DRAFT BASIC ASSESSMENT REPORT

PROPOSED CHROME TANNING SALTS AND VITAMIN K COMPOUNDS PRODUCTION FACILITY

FOR:

BROTHER CISA, NEWCASTLE, KWAZULU-NATAL

KZN EDTEA REF:
DC25/0004/2020

NEAS reference number (EIA):
KZN/EIA/0001344/2020

September 2020

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R No 2009/014472/07

PROJECT INFORMATION SHEET

PROJECT:
Proposed Chrome Tanning Salts and Vitamin K Compounds Production Facility, Brother CISA, Newcastle, Kwazulu-Natal

APPLICANT:
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KZN EDTEA reference number: DC25/0004/2020
NEAS reference number (EIA): KZN/EIA/0001344/2020

REPORT STATUS: Basic Assessment Report for review and comment by interested and affected parties

EXECUTIVE SUMMARY

INTRODUCTION

Brother CISA (Pty) Ltd (hereinafter referred to as the Brother CISA) has commissioned the services of EScience Associates (Pty) Ltd. (hereinafter referred to as 'EScience Associates' or 'EScience'), as an independent Environmental Assessment Practitioner (EAP), to conduct an Environmental Impact Assessment (EIA) process as part of the environmental permitting applications for the proposed expansion of its existing product range at its Newcastle plant in KwaZulu Natal.

Brother CISA proposes to establish an inorganic and an organic process producing 50 000 t/a of inorganic chrome tanning salts and 30 000 t/a of organic chrome tanning salts respectively, as well as production of 2 000 t/a of synthetic vitamin K compounds.

LEGISLATIVE CONTEXT

The establishment and operation of the proposed activities at the facility may not commence prior to obtaining an Environmental Authorisation in terms of Section 24 of the National Environmental Management Act (Act 107 of 1998) (NEMA). Section 24(1) of the National Environmental Management Act (Act 107 of 1998) {NEMA} requires applicants to consider, investigate, assess, and report the potential environmental impact of these activities. The requirements for the investigation, assessment and communication of potential environmental impacts are contained in the so-called NEMA EIA regulations, GN.R 982 of 14 December 2014, as amended.

The proposed activities are 'listed' in terms of GN. R. 983 of December 2014, as amended (Listing Notice 1) as activities that require Environmental Authorisation prior to the commencement thereof, as detailed in below table.

NEMA Listed Activities applicable to the proposed project		
NEMA LISTING NOTICE 1 - GN983 of 2014, as amended		
Activity Number	**Activity Description**	**Reason**
34	*"The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding—* *…*	The facility's AEL will need to be amended.
51	*The expansion and related operation of facilities for the storage, or storage and handling, of a dangerous good, where the capacity of such storage facility will be expanded by more than 80 cubic metres.*	Dangerous goods storage capacity will be increased to accommodate various raw materials, intermediary products, and final products.

The facility will require an amendment of its Atmospheric Emissions Licence due to the triggering of the following activities listed in terms of Section 21 of the Air Quality Act (NEMAQA), 2004 (Act 39 of 2004) in GN 893:2013, as amended:

NEMAQA Listed Activities applicable to the proposed project		
Activity Number	**Activity Description**	**Reason**
Category 7: Inorganic Chemicals Industry Subcategory 7.2: Production of Acids	*The production, bulk handling and use in manufacturing of hydrofluoric, hydrochloric, nitric and sulphuric acid (including oleum) in concentration exceeding 10%.* *Processes in which oxides of sulphur are emitted through the production of acid sulphites of alkalis or alkaline earths or through the production of liquid sulphur or sulphurous acid.* *Secondary production of hydrochloric acid through regeneration.*	Brother CISA proposes to use more than 100 tonnes/annum of sulfuric acid (H_2SO_4) in their chromium salts manufacturing process.
Category 7: Inorganic Chemicals Industry Subcategory 7.4: Production, Use in Production or Recovery of Antimony, Arsenic, Beryllium, Cadmium, Chromium, Cobalt, Lead, Mercury, and or Selenium, by the Application of Heat	*Production, use or recovery of antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, mercury, selenium, thallium and their salts not covered elsewhere, excluding their use as catalyst.*	Brother CISA proposes to produce more than 1 ton Chrome Tanning Salts per month.

COMPETENT AUTHORITIES

The competent authority in respect of the application for Environmental Authorisation is the KwaZulu Natal Department of Economic Development, Tourism and Environmental Affairs (KZN EDTEA).

The competent authority in respect of the Atmospheric Emissions Licence Amendment Application is the Amajuba District Municipality.

METHODOLOGY

The focus of the Basic Assessment process is to assess the potential impacts resulting from the project and to assign suitable management measures, where possible, to abate the identified impacts to within acceptable levels.

The impacts have been assessed and the assessment supplemented with specialist inputs where necessary. No environmental or socio-economic fatal flaws have been identified for the proposed project to date.

Specialist studies conducted:

- Air Quality Impact Assessment;
- Archaeological Impact Assessment;
- Palaeontological Impact Assessment;
- Major Hazard Installation Risk Assessment;
- Aviation Impact Assessment

Environmental Impact Assessment aims to ensure effective compliance and governance concerning the sustainable use of environmental resources, while simultaneously focusing on key issues such as stakeholder empowerment, providing access to relevant and concise information to enable informed decision-making. This BA Report was compiled through the execution of a methodology set out to produce a report in compliance with the requirements of GN. R.982, as amended, in terms of Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998, as amended) [NEMA].

PUBLIC PARTICIPATION

Public Participation undertaken to date includes:

- Pre-identification of interested and affected parties (IAPs).
- Advertising the proposed project and associated Basic Assessment process as follows (See Appendix 2.2):
    - English and isiZulu advertisements in the Newcastle Advertiser published on Friday 3rd July 2020;
    - English and isiZulu advertisements in The Star published on Thursday 2nd July 2020;
    - Zulu advertisements in the Amajuba Eyethu (a local isiZulu newspaper) published on 17th July 2020
    - isiZulu announcements on Radio NN and Abusekho Ubunzima Christian Radio on 25th August 2020;
- English and isiZulu A2-size site notices erected at the following locations (See Appendix 2.1 for proof of these notices):
    - The entrance to Newcastle Chemicals Complex;
    - The intersection of the Madadeni Road and Karbochem Road to be visible to pedestrians ;
    - The entrance to Roy Point cemetery;
    - A high foot traffic area near Newcastle Mall;
    - Outside the Boxer Superstore in Madadeni.

The following is to be undertaken through and after distribution of the draft BAR to IAPs:

- Communication with Amajuba District Municipality, Newcastle Local Municipality and all other relevant state Departments that administer laws relating to a matter affecting the environment;
- Distribution of Draft Basic Assessment Report (BAR) for public review for 30 days;
- Addressing of comments made by IAPs on BAR;
- Submission of Final Basic Assessment Report to Competent Authority;

SUMMARY OF ENVIRONMENTAL IMPACTS

A summary of the impact assessment is presented in the table below. It is clear that the impacts of the proposed upgrades, with mitigation are all anticipated to be low, negligible or positive.

Summary of Environmental Impacts		
Construction phase:	**Impact**	**Impact significance with mitigation**
Potential general waste generation during construction phase	-	Negligible
Potential impacts on groundwater resources through accidental leaks and spillages of hazardous materials (particularly hydrocarbons, e.g. diesel, oil) during construction activities	-	Negligible
Potential impacts on surface water resources through accidental leaks and spillages of hazardous materials (particularly hydrocarbons, e.g. diesel, oil) during construction activities	-	Negligible
Potential impacts on soil through accidental leaks and spillages of hazardous materials (particularly hydrocarbons, e.g. diesel, oil) during construction activities	-	Negligible
Potential Air Quality Impacts through dust generation	-	Negligible
Potential noise generation during construction phase	-	Negligible
Socio-economic Impact through creation of temporary / short-term employment opportunities during the construction phase	+	Moderate (Positive)
Archaeological		Negligible (Refer to section 0)
Palaeontological		Negligible (Refer to section 8.3)
Operational phase:	**Impact**	**Impact significance with mitigation**
Air quality	-	Acceptably Low (Refer to section 8.1)
Traffic	-	Low

Summary of Environmental Impacts		
Emergency Incident	-	Societal Risk Acceptably Low (Refer to section 8.4)
Potential impacts on groundwater resources through accidental leaks and spillages of hazardous materials during operations	-	Negligible
Potential impacts on surface water resources through accidental leaks and spillages of hazardous materials during operations	-	Negligible
Potential impacts on soil through accidental leaks and spillages of hazardous materials during operations	-	Negligible
Socio-economic Impact through creation of employment opportunities during operations	+	Moderate (Positive)
Aviation	-	Negligible (Refer to section 8.5)
Decommissioning phase:	**Impact**	**Impact significance with mitigation**
Potential general waste generation during decommissioning phase	-	Negligible
Potential impacts on groundwater resources through accidental leaks and spillages of hazardous materials (particularly hydrocarbons, e.g. diesel, oil) during decommissioning activities	-	Negligible
Potential impacts on surface water resources through accidental leaks and spillages of hazardous materials (particularly hydrocarbons, e.g. diesel, oil) during decommissioning activities	-	Negligible
Potential impacts on soil through accidental leaks and spillages of hazardous materials (particularly hydrocarbons, e.g. diesel, oil) during decommissioning activities	-	Negligible
Potential Air Quality Impacts through dust generation	-	Negligible
Potential noise generation during decommissioning phase	-	Negligible
Socio-economic Impact through creation of temporary / short-term employment opportunities during the decommissioning phase	+	Moderate (Positive)

CONCLUSION

The main objective of this report was to identify and discuss issues of potential environmental significance, and where possible, indicate the significance of those impacts. The identification and assessment of environmental impacts, for each project phase, shows that these impacts can be effectively managed with the proposed mitigation measures in place.

