monoxide (CO)	2,1
• Nitrogen & Argon (N_2 & Ar)	6,4
• Ethane & Ethylene (C_2H_6 & C_2H_4)	0,3
• Water (H_2O)	Nil

2. PHYISICAL CHARACTERISTICS

Property		Units	Average Value
• Gross Energy Content	(EC_s)	MJ/ m^3_s (101,3 kPa &15°C)	33,89 Standardized
	(EC_n)	MJ/ m^3_n (101,3 kPa & 0°C)	35,73 Normalized
	(EC_s)	*MJ/kg (101.3kpa&15°C)*	*46.81 Standardized*
• Relative Density (RD)		-	0,59
• Wobbe Index (WI_n)		$\frac{EC_n}{(RD)^{0,5}}$	46,5
• Density		kg/m^3_s	0,724 standardized
		kg/m^3_n	0,763 normalized
• Dew Point		°C	< -100
• Sulphur (S)		mg/ m^3_n	9
• Lower Explosive Limit (LEL)		gas in air v/v	5%
• Higher Explosive Limit (HEL)		gas in air v/v	17%
• Stoichiometric Conditions		air/gas ratio	8,6
• Molecular Weight		g/mol	17,3
• Viscosity (dynamic)		cP	1,2 x 10^{-2}
• Viscosity (kinematic)		cSt	1,7 x 10^{-2}
• Auto Ignition Temperature		°C	600 – 650
• Theoretical Flame Temperature		°C	1 950
• Cracking Temperature		°C	>1000
• Flame Speed		m/s	0,41
• Flame Speed Factor		-	14 (H_2 = 100)
• Emmisivity = 1)		-	0,35 – 0,45 (black body e
• Volume of products of combustion		m^3/m^3 of gas	9,5 (wet basis) 7,7 (dry basis)
– $C0_2$ produced		kg/GJ	49,7 (HFO = 75)
– H_20 produced		kg/GJ	22,5 (HFO = 13)
• Max. theoretical $C0_2$ in flue		v/v %	12 (dry basis)

3. NOTES

- Net Energy Content is approximate 10% lower than the Gross Energy Content dependant on the application.
- Relative Density is equal to Specific Gravity (air = 1,0) or ratio of the average molecular weight of gas to that of air, where molecular weight of air is taken as 28,97g/mol.
- Sulphur is a component of an organic odorant (THT = Tetrohydrothiopheen), which is added to pipeline gas for safety considerations.
- The separation process of gasses at the Secunda factories occurs at -155°C to ensure that the gas is free from moisture.

Disclaimer: This datasheet is presented for informational purposes only and is subject to change without notice. SASOL GAS accepts NO LIABILITY which may arise from the use of this datasheet.

Source: Vutomi Energy 21/10/2020

srk consulting	NEWCASTLE GAS ENGINE POWER PLANT PRELIMINARY METHANE RICH GAS SPECIFICATION	Project No. 566508

Figure 4-6: Preliminary Methane Rich Gas specification (source: Vutomi, 2020)

4.2.6 Backup Fuel Storage

The storage of backup fuel, to the volume equivalent of a three-day supply reserve, is required for the NGEPP.

As noted in Section 4.2.5 above, the primary fuel Newcastle Energy are proposing to supply the power plant with is MRG via the existing gas pipeline. The secondary fuel, or backup fuel, to satisfy a three-day reserve, is proposed to be in the form of Liquefied Natural Gas (LNG).

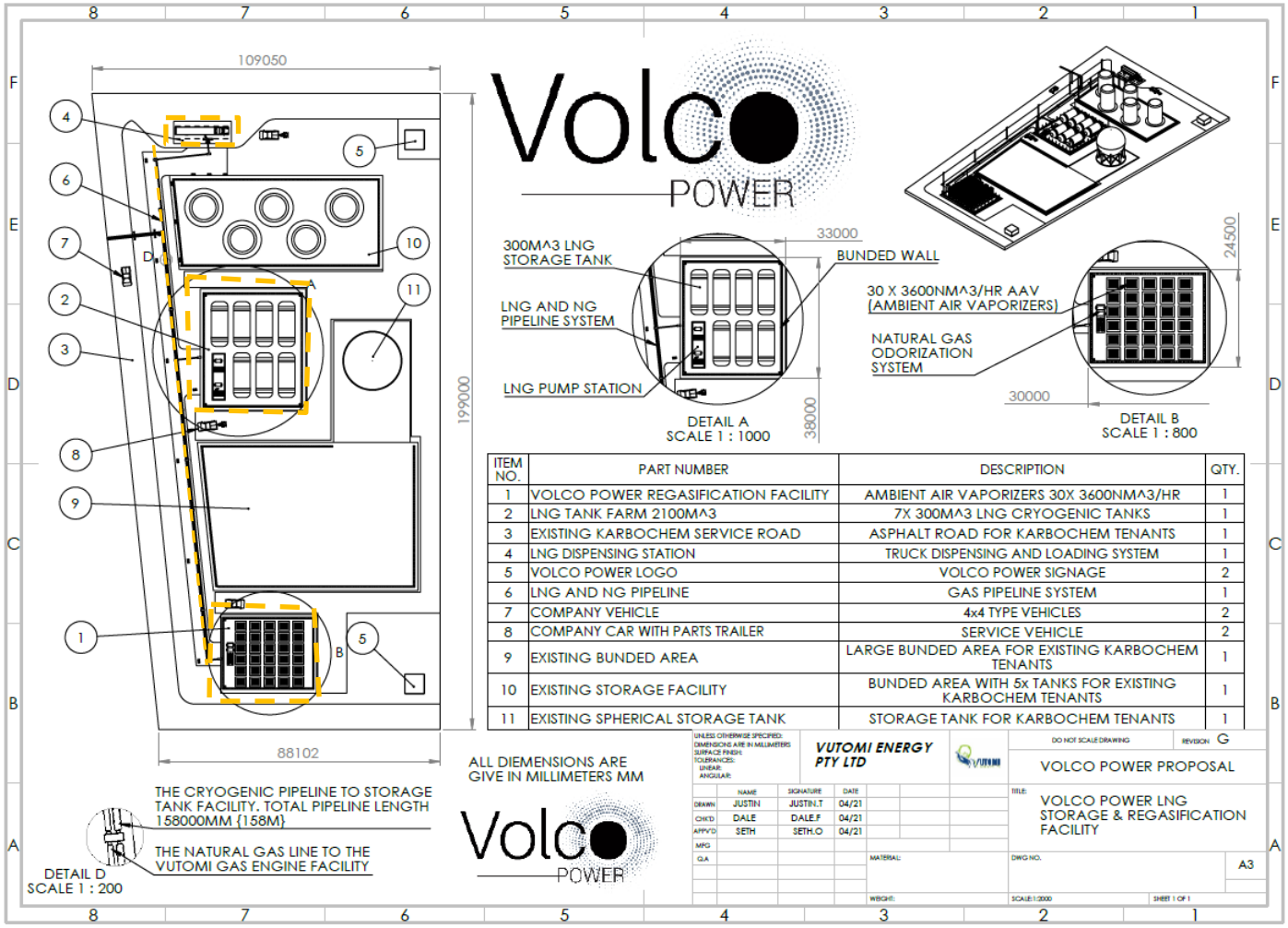
In this regard, Newcastle Energy proposes to develop a 2 100m^3 LNG storage facility comprising of:

- 7 x 300 m^3 cryogenic tanks.
- A regassification facility.
- An LNG offloading skid.
- Pressure reduction station.

The above is proposed to be located within the Karbochem Industrial Complex, on the site immediately to the east of the NGEPP site (as indicated in Figure 4-1).

[Note: A previously considered alternative location was to the north of the NGEPP, however, Karbochem were in favour locating the LNG facilities to the east].

The proposed LNG facility will allow for three days of LNG storage and to utilize the natural boil off gas to feed into the existing piped gas supply at a point after the piped gas pressure reduction station and before entering the gas engines. The boil off gas replenishment would be supplied by LNG ISO containers and offloaded into the cryogenic storage facility. A preliminary layout from Volco Power (Pty) Ltd. (Volco), an LNG supply company, is provided in Figure 4-7 with photographs of the proposed LNG areas provided in Figure 4-8.