It is the professional opinion of the EAP that the EIA process undertaken for the project to date has been procedurally correct, in terms of, *inter alia,* the requirements outlined in Government Notice No. 982 of 4 December 2014, as amended. The EAP, furthermore, believes that the significant issues that may potentially be realised through the possible authorisation of the project by the Competent Authority have indeed been identified to the best practical extent. The EAP also believes that the information provided in this BA Report is sufficient /substantive for IAPs to contribute meaningfully to the EIA process thus far (as required by Government Notice 982) and for the competent authority (CA) to make an informed decision as to whether, or not activity should be authorised. It is, therefore, the EAPs recommendation that the CA approve this activity based on the substantive content provided in the report itself.

In cognisance of the low significance of potential impacts, and the long-term environmental benefits of the proposed activities, it is the recommendation of the EAP that the proposed activities be authorised.

The potential negative impacts of the proposed activities are all deemed to be low or negligible and adequate practical mitigation measures are stipulated in the Environmental Management Programme.

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ABBREVIATIONS

AIA	Archaeological Impact Assessment
ASAPA	Association of Southern African Professional Archaeologists
CAA	Civil Aviation Authority
CARS	Civil Aviation Regulations
CATS	Civil Aviation Technical Standards
CTS	Chrome Tanning Salts
DEFF	Department of Environment Forestry and Fisheries
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act, Act No. 73 of 1989
ECO	Environmental Control Officer
EIR	Environmental Impact Report
EMF	Environmental Management Framework
EO	Environmental Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme Report
FANC	Newcastle Airport (International Civil Aviation Organization airport code)
GA	General Aviation
GN	Government Notice
IAPs	Interested and Affected Parties
ICAO	International Civil Aviation Organisation
LED	Local Economic Development
MagI	Metres above ground level
mamsl	Metres above mean sea level
MHI	Major Hazard Installation
NEMA	National Environmental Management Act, No. 107 of 1998 NEMA EIA
NEMA EIA Regulations	Regulations GN R. 982, R. 983, R. 984 and R. 985 (December 2014), as amended promulgated in terms of Section 24(5) read with Section 44, and Sections 24 and 24D of the National Environmental Management Act, 1998
NEMAQA	National Environmental Management: Air Quality Act (Act 39 of 2004)
NEMWA	National Environmental Management: Waste Act, Act No. 59 of 2008
NHRA	National Heritage Resources Act (Act 25 of 1999)
NOTAMs	Notices to Airmen
NWA	National Water Act, Act No. 36 of 1998
PIA	Palaeontological Impact Assessment
RWY	Runway
SABS	South African Bureau of Standards
SACAA	SA Civil Aviation Authority
SDC	Sodium Dichromate
SMC	Sodium Monochromate

1 INTRODUCTION

1.1 BACKGROUND

Brother CISA (Pty) Ltd (hereinafter referred to as Brother CISA) has commissioned the services of EScience Associates (Pty) Ltd. (hereinafter referred to as 'EScience Associates' or 'EScience'), as an independent Environmental Assessment Practitioner (EAP), to conduct a Basic Assessment (BA), in accordance with the environmental regulatory process for environmental permitting applications, for the proposed expansion of their existing product range at their Newcastle plant in KwaZulu Natal.

The Brother CISA chrome chemicals facility is situated within the Newcastle Chemicals Park. The plant is authorised to produce various chrome chemicals products which include sodium dichromate (SDC), chromic acid, and chrome oxide. The plant was founded in 1996 and went into operation in 1998. It currently has an authorised production capacity of 140 000 tonnes per annum (t/a) of SDC equivalents (this includes 15 000 t/a of chromic acid, and 20 000 t/a of chrome oxide) and 20 000 t/a of sodium sulphate, as per environmental authorisation reference number DC25/0006/08/ AMND/2010.

Brother CISA proposes to establish an inorganic and an organic process producing 50 000 t/a of inorganic chrome tanning salts (CTS) and 30 000 t/a of organic CTS respectively, as well as production of 2 000 t/a of synthetic vitamin K compounds.

1.2 PURPOSE OF BASIC ASSESSMENT

The proposed expansion requires an Environmental Authorisation in terms of The National Environmental Management Act, 1998 (Act No. 107 of 1998, as amended) (NEMA), as well as an amended Atmospheric Emissions Licence in terms of the National Environmental Air Quality Act (NEMAQA) {Act 39 of 2004, as amended}.

As a result, a Basic Assessment process must be undertaken to inform application for these licences. These and other environmental legal requirements are detailed in section 4 of this report.

The objective of the environmental impact assessment process is to, through a consultative process—

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

b. degree to which these impacts—
    i. can be reversed;
    ii. may cause irreplaceable loss of resources, and
    iii. can be avoided, managed or mitigated;

e) identify the most ideal location for the activity based on the lowest level of environmental sensitivity identified during the assessment;
f) identify, assess, and rank the impacts the activity will have through the life of the activity;
g) identify suitable measures to avoid, manage or mitigate identified impacts; and
h) identify residual risks that need to be managed and monitored

The proposed activities are 'listed' in terms of GN. R. 983 of December 2014, as amended (Listing Notice 1) as activities that require Environmental Authorisation prior to the commencement thereof, as detailed in Table 1-1.

Table 1-1: NEMA Listed Activities applicable to the proposed project

NEMA LISTING NOTICE 1 - GN983 of 2014, as amended		
Activity Number	**Activity Description**	**Reason**
34	*"The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding—* *(i) where the facility, infrastructure, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies;* *(ii) the expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or* *(iii) the expansion is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will be increased by 50 cubic meters or less per day."*	The facility's AEL will need to be amended to include the proposed activities.
51	*The expansion and related operation of facilities for the storage, or storage and handling, of a dangerous good, where the capacity of such storage facility will be expanded by more than 80 cubic metres.*	Dangerous goods storage capacity will be increased to raw materials, intermediary products and final products.

Activities under listing notice 1 require a Basic Assessment process to be undertaken whereas activities under listing notice 2 require a Scoping and EIA process to be undertaken.

The competent authority in respect of the application for Environmental Authorisation is the KwaZulu Natal Department of Economic Development, Tourism and Environmental Affairs (KZN EDTEA)

The facility will require an amendment of its Atmospheric Emissions Licence to include the triggering of the following activities listed in terms of Section 21 of the Air Quality Act (NEMAQA), 2004 (Act 39 of 2004) in GN 893:2013, as amended:

Table 1-2: NEMAQA Listed Activities applicable to the proposed project

Activity Number	Activity Description	Reason
Category 7: Inorganic Chemicals Industry Subcategory 7.2: Production of Acids.	*The production, bulk handling and or use in manufacturing of hydrofluoric, hydrochloric, nitric and sulphuric acid (including oleum) in concentration exceeding 10%.* *Processes in which oxides of sulphur are emitted through the production of acid sulphites of alkalis or alkaline earths or through the production of liquid sulphur or sulphurous acid.* *Secondary production of hydrochloric acid through regeneration.*	Brother CISA proposes to use more than 100 tonnes/annum of sulfuric acid (H_2SO_4) in their chromium salts manufacturing process.
Category 7: Inorganic Chemicals Industry Subcategory 7.4	*Production, Use in Production or Recovery of Antimony, Arsenic, Beryllium, Cadmium, Chromium, Cobalt, Lead, Mercury, and or Selenium, by the Application of Heat*	Brother CISA proposes to produce more than 1 ton Chrome Tanning Salts per month.

The competent authority in respect of the AEL Amendment Application is the Amajuba District Municipality.

1.3 LOCATION AND SITE DESCRIPTION

The Brother CISA chrome chemicals facility is situated within the Newcastle Chemical Park, Karbochem Road, Newcastle, in northern KwaZulu Natal.

Refer to Figure 1-1 for location of the facility, and Table 1-3 for further details of the site.

Table 1-3: Location and extent of the plant

Physical Address of the Plant	1 Karbochem Road, Newcastle, 2940
Description of Site (Where No Street Address)	N/A
Coordinates of Approximate Centre of Operations	Latitude: 27.780936°S; Longitude: 29.976462°E
Extent (km^2)	0.327
Elevation Above Mean Sea Level	1240
Province	Kwazulu-Natal
Metropolitan/District Municipality	Amajuba District Municipality
Local Municipality	Newcastle Local Municipality

Brother CISA's operations are undertaken on the properties listed in Table 1-4 below. The properties belong to the applicant.

Table 1-4: List of Properties	
Property Registration Number (Surveyor-General Code)	(K252)NOHS 0221 0001 5432 000000
	(K252)NOHS 0221 0001 3661 000020
	(K252)NOHS 0221 0001 3661 000030
	(K252)NOHS 0221 0001 3661 000060
	(K252)NOHS 0221 0001 3661 000050
	(K252)NOHS 0221 0001 3744 000030

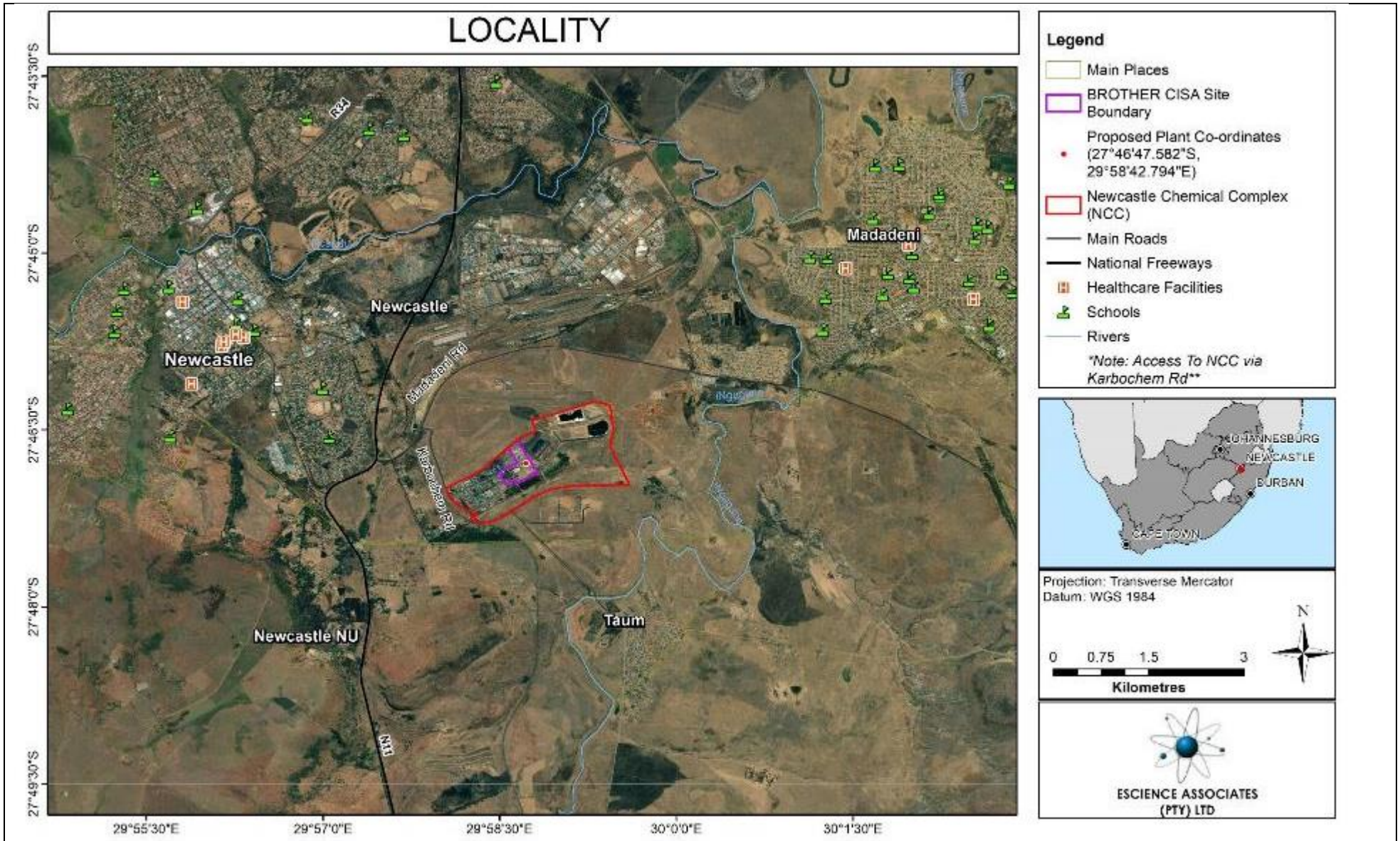


Figure 1-1: Regional Locality Map

1.4 ADMINISTRATIVE INFORMATION

The following section and associated set of tables provides pertinent administrative information pertaining to the Applicant, the Environmental Assessment Practitioner who developed the Basic Assessment Report, as well as the Competent Authority (Table 1-5 to Table 1-8).

CV's of the EAPs are provided in Appendix 1 to this report.

Table 1-5: Name and Address of Proponent	
Company Name	Brother CISA (Pty) Ltd
Company Registration	1996/014329/07
Physical Address	Newcastle Chemical Park, Karbochem Road, Newcastle, KZN
Postal Address	Private Bag X6600, Newcastle, 2940
Telephone	034 370 7000
Contact person:	Jacque Hunlun
Position	EH & S Manager
Telephone:	034 370 7005
E-mail:	jacque.hunlun@brothercisa.com

Table 1-6: Details of EAP	
Name of Company	EScience Associates (Pty) Ltd.
Contact Person	Abdul Ebrahim
Postal Address	PO Box 2950, Saxonwold, Johannesburg, 2132
Physical Address	9 Victoria Street, Oaklands, Johannesburg, 2192
Telephone	(011) 718 6380
Email	abdul@escience.co.za

Table 1-7: Qualifications and Experience of the EAPs		
Name	Qualification and Professional Affiliations	Experience
Abdul Ebrahim	BEng (Hons) Environmental Engineering Certified EAP Member of the Engineering Council of South Africa	20 Years
Sam Leyde	BSc Honours Mechanical Engineering	6 Years
James Pugin	MSc Archaeology BSc (Hons) Archaeology BA Geography and Archaeology	3 Years

Table 1-8: Details of the Competent Authority	
Competent Authority	KZN Department of Economic Development, Tourism and Environmental Affairs (KZN EDTEA).
Telephone	034 328 0300
E-mail:	poovie.moodley@KZN EDTEA.gov.za
Physical Address	Newcastle Regional Office 43 Hardening St, Newcastle
Assessing officer:	Ms. Bongiwe Msomi
E-mail:	Bongiwe.Msomi@KZN EDTEA.gov.za

2 DESCRIPTION OF PROPOSED ACTIVITIES

2.1 PROCESS DESCRIPTION

Brother CISA produces sodium dichromate (SDC) and various related chrome chemicals and by-products. Brother CISA proposes to expand its existing product range to include chrome tanning salts (CTS) and synthetic vitamin K compounds. It is intended to establish an inorganic and an organic process producing 50 000 t/a of inorganic CTS and 30 000 t/a of organic CTS respectively, as well as production of 2 000 t/a of synthetic vitamin K compounds.

One of the primary raw materials for producing these will be sodium dichromate (SDC) coming from the existing operations. The manner in which the proposed CTS Plant will fit into the existing operation is shown in Figure 2-1.