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	VOLCO POWER REGASIFICATION FACILITY	AMBIENT AIR VAPORIZERS 30X 3600NM^3/HR	1
2	LNG TANK FARM 2100M^3	7X 300M^3 LNG CRYOGENIC TANKS	1
3	EXISTING KARBOCHEM SERVICE ROAD	ASPHALT ROAD FOR KARBOCHEM TENANTS	1
4	LNG DISPENSING STATION	TRUCK DISPENSING AND LOADING SYSTEM	1
5	VOLCO POWER LOGO	VOLCO POWER SIGNAGE	2
6	LNG AND NG PIPELINE	GAS PIPELINE SYSTEM	1
7	COMPANY VEHICLE	4x4 TYPE VEHICLES	2
8	COMPANY CAR WITH PARTS TRAILER	SERVICE VEHICLE	2
9	EXISTING BUNDED AREA	LARGE BUNDED AREA FOR EXISTING KARBOCHEM TENANTS	1
10	EXISTING STORAGE FACILITY	BUNDED AREA WITH 5x TANKS FOR EXISTING KARBOCHEM TENANTS	1
11	EXISTING SPHERICAL STORAGE TANK	STORAGE TANK FOR KARBOCHEM TENANTS	1

Notes:
1) The facilities indicated in dashed orange outlines are the proposed main LNG components.
2) Existing Karbochem infrastructure is also indicated in the layout (for orientation) but is not included in the scope of this EIR.

srk consulting

NEWCASTLE GAS ENGINE POWER PLANT
PRELIMINARY LAYOUT FOR LNG STORAGE AND REGASSIFICATION FACILITY

Project No. 566508

Figure 4-7: Preliminary layout for LNG storage and regassification facility (source: Volco Power, 2021)

Figure 4-8 (a): View of proposed LNG Dispensing Station (area to the right of photograph)

Figure 4-8 (b): View of proposed Regassification Facility area

Figure 4-8 (c): View of proposed LNG Tank Farm area

Figure 4-8 (d): View of proposed LNG Pipeline route (from Dispensing Station towards Regassification Facility)

srk consulting	**NEWCASTLE GAS ENGINE POWER PLANT** PHOTOGRAPHS OF THE LNG FACILITY AREA	Project No. 566508

Figure 4-8: Photographs of the proposed LNG Facility area

4.2.7 Water Requirements and Supply

Raw and potable water for the NGEPP is envisaged to be supplied by the adjacent Karbochem Industrial Complex, subject to confirmation of water availability. The Karbochem plant supplies the existing 18.5 MW cogeneration plant under a Services and Utilities Agreement.

A complete water balance showing water consumption and rejection rates has yet to be finalised. However, water demand is not expected to significant as there is no large requirement for cooling (i.e. it is proposed to be a closed loop cooling system and only a small amount of make-up water should be required). In this regard, the Newcastle Energy technical team has estimated a water consumption of approximately 7.6 m^3 per day.

The main water requirements will be for:

- Fire water system (especially for the first fill).
- Drinking water, toilets, showers, etc.
- Engine cooling system (especially make-up water for air cooled radiators).

Water will be needed during the construction process as normal. It is anticipated that construction water will be supplied via Karbochem too.

4.2.8 Waste Treatment

Wastewater and effluent from the NGEPP is envisaged to be discharged to the adjacent Karbochem Industrial Complex, as per the Services and Utilities Agreement for the existing 18.5 MW cogeneration plant.

4.3 NEMA Listed Activities

The NEMA listed activities included in the application for Environmental Authorisation are detailed in Table 4-2**.**

Table 4-3: Applicable NEMA Listed Activities

No.	Activity Description	Applicability to the Project
NEMA EIA Listing Notice 1 (GN 327) – BA process required		
31	The decommissioning of existing facilities, structures or infrastructure for— (i) any development and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014; …….	There is an existing 18.5 MW gas fired cogeneration plant on the site, which is owned by Newcastle Energy. This existing plant will be decommissioned and removed from site to provide space for the proposed 100 MW NGEPP.
NEMA EIA Listing Notice 2 (GN 325) – S&EIR process required		
2	The development and related operation of facilities or infrastructure for the generation of electricity from a non-renewable resource where the electricity output is 20 megawatts or more.	The NGEPP is proposed to have 100 MW capacity, to be achieved via installation of 13 gas engines and associated infrastructure.
4	The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres. Where "dangerous goods" means goods containing any of the substances as contemplated in South African National Standard No. 10234, supplement 2008 1.00: designated "List of classification and labelling of chemicals in accordance with the Globally Harmonized Systems (GHS)" published by Standards South Africa, and where the presence of such goods, regardless of quantity, in a blend or mixture, causes such blend or mixture to have one or more of the characteristics listed in the Hazard Statements in section 4.2.3, namely physical	The storage of backup fuel (LNG), to the volume equivalent of a three-day supply reserve, is required for the NGEPP. The proposed combined capacity of containers for the storage and handling of dangerous goods on site will be 2 100 m^3.

No.	Activity Description	Applicability to the Project
	hazards, health hazards or environmental hazards.	
6	The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding- (i) activities which are identified and included in Listing Notice 1 of 2014; (ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; (iii) the development of facilities and infrastructure for the treatment of effluent, polluted water, wastewater or sewage where such facilities have a daily throughput capacity of 2 000 cubic metres or less; or (iv) where the development is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will not exceed 50 cubic metres per day.	The proposed project will require an Atmospheric Emission License (AEL) in terms of National Environmental Management: Air Quality Act (No. 39 of 2004) (NEM: AQA). In this regard, Government Notice No. 893 (November 2014) (as amended June 2015, October 2018 and March 2020), as promulgated under NEM: AQA, includes the following listed activity: • Category 1 “Combustion Installations”, which includes Subcategory 1.4 “Gas combustion installations”.

4.4 Environmental Aspects and Studies

During the EIA, the assessment of the key environmental aspects and impacts identified for the project was informed by various specialist investigations, reports and plans.

The main studies which have informed the preparation of this EMPr are listed in Table 4-3**.**

Table 4-4: Environmental Aspects and Specialist Studies

Environmental Aspect	Specialist Studies and Plans	Undertaken by
Air quality	Atmospheric Impact Report for Proposed Gas-to-Power Plant in Newcastle, South Africa (EIR Appendix G-1)	SRK Consulting
Climate change	Climate Change Impact Assessment for the Newcastle Gas Engine Power Plant, KwaZulu-Natal (EIR Appendix G-2)	SRK Consulting
Aquatic ecology	Aquatic Ecological Impact and Compliance Statement Considering Development of the Proposed 100 MW Newcastle Gas Engine Power Plant (NGEPP) Independent Power Producer (IPP) Project in Kwazulu-Natal Province (EIR Appendix G-3)	Scientific Aquatic Services (SAS)
Terrestrial biodiversity	Terrestrial (Biodiversity) Compliance Statement Considering Development of the Proposed 100 MW Newcastle Gas Engine Power Plant (NGEPP) Independent Power Producer (IPP) Project in Kwazulu-Natal Province (EIR Appendix G-4)	Scientific Aquatic Services (SAS)
Noise	Acoustic Impact Assessment for Proposed Newcastle Gas Engine Power Plant, KwaZulu-Natal (EIR Appendix G-5)	SRK Consulting
Risk	Quantitative Risk Assessment for the Proposed Newcastle Gas Engine Power Plant at Newcastle in the KwaZulu-Natal Province (EIR Appendix G-6)	RISCOM (Pty) Ltd.
Groundwater	Hydrogeological Assessment for the proposed Newcastle Gas Energy Power Plant (EIR Appendix G-7)	SRK Consulting

4.5 Environmental Impact Summary

A summary of the assessment of identified potentially significant impacts for the proposed NGEPP development is provided in Table 4-4.