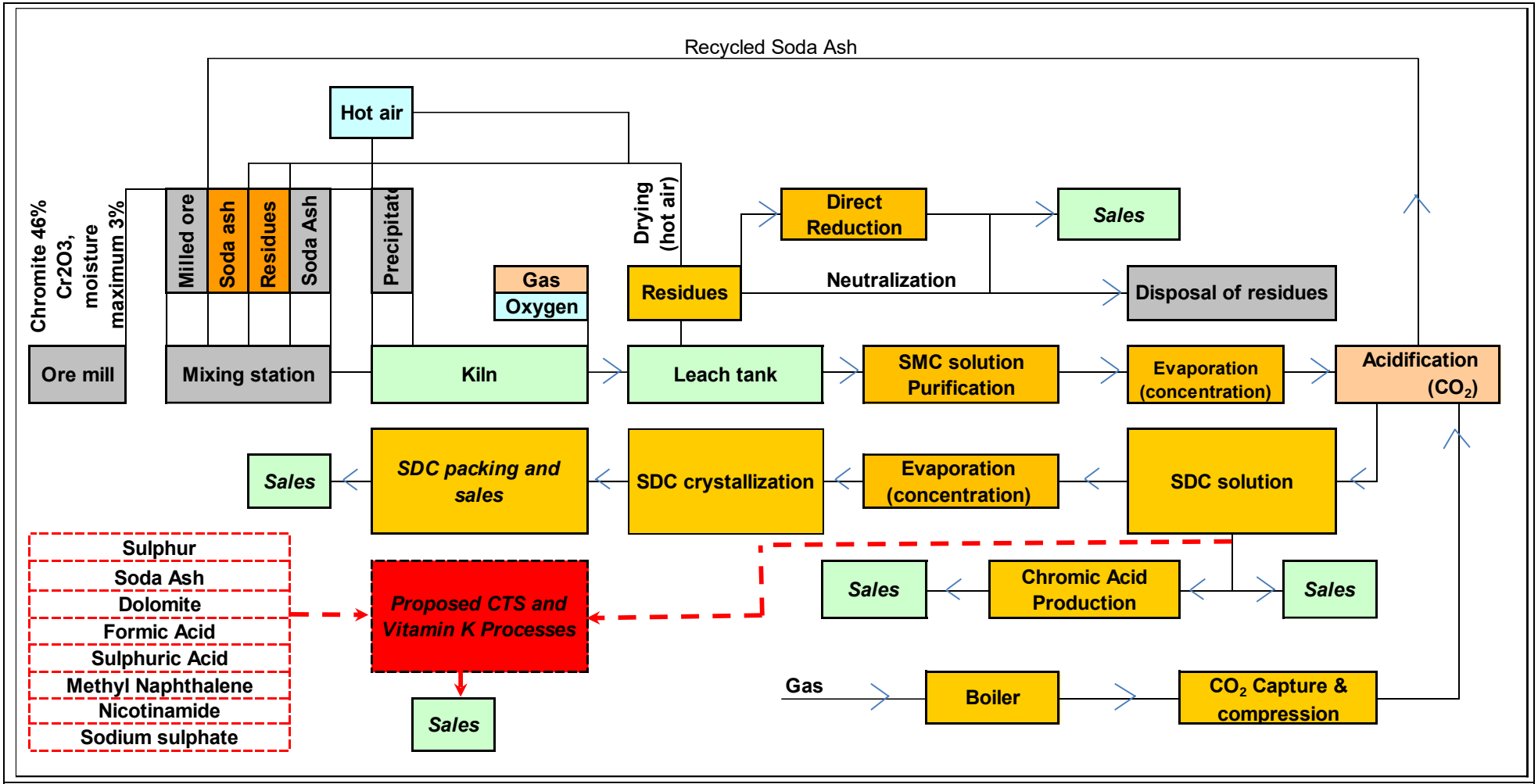


Figure 2-1: Overall Process Flow Diagram

There are two proposed processes:

1. Inorganic Chrome Tanning Salts Production Process
2. Organic Chrome Tanning Salts and Synthetic Vitamin K Production Process

these are discussed in detail in the ensuing sections.

2.1.1 INORGANIC CHROME TANNING SALTS PRODUCTION PROCESS

The manufacture of inorganic CTS involves the reaction of Sodium Dichromate (SDC) and Sulphur Dioxide gas (SO_2). The SO_2 gas is generated by burning sulphur in a furnace. The SO_2 gas from the burner is fed into a set of absorption columns where it reacts with, and reduces the SDC, to form CTS. This produces a CTS liquor which is then dried to form a powder. The powder along, with various additives, is then stored as a product and may be bagged or supplied to clients in bulk.

The proposed inorganic process is illustrated in Figure 2-2.

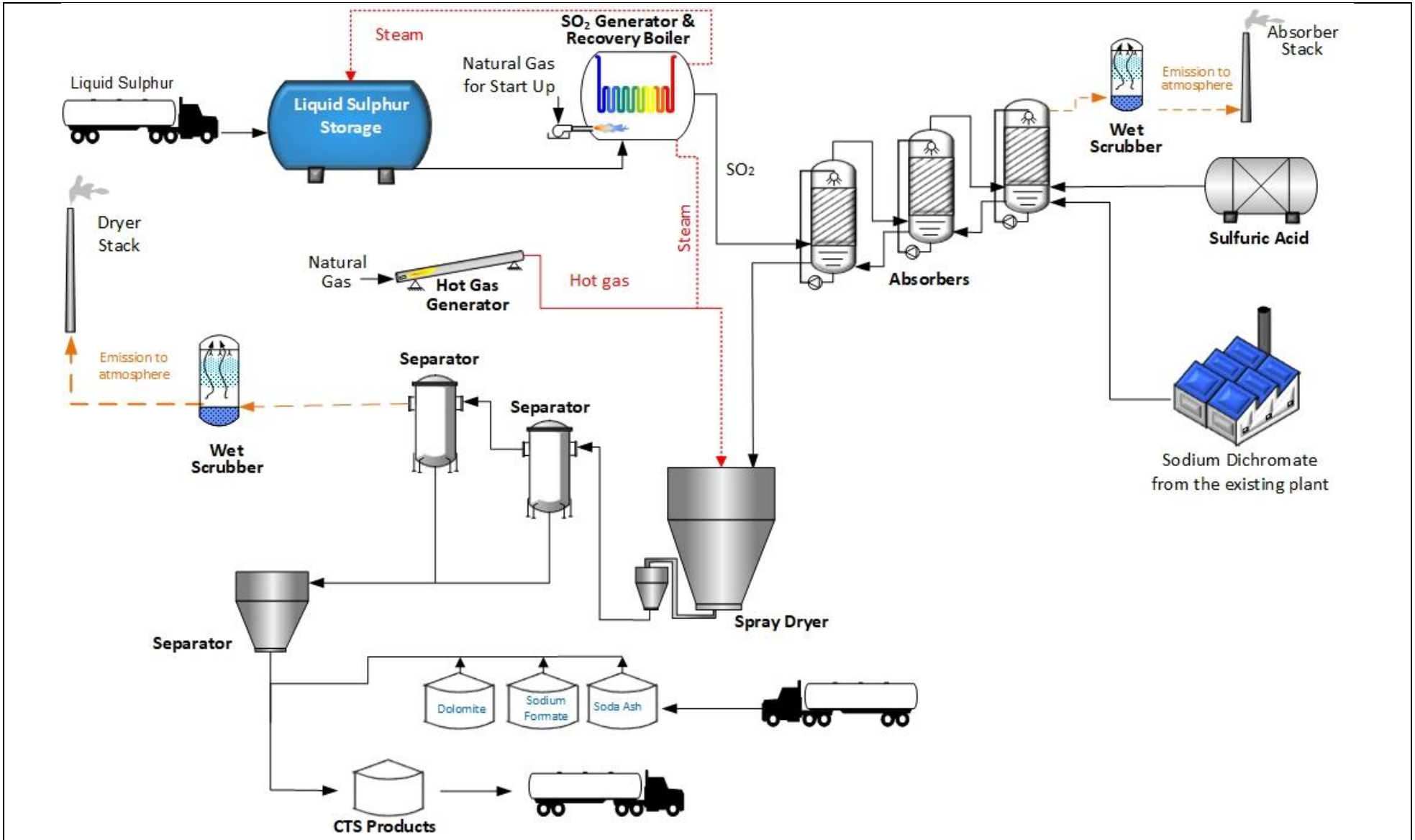


Figure 2-2: Inorganic CTS Process Flow Diagram

2.1.2 ORGANIC CHROME TANNING SALTS AND SYNTHETIC VITAMIN K PRODUCTION PROCESS

To manufacture organic CTS and synthetic vitamin K compounds, methyl naphthalene and sulphuric acid are mixed with SDC to produce crystalline menadione. This is subsequently dissolved with heptane and sulphurated to produce menadione sodium bisulphite (MSB). Menadione sodium bisulphite is a water-soluble form of menadione, which belongs to the Vitamin K class of compounds. A portion of the MSB is then purified, dried and packaged, and the remainder is converted to menadione nicotinamide bisulphite (MNB). MNB is subsequently purified, dried and packaged. MNB is a bioactive source of vitamin K.

The bulk of sodium sulphate recovered as a by-product of the above is then used to produce organic CTS. The sodium sulphate is mixed with SDC, glycol, and sulphuric acid to produce CTS solution. The solution is concentrated by evaporation, mixed with further sodium sulphate and then dried. The dried powder along, with various additives, is then stored as product and may be bagged or supplied to clients in bulk.

The proposed organic process is illustrated in Figure 2-3 to Figure 2-6.

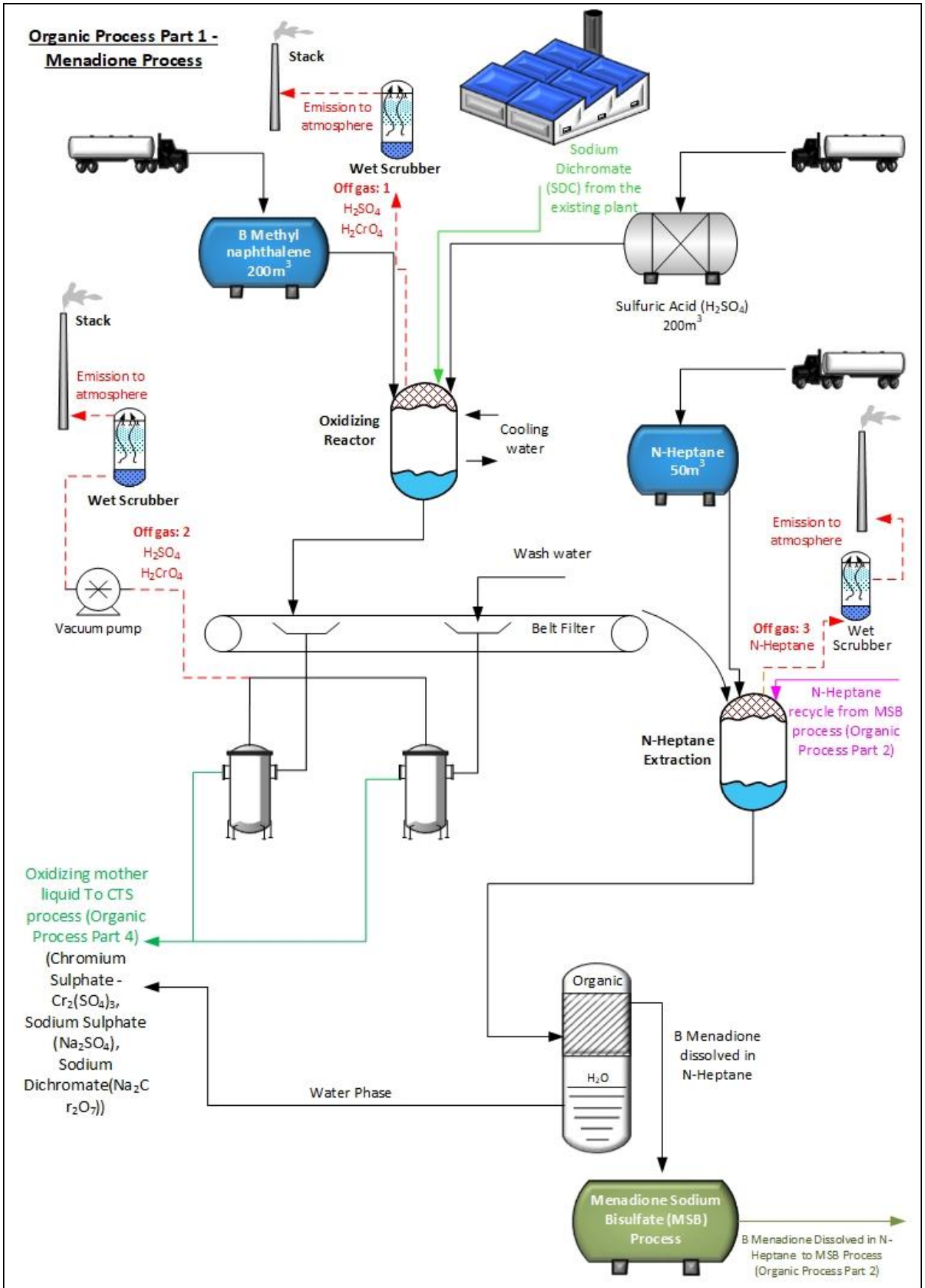


Figure 2-3: Organic Process Part 1 - Menadione Process

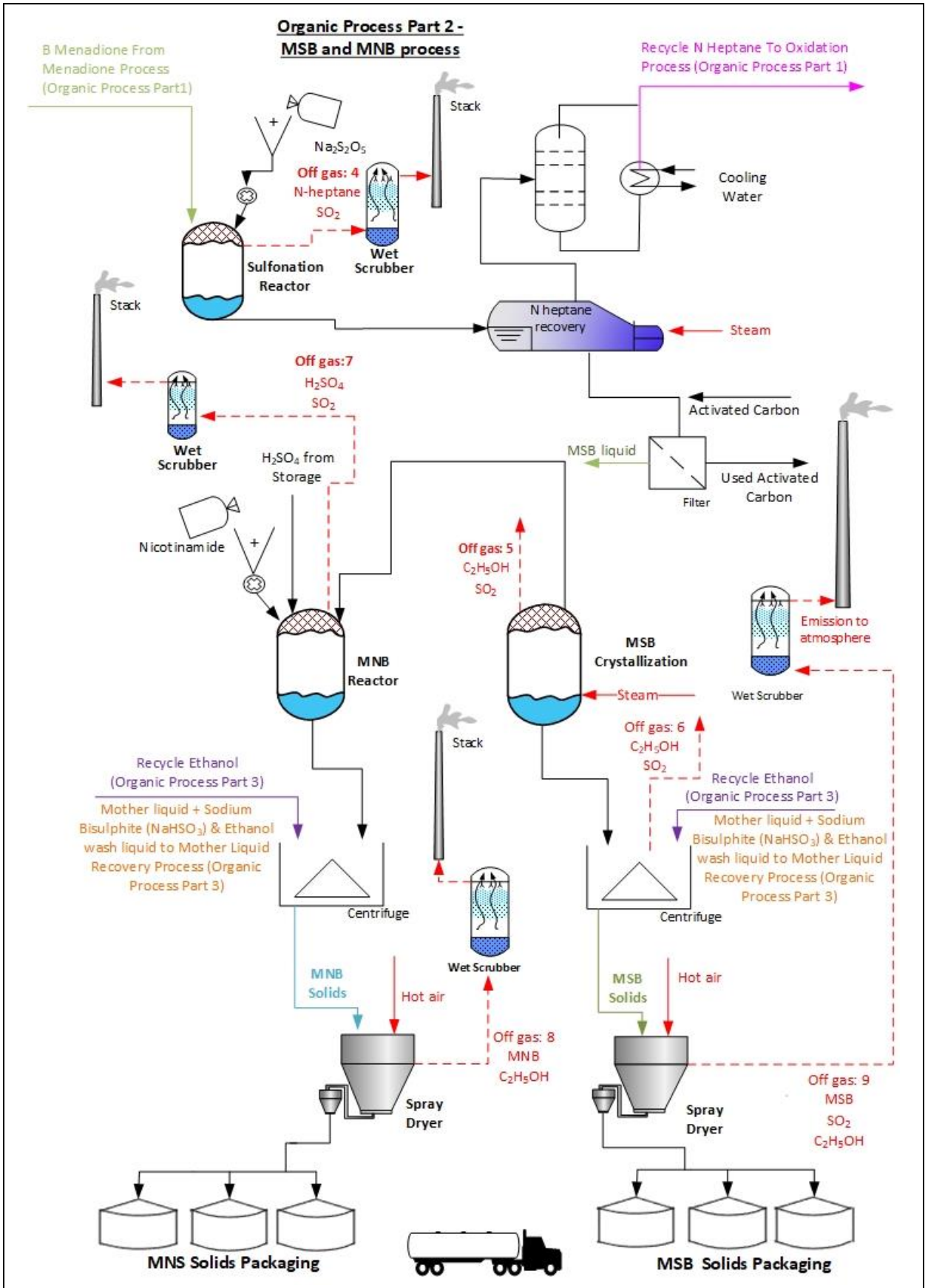


Figure 2-4: Organic Process Part 2 - Menadione sodium bisulphite (MSB) and menadione nicotinamide bisulphite (MNB) process