Table 4-5: Impact Assessment Summary

Potential Impacts	Significance	
	Pre-mitigation	Post-mitigation
Air Quality (nuisance / health risk)		
Impact AQ1: Dust emissions due to the demolition of the existing cogeneration plant and site clearance	Very Low	Very Low
Impact AQ2: Dust emissions during the construction phase	Very Low	Very Low
Impact AQ3: Dust and gas emissions during the operational phase	Low	Low
Climate Change		
Impact CC1: GHG emissions resulting from the Construction Phase	Low	Low
Impact CC2: GHG emissions resulting from the Operational Phase	High (+ve)	High (+ve)
Impact CC3: Impact of increased temperatures during operation	Insignificant	Insignificant
Impact CC4: Impact of decreased annual rainfall or increased drought periods during operation	Low	Low
Impact CC5: Impact of increased fire days, intense thunderstorms and damaging flood events during operation	Low	Low
Aquatic Ecology		
Impact AE1: Disturbance to wetlands or other freshwater habitat (demolition of existing plant construction of new one)	Very Low	Insignificant
Impact AE2: Disturbance to wetlands or other freshwater habitat (operational phase)	Low	Low
Terrestrial Biodiversity		
Impact TD1: Disturbance to terrestrial biodiversity	Very Low	Insignificant
Noise		
Impact N1: Noise impacts during the construction phase	Very Low	Very Low
Impact N2: Noise generated during the operational phase	Medium	Low
Risk (loss of containment / fire / explosion / exposure)		
Impact QR1: Loss of containment of methane rich gas	Medium	Low
Impact QR2: LNG ISO container failure	Medium	Low
Impact QR3: LNG pipeline failure	Medium	Low
Impact QR4: LNG storage	Medium	Low
Impact QR5: LNG vaporisers	Medium	Low
Groundwater and Surface Resources		
Impact GW1: Poor management of contaminated sump water during decommissioning will result to deterioration of groundwater quality in the immediate vicinity	Medium	Very Low
Impact GW2: Poor management of chemicals (HCl, hydrocarbons and Caustic soda, etc.) from the storage facilities onsite during demolition will result to deterioration of groundwater quality in the immediate vicinity	Medium	Very Low
Impact GW3: Poor management of sewage from the septic tank onsite during demolition will result to deterioration of groundwater quality in the immediate vicinity	Medium	Very Low
Impact GW4: Impact to surface water – disposal of groundwater seepage to the surface water resource impacting aquatic systems	Medium	Very Low

Potential Impacts	Significance	
	Pre-mitigation	Post-mitigation
Impact GW5: Impact to water – spillage from the chemical storage tanks and other potential contamination sources contaminating surface and groundwater resource	Medium	Very Low
Socio-economic		
Impact SE1: Employment opportunities during construction	Very Low (+ve)	Low (+ve)
Impact SE2: Employment opportunities during operation	Low (+ve)	Medium (+ve)
Impact SE3: Increase in GDP during construction and operation	Medium (+ve)	High (+ve)
Impact SE4: Contribution to increased energy security during operation	Medium (+ve)	Medium (+ve)

5 Roles and Responsibilities

Newcastle Energy is responsible for ensuring adherence to the management and mitigation measures detailed in this EMPr and the relevant approvals. Newcastle Energy's management, employees and contractors are all bound by the EMPr and must use this document as a guide to avoid, minimise and manage environmental, health and social impacts.

The general roles and responsibilities for implementation and monitoring of this EMPr are outlined in Table 5-1.

Table 5-1: Roles and Responsibilities

Responsible Agent	Role / Responsibility
Project Proponent (Newcastle Energy)	• Ultimately accountable for ensuring implementation of and compliance with the EMPr and conditions of the Environmental Authorisation during all project phases. • Appoints appropriately qualified personnel to co-ordinate, supervise and expedite implementation and monitoring of the EMPr. • Responsible for compliance with the provisions for duty of care and remediation of damage in accordance with Section 28 of the National Environmental Management Act No. 107 of 1998 (NEMA) and its obligations regarding the control of emergency incidents in terms of Section 30 of NEMA. • Ensures that the contractual documentation associated with appointment of all Consultants and Contractors contains an Environmental Specification with the requirements /mitigation measures of the EMPr and Environmental Authorisation. • Appointment of the ECO.
Demolition/ Construction Phase Project Manager (PM)	• Overall responsibility and accountability for managing the construction phase, Contractors, Consultants and for ensuring the environmental management requirements for construction are met. • The PM may be a Consulting Engineer /Implementation Contractor, appointed by the Project Proponent to manage the construction work contract on the Project Proponent's behalf.
Construction Contractor	• The Principal Contractor is responsible for implementation and compliance with the construction requirements of the EMPr and conditions of the Environmental Authorisation, contract (including Environmental Specification) and relevant environmental legislation. • The Principal Contractor must ensure all subcontractors have a copy of and are fully aware of the content and requirements of the EMPr.
Environmental Officer (EO)	• Appointed by the Project Proponent (during the operational phase) or the Construction PM or Contractor (during the construction phase) as the environmental representative on site. • Acts on behalf of the PM / Contractor / Project Proponent with the mandate to manage and monitor implementation of the EMPr. • Attends relevant meetings, conducts regular inspections, monitors compliance with the EMPr and is responsible for providing environmental reporting requirements in terms of the EMPr.

Responsible Agent	Role / Responsibility
	• Conveys the contents of the EMPr to the site team and conducts environmental awareness training prior to work being undertaken on site. • Advises the PM / Production Manager on actions or issues impacting on the environment and provides appropriate recommendations to address and rectify these matters.
Environmental Control Officer (ECO)	• An independent person with the relevant environmental auditing expertise. • Objectively monitor and audit compliance with relevant environmental legislation, conditions of the Environmental Authorisation and the EMPr. • Assessment of the suitability or effectiveness of the EMPr. • Advise the PM (during construction) / Production Manager (during operation) on actions or issues impacting on the environment and provides appropriate recommendations to address and rectify these matters. • Submits environmental audit reports to the DFFE. • Notification of commencement of construction to DFFE and notification of potential interested and affected parties (I&APs) of the availability of environmental audit reports for review.

6 Environmental Management Programme

In accordance with Items 1(d), (e), (i) and (j) of Appendix 4 of GN 326, this chapter provides:

- A description of impact management outcomes for all phases of the development, namely:
  - Planning and design.
  - Construction activities.
  - Operation activities.
- A description of impact management actions.
- An indication of the person who will be responsible for implementation of the impact management actions.
- The time periods within which the impact management actions must be implemented.

The sub-sections below form the core of this EMPr.

The relevant impact management outcomes and actions must be adhered to at all times during the various project phases.

The stipulated measures have therefore been structured in a simple, check-list format for each project phase, to facilitate ease of implementation and compliance monitoring.

6.1 Planning and detailed design phase

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
Authorisations	All legally required environmental permits, licences and authorisations are obtained and implemented	1	Ensure that all required environmentally related licences and permits have been obtained before the start of demolition and construction. These include, but • Environmental Authorisation. • Atmospheric Emissions Licence (AEL). • Major Hazard Installation (MHI). • Water Use Authorisation (WUA) or confirmation from the Department of Water and Sanitation (DWS) that a WUA is not required.	Proponent and Design Engineer	Before commencement of construction
		2	Ensure that all conditions stated in required licences and permits are integrated into the project design and management procedures.		
		3	Review the detailed design of each component of the NGEPP and associated facilities to determine whether there are significant deviations from the authorised project description and obtain confirmation from DFFE regarding the need, or not, to apply for an amendment to the authorisation in cases such as, but not limited to, the following: • Substantial changes to the layout. • Stack height and parameters. • Changes in on site storage of dangerous goods. • Changes in fuel type, or changes in the use of backup fuels. • A change in the height of the stacks for exhaust gases.		
Preparation for construction phase	Ensure environmental requirements are included in project planning	4	Include the EMPr in all tender documents to ensure that sufficient resources are allocated to environmental management by the Contractor.	Project management consultant team	Prior to call for tenders
		5	Plan and make adequate financial provision for rehabilitation and restoration activities and clearly allocate timing and responsibility for environmental rehabilitation.	The Proponent	Before construction commences
Climate change	Design with climate change in mind	6	Engineering designs of the facility must take into consideration climate change impacts. For example, due to increasing ambient temperatures, allowance must be made for increased gas expansion within any pipelines and storage facilities in order to minimise potential gas leakages and the resultant GHG emissions.	Design Engineer	During detailed design and in preparation for building plan approval.
		7	Specify methods for GHG emissions reduction throughout its operations, such as the use of energy efficient technologies in office spaces, fuel composition analysis and exhaust stack gas analysis to promote optimisation of operations.		

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
		8	Design of the facility must ensure that plant equipment and infrastructure is weather-proofed, specifically in light of the anticipated increase in extreme weather occurrences (severe winds, extreme heat, heavy rains, and flooding impacts).		
Pollution of soil and stormwater	Appropriate stormwater management design	9	A detailed storm water management plan for the site must be developed and is to incorporate the outputs from the Hydrology and Flooding Assessment (SRK, 2020) undertaken to inform the feasibility study for the NGEPP. Specific requirements to be included in the design include: • The post-development clean storm water runoff must be attenuated and discharged at the same flow rate as pre-development peak flows. In addition all dirty storm water runoff from the 1:50 year flood must be collected and discharged to effluent system. • An attenuation facility is recommended to attenuate and discharge the post-development back to the pre-development clean storm water runoff. The attenuation pond required depth is 1.5m and an area of 200m^2 with an outlet pipe of 350mm (diameter or opening). • Ensure that the existing formalised storm water channel continues to drain the minor upstream catchment along the existing servitude. • Rainwater harvesting that will reduce flood peaks and provide water to the development that may be used for plant activities, landscaping or the flushing of toiles.	Design Engineer	During detailed design and in preparation for building plan approval.
		10	Ensure the stormwater drainage capacity takes into account climate change predictions in order to minimise flood occurrences onsite and the associated contamination occurrences that might occur as a result.		
Soil and groundwater contamination	Ensure that all possible causes of pollution are mitigated	11	Confirming levels of soil and groundwater contamination via a Phase II site assessment process and remediate as necessary. Residual contamination associated with the existing sump must be remediated before subsequent construction of the NGEPP.	Proponent and appointed hydrogeological / contamination specialist	During detailed design and before construction commences.
Safety management	Appropriate safety risk management design	12	Detail design to address recommendations from safety specialist, as reported in Appendix G-6 of the EIR, including: • Compliance with applicable SANS codes, i.e., SANS 1461, SANS 10087, SANS 10089, SANS 10108, etc. • Incorporation of applicable guidelines or equivalent international recognised codes of good design and practice into the designs. • Design to include installation of instrumentation, including detection and emergency shut down for natural gas leaks in the gas pipelines.	Proponent and Design Engineer	During detailed design and in preparation for building plan and MHI approval.

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
			• 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 Newcastle Energy 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). • The Karbochem Industrial Complex must review the MHI requirements with regards to the new LNG installation, as required by the MHI regulation. • Final acceptance of the facility risks with an MHI risk assessment that must be completed in accordance to the MHI regulations (i.e. basing such a risk assessment on the final design and including engineering mitigation).		

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
Waste management	Appropriate waste management planning	13	A detailed methodology for demolition is to be devised by the appointed demolition contractor. This methodology is to include a waste management plan for the decommissioning and demolition waste.	Proponent and Demolition Contractor	Prior to commencement of demolition
		14	A construction method statement and waste management plan is to be devised by the appointed construction contractor.	Proponent and Demolition Contractor	Prior to commencement of construction

6.2 Demolition

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
Air quality: Dust emissions	Reduction of dust emission impacts from the demolition of the existing cogeneration plant and site clearance	1	Demolished equipment and/or materials (that may be a source of dust) which are stockpiled on site prior to their removal should be covered with a tarpaulin to reduce fugitive dust emissions.	Contractor	Duration of demolition
		2	Transportation of dust raising materials in closed body vehicles or covering material with a tarpaulin will reduce fugitive dust emissions.		
		3	Additional application of water during site clearing activities will reduce fugitive dust.		
		4	On windy days, or when fugitive dust can be observed leaving the site of works, additional application of water to the affected areas should be applied.		
		5	Material which cannot be watered should be covered until utilized.		
		6	Site clearance activities should be stopped during periods of high wind speeds.		
Aquatic ecology: Disturbance to wetlands or other freshwater habitat	No impact to wetland or other freshwater habitats	7	No waste disposal is to be permitted within the Karbochem Spruit or the stormwater channel within that traverses the eastern boundary of the study site and discharges into the Karbochem Spruit. All waste is to be removed from the study site and disposed of at a registered waste disposal facility. It is further recommended that waste such as wash water should be treated on-site or discharged to a suitable sanitation system to prevent contamination and runoff into the Karbochem Spruit.	Contractor	Duration of demolition
Terrestrial biodiversity: Disturbance to terrestrial biodiversity	No impact to terrestrial biodiversity	8	No collection of floral or faunal species may be allowed by construction personnel.	Contractor	Duration of demolition
		9	No hunting or trapping of faunal species is to be allowed by construction personnel.		
		10	Informal fires by construction personnel should be prohibited, and no uncontrolled fires whatsoever should be allowed.		
		11	No dumping of litter, rubble or cleared vegetation on site should be allowed. Infrastructure and rubble removed as a result of the construction activities should be disposed of at an appropriate registered landfill site. No temporary dumpsites should be allowed in areas with natural vegetation. It is advised that waste disposal containers and bins be provided during the construction phase for all construction rubble and general waste. Vegetation cuttings must be carefully collected and disposed of at a separate waste facility.		

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
Noise: Noise generated	Ensure that all possible causes of pollution and potential nuisances (noise, dust, lights, etc.) are mitigated as far as possible to minimise impacts to the surrounding environment.	12	Planning demolition activities in consultation with Karbochem and other tenants of the Karbochem Industrial Complex to ensure activities with the greatest potential to generate noise are planned during periods of the day, thereby less likely resulting in a disturbance. Information regarding demolition activities should be provided to any I&APs upon request.	Contractor	Duration of demolition
		13	All equipment, machines and vehicles to be used onsite during the demolition phase are to be the quietest reasonably available and are to be routinely maintained to ensure the effectiveness of the noise suppression systems.		
		14	Through site induction programmes, all demolition personal (including contractors) should be informed of their responsibilities and the importance of managing noise levels during the demolition phase of the project.		
		15	When working near a potential sensitive receptor, limit the number of simultaneous activities to a minimum as far as possible.		
		16	Any noise-related complaints received during the demolition phase are to be registered and result in the implementation of appropriate modified practices.		
Groundwater: Management of contaminated sump water		17	Safely empty the effluent sump before any decommissioning activity, demolish the sump after removing the potential contamination sources at the plant (chemical tanks, and containers etc.).	Contractor	Duration of demolition
		18	Contaminated sump water must not be used or discarded on site. This must be transported to the Karbochem effluent treatment plant.		
		19	Implement soil and groundwater remedial measures as stipulated in the Phase II site assessment report (i.e. as undertaken during the detailed design phase).		
Groundwater: Management of chemicals from the storage facilities onsite		20	Safely empty the storage tanks of any chemical content before any decommissioning activity, demolish bund walls only once the storage tanks are removed.	Contractor	Duration of demolition
		21	Empty chemical containers must be handled as hazardous and must be removed from site before any demolition activities.		
Groundwater: Management of sewage from the septic tank onsite		22	Safely empty the septic tank before any decommissioning activity, demolish the tank only when the sewage has been removed.	Contractor	Duration of demolition
		23	The contaminated material including soil must be removed for safe disposal off-site.		
Surface water: Management		24	A detailed storm water management plan (as developed during the detailed design phase) must be implemented during the demolition phase. This includes ensuring that that the existing storm water channel continues to drain the minor upstream catchment along the existing servitude.		