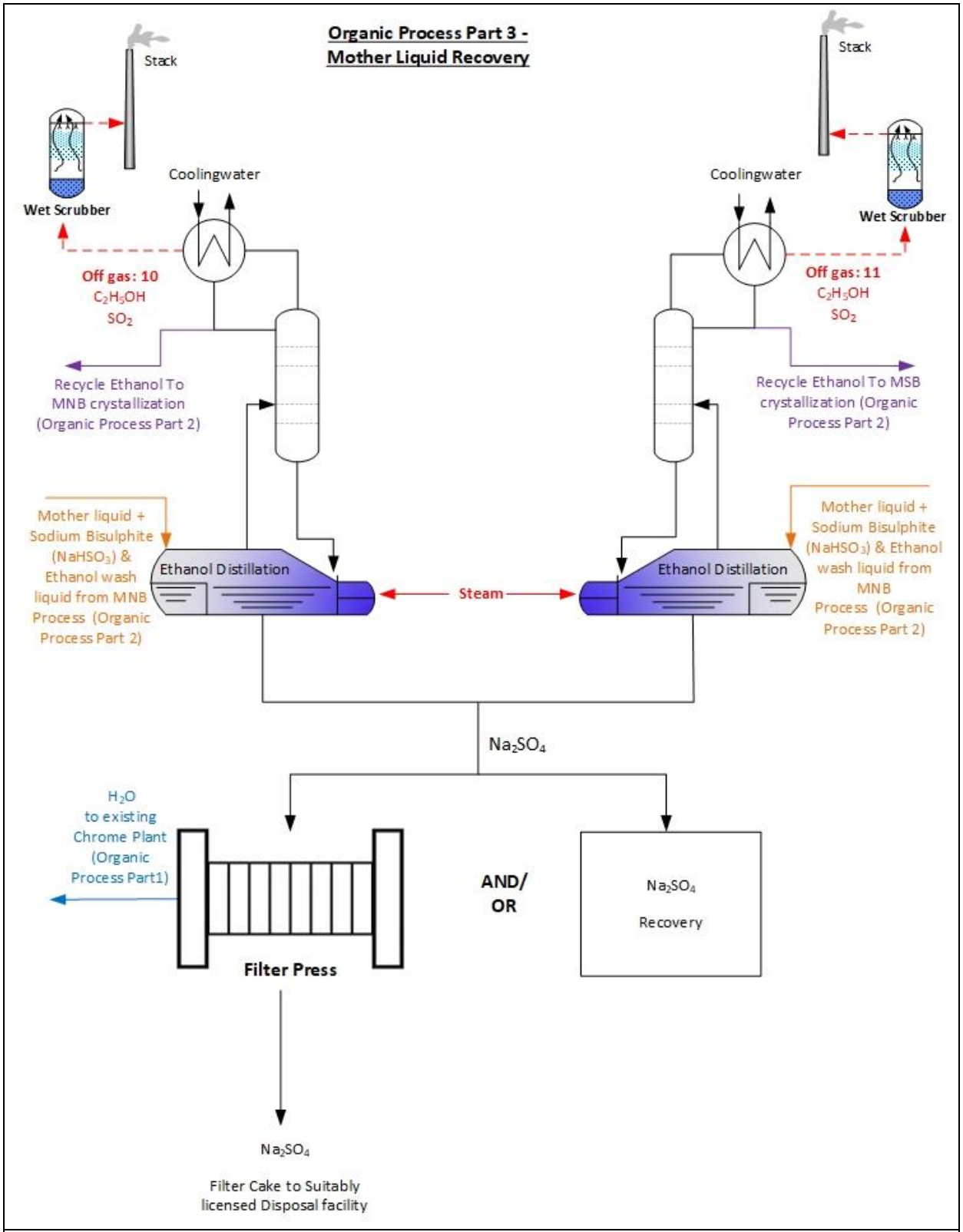


Figure 2-5: Organic Process Part 3 - Mother liquid recovery process

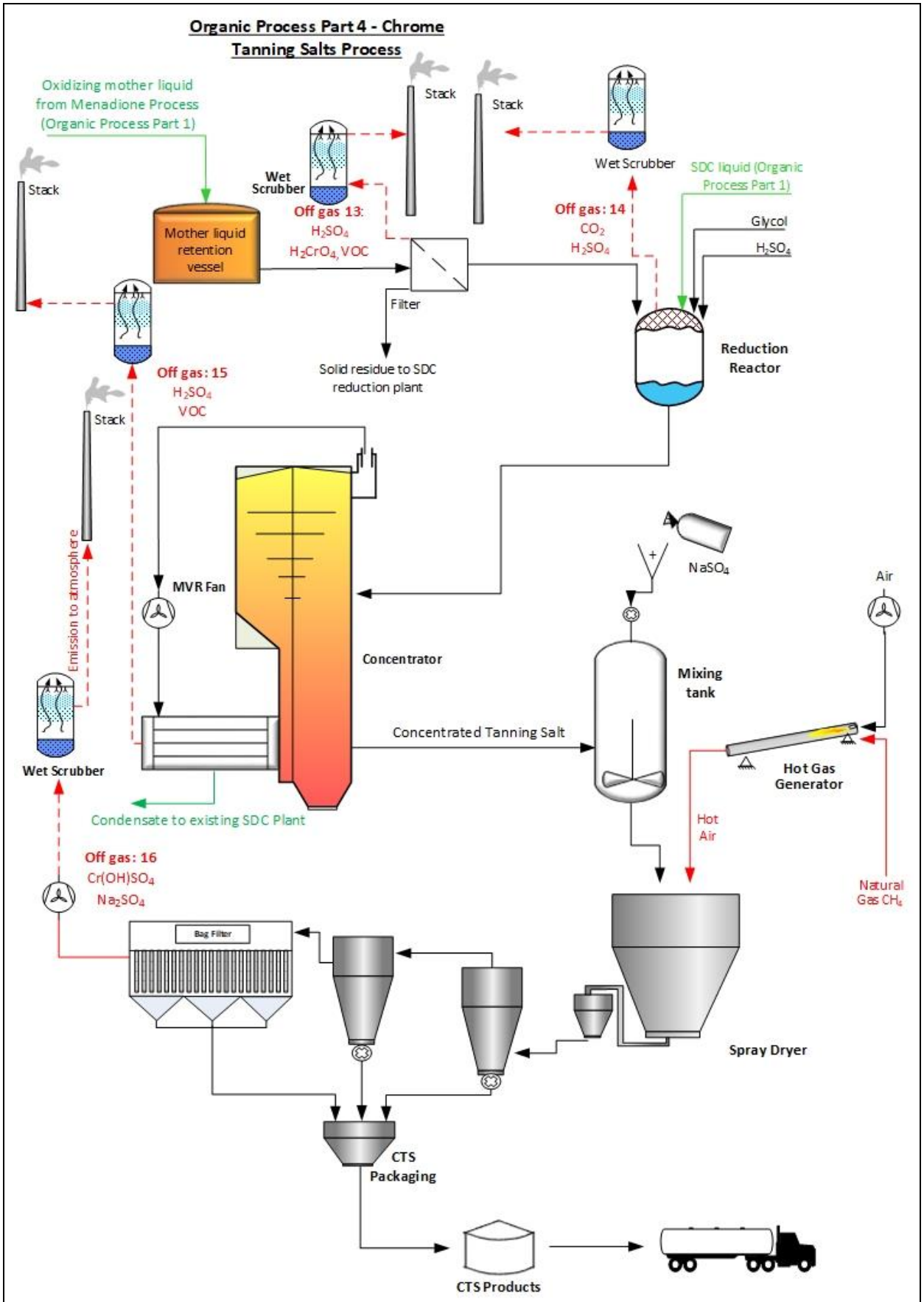


Figure 2-6: Organic Process Part 4 – Chrome Tanning Salts process

2.1.3 STORAGE OF DANGEROUS GOODS

The storage quantities for raw materials and products are shown in Table 2-1 and Table 2-2 respectively. It is notable that "dangerous goods" is defined as "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 hazards, health hazards or environmental hazards;"

Although some of the materials are not listed in the SANS 10234 supplement of 2008 they may be assessed as being hazardous in terms of SANS 10234 classification procedures. All the materials have been included here in keeping with the precautionary principle.

Table 2-1: Raw Material Storage Quantities

Name Of Raw Material	Storage Quantity (tons)	SANS 10234 Classification*
Vitamin K3 Raw Materials		
B-methyl naphthalene	340	Not listed
Sulfuric acid	900	Skin corrosive
Sodium dichromate	2000	Oxidising solid Carcinogen Mutagen Reproductive toxicity Skin corrosion Respiratory sensitivity Acute aquatic toxicity Chronic aquatic toxicity
N-heptane	60	Flammable liquid Aspiration hazard Acute aquatic toxicity Chronic aquatic toxicity
Sodium pyrosulphite	200	Not listed
Nicotinamide	100	Not listed
Activated carbon	10	Not listed
Ethanol	60	Flammable liquid
Liquid alkali (Sodium hydroxide)	200	Eye irritant, Skin irritant
Liquid ammonia	4	Acute toxicity (inhalation) Skin corrosive Acute aquatic toxicity
Organic Chrome Tanning Salts Raw Materials		
Sodium dichromate	200	As above
Glucose	100	Not listed
Oxidized mother liquor	500	Not listed
Sodium sulphate	100	Not listed
Inorganic Chrome Tanning Salts Raw Materials		

Table 2-1: Raw Material Storage Quantities		
Name Of Raw Material	**Storage Quantity (tons)**	**SANS 10234 Classification***
Sodium dichromate	500	As above
Molten sulphur	300	Not listed
Sulfuric acid	90	As above
Dolomite	10	Not listed
Sodium formate	4	Not listed
Soda ash	10	Not listed
* as listed in the supplement to SANS 10234:2008		

Table 2-2: Product storage quantities		
Name of Product	**Storage quantity (tons)**	**SANS 10234 Classification***
Vitamin K3 MSB bisulphite Sodium menthoquinone)	10	Not listed
Vitamin K3 MNB bisulphite Nicotinamide menthoquinone)	100	Not listed
Organic Chrome Tanning Salts	3000	Not listed
Inorganic Chrome Tanning Salts	5000	Not listed
* as listed in the supplement to SANS 10234:2008		

2.1.4 SITE LAYOUT

The proposed sit layout is shown in Figure 2-7.

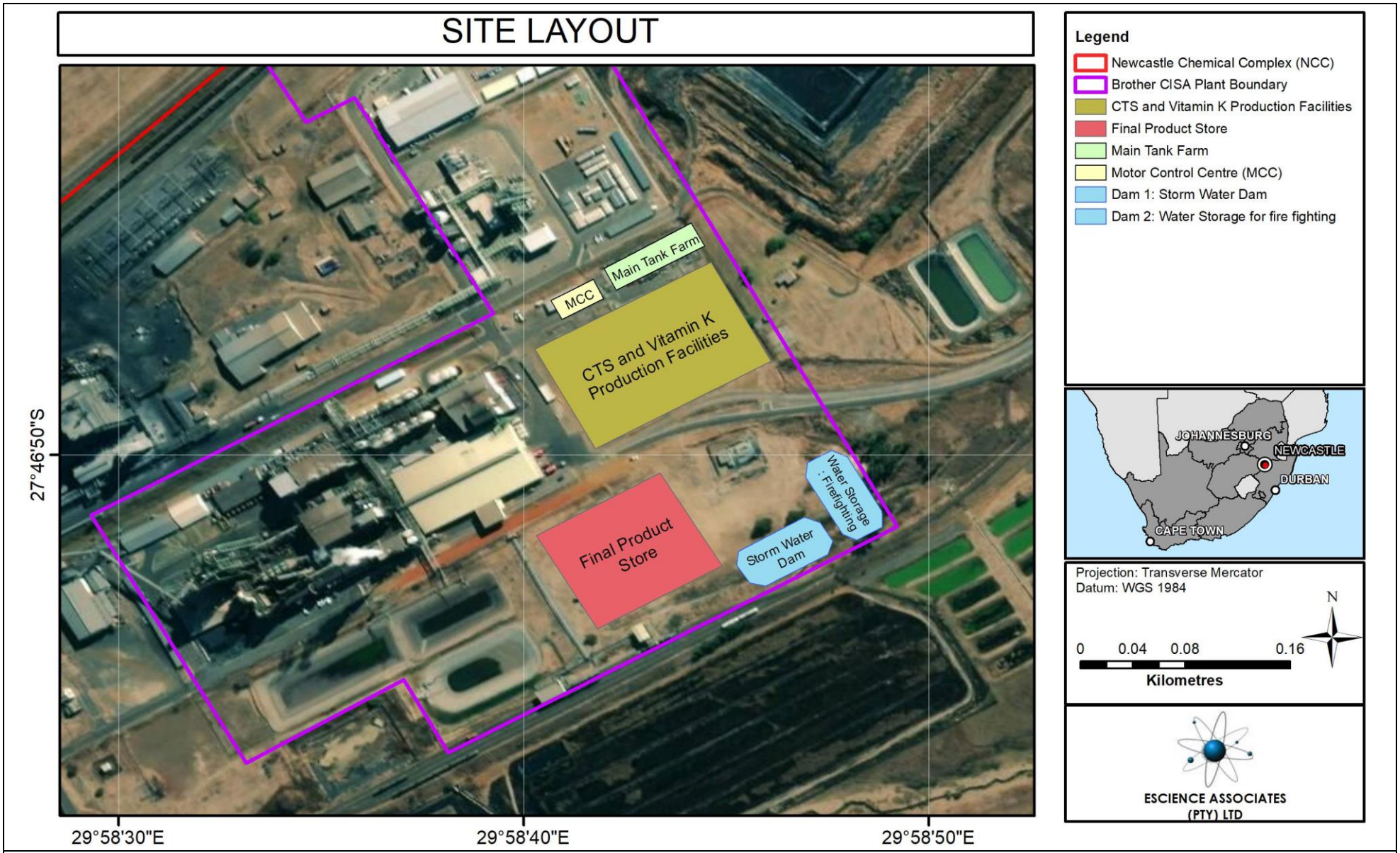


Figure 2-7: Proposed Site Layout

2.2 ALTERNATIVES CONSIDERED

The EIA regulations require that alternatives be considered. The regulations define "alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to the -

(a) property on which or location where the activity is proposed to be undertaken;
(b) type of activity to be undertaken;
(c) design or layout of the activity;
(d) technology to be used in the activity; or
(e) operational aspects of the activity;
and includes the option of not implementing the activity;

2.2.1 LOCATION AND LAYOUT ALTERNATIVES

Given that this is a proposed expansion of existing activities, macro-scale site alternatives are of limited relevance as these proposed activities will be additions to an existing plant, with established supporting facilities and infrastructure, which make the proposed expansion feasible. It is both desirable and necessary for the preferred location to be within the current plant boundary, for the following reasons:

- The Brother CISA facility is existing and operational with services and utilities infrastructure in place.
- The area to be used is part of the disturbed footprint of the facility within the well-established industrial chemicals park
- The facility currently manufactures sodium dichromate which is the most significant raw material for the proposed CTS and Vitamin K production processes. The proposed processes will therefore be directly integrated with the existing chrome chemical production facilities.

Although macro-scale site alternatives are not feasible, alternatives within the current extent of the facility have been considered. Refer to Figure 2-8 for the locations within the site that have been considered.

A site selection matrix has been developed to inform the preferred location selection process (Table 2-3). Selection of the preferred site was undertaken using a first principles approach, based on:

1. Potential environmental impacts;
2. Socio-economic impacts and constraints;
3. Design and operating constraints;
4. Capital and running cost considerations.

The scores in the adjacent columns, for each alternative, indicate whether the outcome is positive or negative for each aspect/criterion considered:

+1 indicates a net benefit or significant advantage over the other alternatives.

-1 indicates a net deterioration or significant disadvantage relative to the other alternatives.

0 indicates neutrality or comparative neutrality.

A cumulative sum at the bottom of the table indicates the net outcome of all considerations.

Table 2-3 below shows the criteria that were used to select the preferred alternative (shown in Figure 2-8) as the most suitable location for proposed activities.

Table 2-3: Site Selection Matrix						
Consideration	**Preferred Location**	**Score**	**Alternative Location 1**	**Score**	**Alternative Location 2**	**Score**
Clearing of undisturbed land	No clearing required; land already disturbed	0	No clearing required; land already disturbed	0	No clearing required; land already disturbed	0
Removal of indigenous vegetation	No clearing required; land already disturbed None	0	No clearing required; land already disturbed None	0	No clearing required; land already disturbed None	0
Removal of protected plant biota	No clearing required; land already disturbed None	0	No clearing required; land already disturbed None	0	No clearing required; land already disturbed one	0
Within 100 m of a natural drainage channel or water course other than a wetland	Located approximately 340m north of Karbochem spruit	0	Located approximately 200m north of Karbochem spruit	0	Located approximately 480m north of Karbochem spruit	0
Within 500 m of a wetland, or riparian area	Located approximately 340m north of Karbochem spruit and associated channelled valley bottom wetland	-1	Located approximately 200m north of Karbochem spruit and associated channelled valley bottom wetland	-1	Located approximately 480m north of Karbochem spruit and associated channelled valley bottom wetland	-1
Comparative proximity to surface water	Located approximately 340m north of Karbochem spruit	0	Located approximately 200m north of Karbochem spruit	-1	Located approximately 480m north of Karbochem spruit	1
Proximity to seismic risk zones	None	0	None	0	None	0
Presence of dispersive soils	None	0	None	0	None	0
Geotechnical considerations	No significant issues identified, site already levelled and compacted	1	No significant issues identified, site still requires levelling and compacting	0	No significant issues identified, site already levelled and compacted	1
Proximal to other receptors in event of catastrophic events	Close to adjacent industrial activities only	0	Close to adjacent industrial activities only	0	Close to adjacent industrial activities only	0
Underlain by unstable geology, dolomitic, or karst areas, where sinkholes and subsidence are likely	None	1	None	1	None	1
Comparative proximity to ground water resources	Upstream of existing groundwater interception trench	1	Downstream of existing groundwater interception trench	-1	Upstream of existing groundwater interception trench	1
Within a declared conservation area	None	0	None	0	None	0

Table 2-3: Site Selection Matrix						
Consideration	**Preferred Location**	**Score**	**Alternative Location 1**	**Score**	**Alternative Location 2**	**Score**
Comparative proximity to heritage resources	None identified	0	None identified	0	None identified	0
Land use zoning	Industrial	0	Industrial	0	Industrial	0
Within 100 m of human receptors	None, adjacent industrial activities only	0	None, adjacent industrial activities only	0	None, adjacent industrial activities only	0
Surface gradient	Relatively flat	0	Relatively flat	0	Relatively flat	0
Servitudes within proposed site	None	0	None	0	None	0
Availability of space	Space available for proposed infrastructure	1	Space available for proposed infrastructure	1	Limited availability of space due to existing production facilities	-1
Visual impact	Within existing industrial boundary - no change to aesthetic profile expected	0	Within existing industrial boundary - no change to aesthetic profile expected	0	Within existing industrial boundary - no change to aesthetic profile expected	0
Noise	Within existing industrial activities - no change to noise profile expected	0	Within existing industrial activities - no change to noise profile expected	0	Within existing industrial activities - no change to noise profile expected	0
Logistics – distance to other infrastructure, utilities and raw material storage areas	Closer to existing infrastructure, utilities and raw material storage areas	1	Further from existing infrastructure, utilities and raw material storage areas	-1	Closer to existing infrastructure, utilities and raw material storage areas	1
Installation cost	Lower installation costs relating to joining existing utilities.	1	Higher installation costs relating to joining existing utilities.	-1	Lower installation costs relating to joining existing utilities.	1
Operational cost	Similar operational costs	0	Similar operational costs	0	Similar operational costs	0
Proximity to Airport	Furthest from airport	1		0	Nearest to airport	-1
Proximity to access road	Area adjacent to access road	0	Area adjacent to access road	0	Area adjacent to access road	0
Outcome	***Preferred Location***	***6***	***Alternative Location 1***	***-3***	***Alternative Location 2***	***3***