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
Socio-economic: Employment opportunities	Provide economic opportunities for the local community	25	Opportunities to support and stimulate SMME activity locally are to be maximised, wherever practical.	Proponent and Contractor	Duration of demolition
		26	Local recruitment for skilled and unskilled workers must be maximised, wherever practical.		
		27	Subcontract to local companies where feasible (e.g. for demolition, waste removal, scrap recycling, haulage, etc.).		
		28	Opportunities for skills training are to be optimised, wherever practical.		
Socio-economic: Increase in GDP	Provide economic opportunities for the local community	29	Opportunities to support and stimulate SMME activity locally are to be maximised, wherever practical.	Proponent and Contractor	Duration of demolition
		30	Subcontract to local SMMEs and BBBEE compliant enterprises for service provides and suppliers were feasible.		
Waste management	Ensure that all demolition waste is safely handled and disposed of as per NEM:WA and as far as possible to minimise impacts to the environment.	31	No on-site waste disposal is permitted.	Proponent and Contractor	Duration of demolition
		32	All materials that cannot be recycled or sold for salvage value, (general and hazardous) are to be removed from the study site as waste (i.e. general and hazardous waste) and disposed of at an appropriately registered waste disposal facility.		
		33	Liquid waste / effluent such as wash water should be treated on-site or discharged to the Karbochem effluent treatment system.		
		34	Implementation of a waste management plan for the decommissioning and demolition waste (i.e. as stipulated for the planning and detailed design phase).		

6.3 Construction

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
Air quality: Dust emissions	Reduction of dust emission impacts from the construction of the NGEPP infrastructure	1	Regular irrigation by water of the site, access roads and construction material to increase moisture to reduce dust without creating runoff.	Contractor	Duration of construction
		2	Transportation of dust raising materials in closed body vehicles or covering material with a tarpaulin will reduce fugitive dust emissions.		
		3	On windy days, or when fugitive dust can be observed leaving the site of works, additional application of water to the affected areas should be applied.		
		4	Material which cannot be watered should be covered until utilized.		
		5	Soil disturbance activities should be stopped during period of high wind speeds.		
Climate change: GHG emissions	Minimise GHG emissions	6	Ensuring regular maintenance of construction equipment to maximise energy efficiency.	Contractor	Duration of construction
		7	As far as possible procure construction materials locally to reduce materials transport distances.		
		8	Plan procurement of materials, equipment and infrastructure to reduce the number of deliveries required.		
		9	Educate construction staff on energy efficiency and the need to reduce energy consumption for example, not to leave equipment idling, turn off any equipment not in use, and make note of any equipment that may not be operating normally or requiring more regular charging/ refuelling.		
Aquatic ecology: Disturbance to wetlands or other freshwater habitat	No impact to wetland or other freshwater habitats	10	Any clearing of vegetation and associated soil disturbance during construction should be limited to essential areas only and exposed soil and soil stockpiles should be protected by covering with a suitable geotextile such as hessian sheeting. It must also be ensured that stockpiles do not exceed 2 m in height. This will aid in prevention of excessive sedimentation and runoff into the Karbochem Spruit.	Contractor	Duration of construction
		11	All construction activities and site clearing should ideally take place during the dry season to limit potential impacts and runoff into the Karbochem Spruit.		
		12	Concrete and cement-related mortars associated with construction activities can be toxic to aquatic life and other biota. Proper handling and disposal of cement on the NGEPP site is considered imperative to minimise or eliminate discharge into the Karbochem Spruit situated downgradient. Measures to minimise contamination include ensuring that mixing of cement should only be undertaken within the construction camp and may not be mixed on bare soil. In addition, it is advised that the mixing of concrete is to be strictly undertaken within a lined, bound or bunded portable mixer.		

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
		13	No waste disposal is to be permitted within the Karbochem Spruit or the stormwater channel within that traverses the eastern boundary of the study site and discharges into the Karbochem Spruit. All waste is to be removed from the study site and disposed of at a registered waste disposal facility. It is further recommended that waste such as wash water should be treated on-site or discharged to a suitable sanitation system to prevent contamination and runoff into the Karbochem Spruit.		
		14	Any concrete spillage outside of the demarcated area on the NGEPP site must be promptly removed and taken to a suitably licensed waste disposal facility.		
Terrestrial biodiversity: Disturbance to terrestrial biodiversity	No impact to off-site terrestrial biodiversity	15	No collection of floral or faunal species may be allowed by construction personnel.	Contractor	Duration of construction
		16	No hunting or trapping of faunal species is to be allowed by construction personnel.		
		17	Informal fires by construction personnel should be prohibited, and no uncontrolled fires whatsoever should be allowed.		
		18	Care should be taken during construction of the proposed development to limit edge effects to surrounding natural habitat. This can be achieved by: • Demarcating of all footprint areas during construction activities. • No construction rubble or cleared alien invasive species are to be disposed of outside of demarcated areas and should be taken to a registered waste disposal facility. • All soils compacted as a result of construction activities should be ripped and profiled and reseeded, where required. • Manage the spread of alien invasive plant (AIP) species, which may affect remaining natural habitat within surrounding areas. Specific mention in this regard is made to Category 1b species identified within the development footprint areas.		
		19	No dumping of litter, rubble or cleared vegetation on site should be allowed. Infrastructure and rubble removed as a result of the construction activities should be disposed of at an appropriate registered disposal facility. No temporary dumpsites should be allowed in areas with natural vegetation. It is advised that waste disposal containers and bins be provided during the construction phase for all construction rubble and general waste. Vegetation cuttings must be carefully collected and disposed of at a separate waste facility.		
		20	Upon completion of construction activities, it must be ensured that no bare areas remain and that indigenous species be used to revegetate the disturbed area.		

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
Noise: Noise generated	Ensure that all possible causes of pollution and potential nuisances (noise, dust, lights, etc.) are mitigated as far as possible to minimise impacts to the surrounding environment.	21	Planning construction activities in consultation with Karbochem and other tenants of the Karbochem Industrial Complex to ensure activities with the greatest potential to generate noise are planned during periods of the day, thereby less likely resulting in a disturbance. Information regarding construction activities should be provided to any I&APs upon request.	Contractor	Duration of construction
		22	All equipment, machines and vehicles to be used onsite during the construction phase are to be the quietest reasonably available and are to be routinely maintained to ensure the effectiveness of the noise suppression systems.		
		23	Through site induction programmes, all construction personal (including contractors) should be informed of their responsibilities and the importance of managing noise levels during the construction phase of the project.		
		24	When working near a potential sensitive receptor, limit the number of simultaneous activities to a minimum as far as possible.		
		25	Any noise-related complaints received during the construction phase are to be registered and result in the implementation of appropriate modified practices.		
Surface water: Disposal of groundwater seepage to the surface water resource impacting aquatic systems		26	Potentially minor seepage from the construction site must be captured and disposed of safely at the Karbochem effluent treatment facility, this is potentially contaminated water and must not be discharged into the surface water resource.	Contractor	Duration of construction
Surface water: Management		27	A detailed storm water management plan (as developed during the detailed design phase) must be implemented during the construction phase. This includes ensuring that that the existing storm water channel continues to drain the minor upstream catchment along the existing servitude.	Contractor	Duration of construction
Archaeological and cultural resources: Loss of resources	No loss of archaeological and cultural resources	28	The following “chance finds” procedure is to be implemented for the construction phase: a) As per the requirements of the National Heritage Resources Act, should any suspected archaeological material be unearthed during construction, all activities are to be halted and Amafa aKwaZulu-Natali (Amafa)[1] alerted of the situation. b) The construction teams should be made aware that archaeological material (e.g. pottery, graves, remains of dwellings, etc.) that often occur underground.	Contractor	Plan compiled prior to construction and implementation for duration of construction

[1] Amafa is the provincial heritage conservation agency for KwaZulu-Natal (email: info@heritage.co.za; tel: 033 394 6543; website: http://www.heritagekzn.co.za).

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
Visual: Loss of aesthetic character of the landscape	Minimal loss of aesthetic character of the landscape	29	Good housekeeping measures (e.g. related to the storage of material, equipment and waste) are to be maintained to minimise potential visual impact to passers-by.	Contractor	Duration of construction
Socio-economic: Employment opportunities	Provide economic opportunities for the local community	30	Opportunities to support and stimulate SMME activity locally are to be maximised, wherever practical.	Contractor	Duration of construction
		31	Local recruitment for skilled and unskilled workers must be maximised, wherever practical.		
		32	Subcontract to local construction companies were feasible.		
		33	Opportunities for skills training are to be optimised, wherever practical.		
Socio-economic: Increase in GDP		34	Opportunities to support and stimulate SMME activity locally are to be maximised, wherever practical.	Contractor	Duration of construction
		35	Subcontract to local SMMEs and BBBEE compliant enterprises for service provides and suppliers were feasible.		
Waste management	Ensure that all construction waste is safely handled and disposed of as per NEM:WA and as far as possible to minimise impacts to the environment.		No on-site waste disposal is permitted.	Proponent and Contractor	Duration of demolition
			All construction wastes (general and hazardous) are to be removed from the study site and disposed of at an appropriately registered waste disposal facility.		
			Liquid waste / effluent such as wash water should be treated on-site or discharged to the Karbochem effluent treatment system.		
			A construction method statement and waste management plan is to be devised by the appointed construction contractor.		

6.4 Operations

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
Air quality: Dust and gas emissions	Reduction of dust and gas emission impacts during operation	1	Require employees to wear Personal Protective Equipment (PPE) in areas of exposure to gaseous emissions.	Proponent	Duration of operation
		2	Regular maintenance will ensure equipment will continue to meet Original Equipment Manufacturer (OEM) specifications and acceptable international emissions standards.		
		3	Isokinetic stack monitoring should take place on an annual basis unless otherwise prescribed in the AEL to determine compliance against the minimum emission standards (MES).		
		4	Development and implementation of a routine ambient air quality monitoring program to determine whether there are any significant increases in emissions and impacts at sensitive receptors as a result of the proposed project. Ambient monitoring for SO_2, NO_2, PM and CO is expected to be a condition of authorisation to the project.		
Climate change: GHG emissions	Minimise GHG emissions	5	Ensure that the plant's thermal efficiency is maximised throughout the life of the plant in order to reduce the gas consumption and therefore the GHG emissions.	Proponent	Duration of operation
		6	Manage changes in operating philosophy or offtake agreement to ensure that the engines only produce as much power as required and therefore reduce emissions. Any decrease in operating time or load factor will result in decreased total annual emissions from the plant.		
		7	Installation of solar/ photo voltaic power to provide backup power and for the projects own use to further reduce emissions intensity of the plant.		
		8	Invest in carbon offset projects through a certified institution to further offset carbon tax liability.		
		9	Create and implement GHG emission reduction projects within local communities as part of Corporate Social Responsibility (CSR) initiatives to further offset carbon tax liability.		
		10	Invest in South African clean energy research and associated projects.		
		11	Develop a GHG management plan to effectively manage and monitor emissions over time. As part of monitoring the following information should be regularly collected: • Total MRG and other fuels consumed. • The amount of oil and lubricant used for maintenance or repair. • The amount of SF6 being refilled into the substation or switch gear.		

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
		12	Use the above information to feed into NGEPP's carbon tax calculations so any reductions will contribute to reducing the carbon tax liability.		
Climate change: Impact of increased temperatures	Minimise impacts on increased temperatures	13	Ongoing trend analysis should be undertaken to ensure that any increase in temperature or times where temperatures exceed the operational limits are identified in sufficient time to make technological improvements to ensure no interruption of supply that may compromise the offtake agreement.	Proponent	Duration of operation
		14	Regular maintenance of the cooling system will be required to ensure limited disruption to supply due to derating at high temperatures.		
Climate change: Impact of decreased annual rainfall or increased drought periods	Minimise impacts on decreased rainfall or increased drought periods	15	Alternatives for air cooling should be investigated to reduce dependence on water. As part of the investigation it is recommended that options to extend the temperature related operational limits also be investigated. This will ensure a greater buffer and an improved guarantee of supply even at expected elevated temperatures.	Proponent	Duration of operation
		16	Should air cooling not be feasible consideration should be given to undertaking a water resource investigation to identify back up water supply should Karbochem be unable provide the required water. In Newcastle given the prediction of extended drought periods but a possibility of increased annual rainfall ground water may prove to be a feasible back up supply option.		
		17	It is strongly recommended that rather than just attenuation, rainwater harvesting be installed to provide additional water resources and address any limitations to the supply of water.		
Climate change: Impact of increased fire days, intense thunderstorms and damaging flood events	Minimise impacts on increased fire days, intense thunderstorms and damaging flood events	18	To address risks of lightning strikes, design should include appropriate lightning protection for all infrastructure including the engines, substations and transmission lines.	Proponent	Duration of operation
		19	Storm water management planning should be reviewed every 5 years to enable adaptation to changes in rainfall patterns. The design should allow sufficient space should additional attenuation to be constructed should it become necessary.		
		20	It is strongly recommended that rather than just attenuation, rainwater harvesting be installed to provide additional water resources and address any limitations to the supply of water. As above the design should allow for the expansion of storage capacity should it become necessary.		
Aquatic ecology: Disturbance to wetlands or	No impact to wetland or other	21	No waste disposal is to be permitted within the Karbochem Spruit or the stormwater channel within that traverses the eastern boundary of the study site and discharges into the Karbochem Spruit. All waste is to be removed from the study site and disposed of at a registered waste disposal facility. It is further recommended that waste such as	Proponent	Duration of operation

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
other freshwater habitat	freshwater habitats		wash water should be treated on-site or discharged to a suitable sanitation system to prevent contamination and runoff into the Karbochem Spruit.		
		22	General good housekeeping must be ensured at all times in order to prevent spills, potential leakage and runoff of hazardous chemicals associated with the NGEPP into the Karbochem Spruit. No waste must be disposed into the stormwater channel and appropriate waste disposal facilities should be allocated as part of the NGEPP project.		
Terrestrial biodiversity: Disturbance to terrestrial biodiversity	No impact to terrestrial biodiversity	23	Informal fires by operational personnel should be prohibited, and no uncontrolled fires whatsoever should be allowed.	Proponent	Duration of operation
		24	Ongoing alien and invasive plant monitoring and clearing/control should take place throughout the operational phase, and the project perimeters should be regularly checked for AIP establishment to prevent spread into surrounding natural areas.		
Noise: Noise generated	Ensure that all possible causes of pollution and potential nuisances (noise, dust, lights, etc.) are mitigated as far as possible to minimise impacts to the surrounding environment.	25	Ensure that all gas engines are located within brick walled buildings.	Proponent and Design Engineer	Duration of operation
		26	Ensure that exhaust silencers are installed across all engines.		
		27	Undertaking maintenance and repairs for equipment and prioritising quieter models/options.		
		28	Ambient noise monitoring campaign to be undertaken once the NGEPP is operational to confirm/refine changes in noise levels at sensitive receptors.		
		29	Avoid unnecessary noise, such as shouting, the use of horns, loud site radios, rough handling of material and equipment.		
		30	Require employees to wear Personal Protective Equipment (PPE) in noisy areas.		
		31	Any noise-related complaints received during the operational phase are to be registered and result in the implementation of appropriate modified practices.		
		32	If required, investigate the use of installing acoustic barriers around noisy operations at the plant.		
Safety management	Appropriate safety risk management design	33	The key safety risks assessed are associated with: • Loss of containment of methane rich gas under pressure resulting in jet fires and explosions. • LNG ISO container failure causing loss of containment under pressure resulting in fires and explosions	Proponent	Duration of operation

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
			• LNG pipeline failure causing loss of containment resulting in fires and explosions • LNG storage causing loss of containment resulting in fires and explosions • LNG vaporisers causing loss of containment resulting in fires and explosions Management measure for all of the above are required to be incorporated into the designs and approvals of the facilities (including MHI approval). In this regard, refer to Section 6.1, ID no. 11, for impact management actions required at the design phase. Maintenance of the facilities, in accordance with the design, as well as compliance with MHI approval (assuming such) will be essential throughout the operational phase of the NGEPP.		
Groundwater and surface water	Avoid spillage from the chemical storage tanks and other potential contamination sources contaminating surface and groundwater resource	34	All chemical storage facilities are to be bunded and material handled and stored is a safely according to MSDS and related guidelines. Any other potential contamination sources (e.g. sumps) are to be engineered to prevent leakages and seepage to groundwater resource.	Proponent	Duration of operation
		35	Water monitoring to be carried out to ensure water contamination is recorded, and management strategies are implemented timeously. In this regard, a surface and groundwater monitoring network for the NGEPP must be established and maintained as follows (see Figure 8-1 in the hydrogeological report, Appendix G-7): • A minimum of five (5) borehole pairs should be installed into shallow (15 m) and deep (30 m) aquifers for adequate coverage of the NGEPP and LNG facilities. • Two surface water monitoring stations should be established on the stormwater drainage upgradient (SW1) and downgradient (SW2) of the site for surface water monitoring. • Sampling and analysis of water quality should be conducted monthly during construction, monthly for the first six month following NGEPP construction, followed by quarterly and then bi-annually depending on the results of the first six month during operation. • Based on this study results, water samples should be analysed for Physiochemical Properties (pH, EC, TDS and Alkalinity), Major ions and Trace metal (including Al, B, Ba, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Sb, Se, Sr. Ti, U, V and Zn). • Monitoring should be systematic and consistent so that meaningful interpretations can be made of the datasets. • All monitoring data should be compiled on a database for easy access and interpretation.		
Socio-economic:	Provide economic	36	Opportunities to support and stimulate SMME activity locally are to be maximised, wherever practical.	Proponent	Duration of operation

Aspect & Impact	Impact Management Outcomes	ID	Impact Management Actions	Responsible	Implementation Timeframe
Employment opportunities	opportunities for the local community	37	Local recruitment for skilled and unskilled workers must be maximised, wherever practical.		
		38	Subcontract to local SMMEs and BBBEE compliant enterprises for service provides and suppliers were feasible.		
		39	Opportunities for skills training are to be optimised, wherever practical.		
Socio-economic: Increase in GDP	Provide economic opportunities for the local community	40	Opportunities to support and stimulate SMME activity locally are to be maximised, wherever practical.	Proponent	Duration of operation
		41	Subcontract to local SMMEs and BBBEE compliant enterprises for service provides and suppliers were feasible.		
Waste management	Ensure that all operational waste is safely handled and disposed of as per NEM:WA and as far as possible to minimise impacts to the environment.		No on-site waste disposal is permitted.	Proponent	Duration of operation
			All operational phase wastes (general and hazardous) are to be removed from the study site and disposed of at an appropriately registered waste disposal facility.		
			Liquid waste / effluent must discharged to the Karbochem effluent treatment system.		
			An operational phase waste management plan is to be compiled and implemented.		

7 Monitoring and Auditing

In accordance with Items 1(g), (h), (k) and (l) of Appendix 4 of GN 326, this chapter provides:

- The method and frequency of monitoring implementation of the impact management actions.
- The mechanism for monitoring compliance with the impact management actions and a program for reporting on compliance.

The key to successful implementation of the EMPr is appropriate monitoring and review to ensure effective functioning of the EMPr and to identify and implement corrective measures in a timely manner. All the results obtained during environmental monitoring must be documented for audit purposes.

7.1 Implementation Monitoring

Newcastle Energy or it's delegated representative i.e. the appointed Demolition/Construction Project Manager or Principal Contractor, is to delegate or appoint a suitable person to act as the Environmental Officer (EO).

The role of the EO is to monitor implementation of the EMPr during the demolition, construction and operational phases (refer to Table 5-1 for the responsibilities of the EO).

Ideally, the EO will be on-site full-time and may have other duties e.g. health and safety officer (note the role of EO will likely be fulfilled by a different person during the construction and operational phases).

The method and frequency of monitoring by the EO is specified in Table 7-1.

Table 7-1: Implementation Monitoring Method and Frequency

Project Phase	Monitoring Method	Reporting Frequency
Pre-construction	• Preparation of an audit checklist. • Site inspection with the ECO and construction management team. • Provide environmental awareness training for all construction workers. • Pre-construction audit checklist and action items distributed to the construction management team and ECO.	Once off
Demolition and Construction	• Regular site inspections (weekly as a minimum). • Attend and report at construction management team meetings. • Provide environmental awareness training, as required. • Review monitoring results. • Weekly audit checklist and action items distributed to the construction management team and the ECO.	Weekly
Post-construction	• Final site inspection and meeting with the ECO and construction management team. • Final post-construction audit checklist and action items distributed to the construction management team and ECO.	Once-off
Operation	• Regular site inspections (monthly as a minimum). • Provide environmental awareness training for staff, as required. • Monthly audit checklist and action items distributed to the operations management team and made available to the ECO at the annual audit.	Monthly
Decommissioning	• Ensure that a Closure and Rehabilitation Plan, including a monitoring and auditing schedule, is prepared and submitted to DFFE for approval at least 12 months prior to closure of the plant.	Once off

7.2 Compliance Monitoring and Reporting

Newcastle Energy is to appoint an independent person with the relevant environmental auditing expertise to undertake compliance audits i.e. the Environmental Control Officer (ECO) (refer to Table 5-1 for further details on the responsibilities of the ECO).

The mechanism for monitoring compliance with the EMPr and a program for reporting on compliance is specified in Table 7-2**.**

Table 7-2: Compliance Monitoring and Reporting

Project Phase	Monitoring Method	Monitoring Frequency	Reporting Frequency
Pre-demolition and construction	• Notify DFFE of the ECO appointment and the construction commencement date and provide a schedule of site audit visits (for DFFE attendance). • Review of the EMPr checklist prepared by the EO. • Advice to the EO for environmental awareness training. • Site inspection with the EO and construction management team. • Review of the pre-construction EMPr checklist and action items prepared by the EO. • Prepare the pre-construction environmental audit report for submission to DFFE. • Notify all potential interested and affected parties (I&APs) of the availability of the audit report for review.	Once off	Once off
Demolition and Construction	• Review of the weekly EMPr checklists and action items prepared by the EO. • Ad-hoc advice to the EO. • Fortnightly site inspections with the EO during earthworks. • Monthly site inspections with the EO after completion of earthworks. • Attend construction management team meetings when aligned to site inspection visits and review meeting minutes. • Review monitoring results. • Prepare monthly audit reports for submission to DFFE. • Notify I&APs of the availability of the audit report for review.	Fortnightly / Monthly	Monthly
Post-construction	• Final site inspection and meeting with the EO and construction management team. • Review of the final post-construction audit checklist and action items prepared by the EO. • Prepare the final close-out environmental audit report for submission to DFFE. • Notify I&APs of the availability of the audit report for review.	Once-off	Once-off
Operation	• Site inspection with the EO and review of site records. • Review of the monthly audit checklists prepared by the EO. • Review of relevant management plans and monitoring results.	Annual	Annual

Project Phase	Monitoring Method	Monitoring Frequency	Reporting Frequency
	• Prepare an annual environmental audit report for submission to DFFE. • Notify all potential I&APs of the availability of the audit report for review.		
Decommissioning	• Compliance auditing and reporting as per the approved requirements at that time (i.e. future legal requirements).	To be determined	To be determined

8 Environmental Awareness Plan

A detailed environmental awareness plan will be developed once all relevant authorisations for the proposed Newcastle Energy plan have been obtained.

The plan will address the following items:

- Basic environmental awareness.
- Specific environmental responsibilities associated with each position.
- Training on chemical hazards.
- Emergency training.
- Resources available for use in personnel environmental awareness training.

All personnel working at the Newcastle Energy (including Contractors and site staff) will be required to undertake an induction course that focusses on health, safety and environmental issues. This is to include environmental training in terms of the actions stipulated in this EMPr which are applicable to specific activities.

9 Amendments

Amendments to the EMPr may be required as the project phases proceed. The correct procedure to be followed for a proposed amendment of the EMPr is to be confirmed with DFFE prior to implementation of the amendment.

10 Newcastle Energy Acceptance

[**Note**: Final EMPr will be signed by the Proponent.]

I, _____, (full name) representing

_____, (company name) have read, understood and accept the above environmental management programme as a framework for my company's environmental performance during the above mentioned activities.

Name: _____ Date:_____

Signature: _____

Prepared by

Tamaryn Hale (Pr.Sci.Nat. EAP)

Senior Environmental Scientist

Reviewed by

Marius van Huyssteen

Principal Environmental Scientist / Partner

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

Appendices

Appendix A: Curriculum Vitae of Environmental Assessment Practitioner

Marius van Huyssteen

Partner / Principal Environmental Scientist

Profession	Principal Environmental Scientist
Education	BSc, Cellular, Molecular & Chemical Sciences, University of Cape Town, 2002
	BSc (Hons), Geography & Environmental Management, University of Natal, 2003
	Environmental Vegetation Management, New Africa Skills Development (Pty) Ltd, 2006
	Aspects International - Environmental Auditors Course, ISO14001, 2007
	Project Management, Engineers & Technical Professionals, The Essential Principles of Project Management, Effective Human Interventions, 2009
	AVCASA Crop Protection Course, Tshwane University of Technology, 2010
	RiskZA - Environmental Auditors Course, ISO14001:2015, 2019
Registrations/ Affiliations	Certified Environmental Assessment Practitioner (EAP) with the Interim Certification Board for Environmental Assessment Practitioners, South Africa
	Member, IAIA South Africa

Specialisation

Environmental project management, environmental management, environmental auditing and compliance (incl. due diligence work), environmental impact assessment (EIAs), environmental management plans (EMPs), stakeholder engagement facilitation, mine closure and rehabilitation planning.

Expertise

Marius van Huyssteen is a Principal Environmental Scientist and Partner with over 16 years experience, primarily in South Africa, but also in Africa (including DRC, Sierra Leone, Lesotho and Mozambique). Marius' expertise lies predominantly in undertaking and managing large scale Environmental and Social Impact Assessments (ESIA) and environmental compliance / auditing projects compliant with in country legislation as well as Lender Standards (as required). In addition, he provides technical and/or review capabilities to SRK Teams working on risk assessment, due diligence, sustainability and mine closure and rehabilitation studies. He has worked on a wide range of projects, notably in the mineral sand mining industry, off-shore telecommunications cables, renewable energy projects, light and heavy industrial developments, bulk material storage and handling facilities and electrical distribution infrastructure development.

Employment

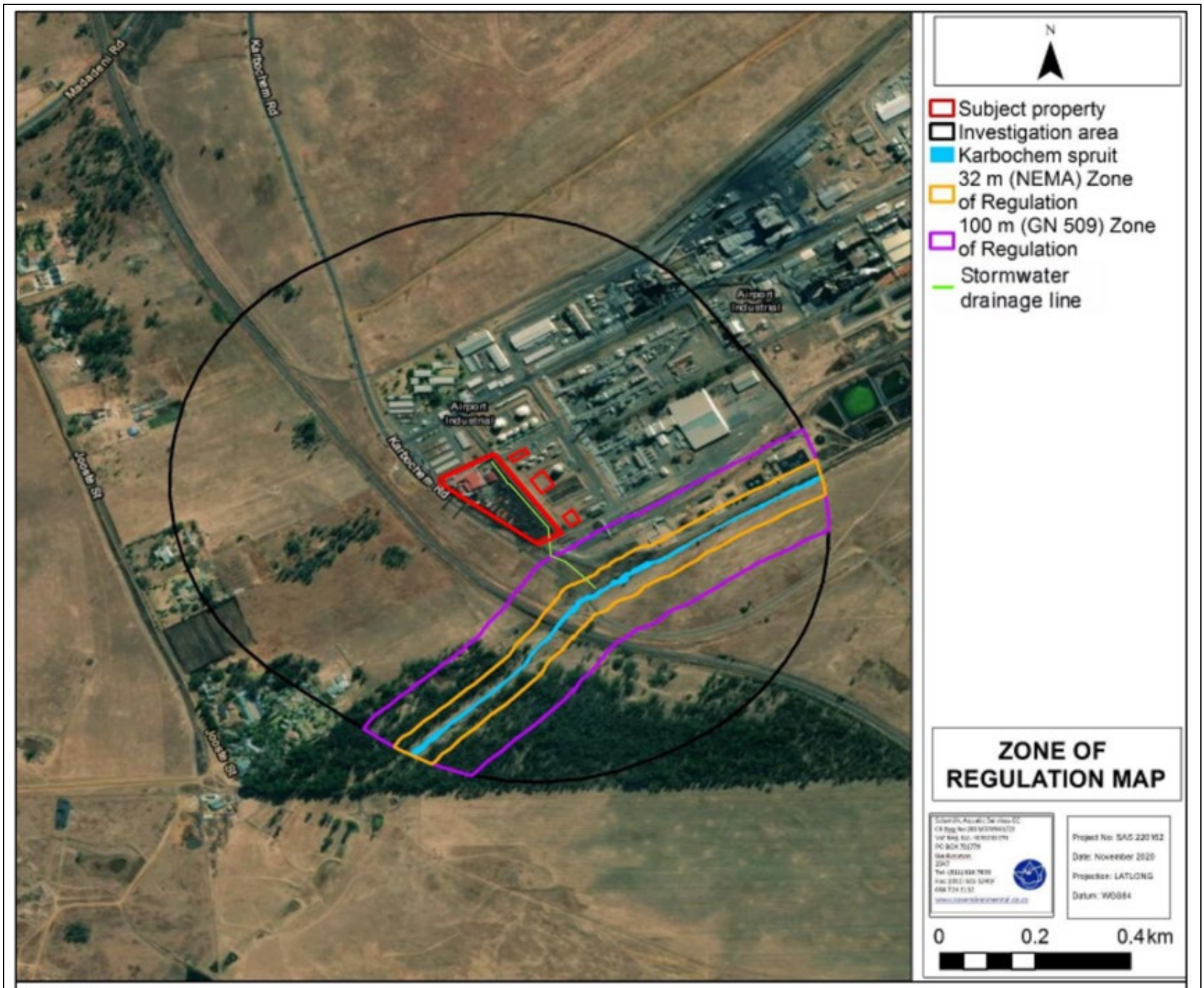
Nov 2019 - Present	SRK Consulting (Pty) Ltd, Partner, Durban
Nov 2016 - Oct 2019	SRK Consulting (Pty) Ltd, Associate Partner, Durban
Jan 2014 - Oct 2016	SRK Consulting (Pty) Ltd, Principal Environmental Scientist, Durban
Apr 2009 - Dec 2013	SRK Consulting (Pty) Ltd, Senior Environmental Scientist, Durban
Mar 2004 - Mar 2009	SRK Consulting (Pty) Ltd, Environmental Scientist, Durban

Languages

English – read, write, speak

Afrikaans – read, write, speak

Appendix B: Environmental Sensitivities Map



NOTES:

1) Noise levels in the immediate vicinity of the operational activities are predicted to be high, as would be expected. At distances greater than 25 m from the source (approximate location of the fenceline), noise levels reduce considerably. As such, the "Subject Property" polygons indicate the primary noise affected areas.
2) All maximum period average and short term (P99 1-hour and 24-hour) average concentrations for NO_2, PM_{10}, CO and NMHC (modelled as benzene) demonstrate full compliance with the respective National Ambient Air Quality Standards (NAAQS) at all receptors. As such, no air emissions detail is included in this composite map.

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Figure B-1: Sensitive environmental features in the vicinity of the site (Source: adapted from SAS Zone of Regulation Map (SAS, 2020a))