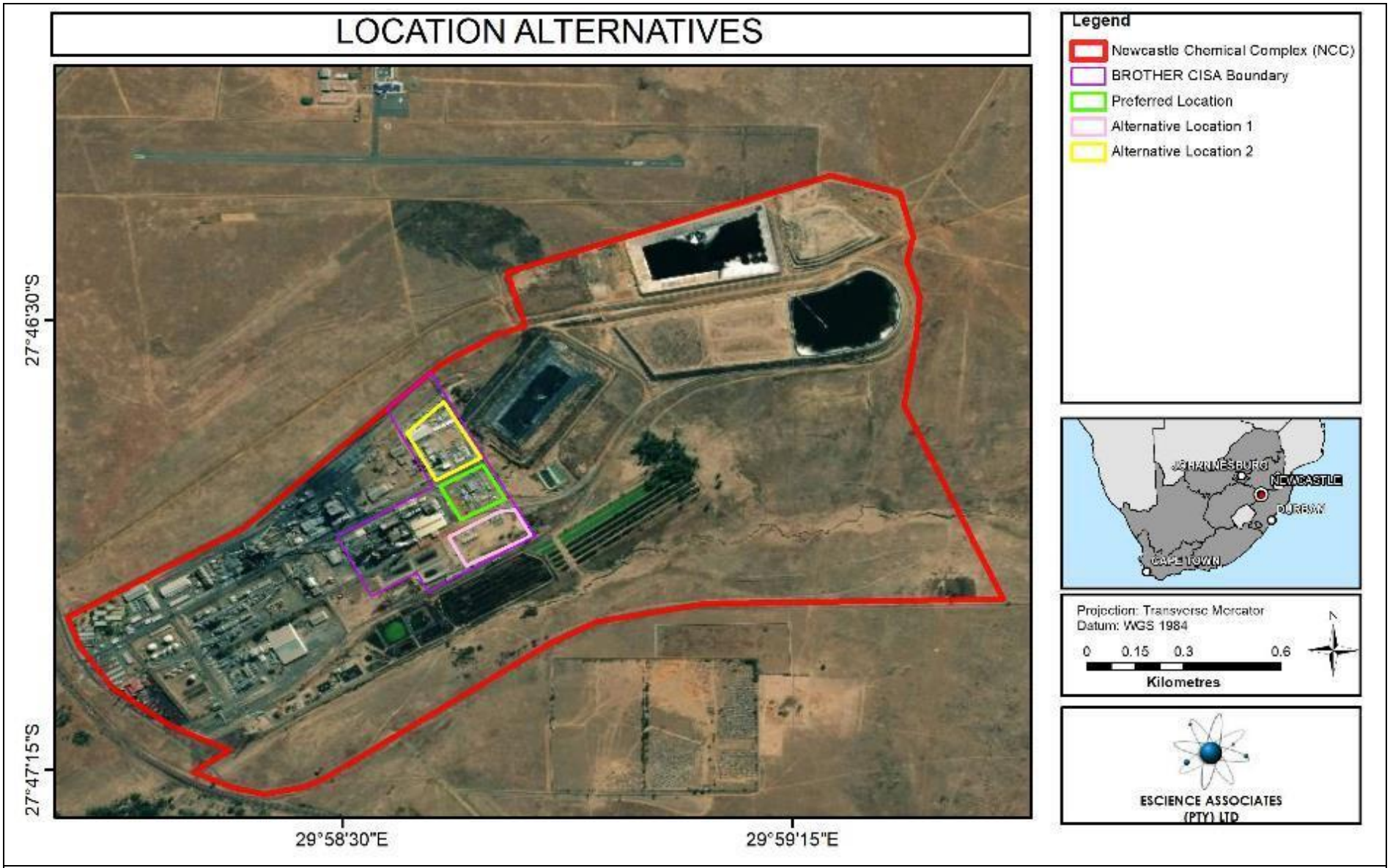


Figure 2-8: Location Alternatives

2.2.2 ACTIVITY ALTERNATIVES

The proposed type of activity is inherently related to the existing activities and products at the site. Different means of meeting the general purpose and requirements of the proposed activity are inherent in the process and technology alternatives considered in section 2.2.3.

2.2.3 TECHNOLOGY/PROCESS ALTERNATIVES

Vitamin K is an important nutrient for animals. Vitamin K can exist in three forms, two of them are naturally occurring and one is a synthetic analogue:

- Vitamin K1, also known as phytonadione or phylloquinone, is the form of vitamin K that occurs naturally in plants.
- Vitamin K2, or menaquinone, also naturally occurring, is the fat soluble form of vitamin K synthesized by the bacteria in the intestinal tract. Bacteria synthesize a range of related forms of this vitamin. These vitamin K analogues are collectively known as K2.
- Vitamin K3, also known as menadione, is the synthetic, water soluble analogue of vitamin K that can be converted to K2 in the intestine. Enzymes in mammalian and avian tissues are also capable of converting menadione to the active forms of vitamin K. (US FDA, 2020).

The latter form is relevant to the proposed development, in particular menadione sodium bisulphite and menadione nicotinamide bisulphite. Vitamin K production worldwide is predominantly undertaken through liquid phase oxidation. This process is divided into 3 types below depending on the oxidising agent.

2.2.3.1 Hydrogen Peroxide Oxidation Process

In the presence of palladium polystyrene sulphonic acid resin, hydrogen peroxide is used for oxidation of beta-methylnaphthalene. In this process the palladium compound used must be regenerated in the process, and this results in significant production of industrial wastewater. There is also risk explosion if adequate controls are not in place. For these reasons this process is deemed less desirable from a risk management perspective.

2.2.3.2 Cerium Salt Oxidation Process

Menadione nicotinamide bisulphate may be produced by reacting methylnaphthalene with an aqueous cerium salt solution. The process requires methyl isophthalic acid, and naphthoquinones. This method requires and electrolytic process, and thus has high electrical energy consumption. Cerium salt is a limited and expensive resource thereby limiting the industrialisation scale of this method. Due to these limitations and the electrical energy demand this process is also less desirable.

2.2.3.3 Chromic Salts Oxidation Process and Chrome Tanning Salts Co-production

This process allows for cost reduction in both the production of Chrome Tanning salts and the production of Vitamin K through employing the concept of the circular economy, by each process utilising by products of the other process.

The Chrome Tanning Salts process utilises the oxidised mother liquid containing Chromium Sulphate and Sodium Sulphate that is produced by the Vitamin K process. The

Vitamin K process utilises the sodium dichromate that currently produced on site. This process doesn't produce any wastewater.

2.2.3.4 Inorganic CTS Production

The manufacture of inorganic CTS involves the reaction of sodium dichromate (SDC) and sulphur dioxide gas (SO_2). The SO_2 gas is generated by oxidising sulphur in a furnace. The SO_2 gas from the burner is fed into a set of absorption columns where it reacts with, and reduces the SDC, to form CTS. This produces a CTS liquor which is then dried to form a powder. The powder along, with various additives, is then stored as product and may be bagged or supplied to clients in bulk. Heat generated from oxidising the sulphur is used generate steam which is subsequently used to dry the products into a powder format. The process is thus both energy efficient and economical as the primary raw material (SDC) is produced on the site.

2.2.3.5 Preferred Alternatives

CISA proposes to produce CTS using both the inorganic and organic process, and vitamin K compounds integrated with organic CTS process. This combination of processes provides and optimal product mix with optimal energy consumption and economic production attached to the existing SDC plant. It is notable that these processes have the following advantages over the other technology alternatives:

1. The fact that no wastewater is produced. Water is recirculated back through the process as it contains valuable precursors for use in the SDC plant.
2. Lower energy consumption. In particular the benefit of heat recovery from sulphur oxidation provides high thermal efficiency for the inorganic process.
3. Lower dependence of electricity as electrolysis is not required.
4. Direct supply of the primary raw material (SDC) and exploitation of an existing resource rather than developing processes which require alternative raw materials to be brought to the site.
5. Local value addition to the existing chrome chemical facility by transforming SDC produced on the site further up the economic value chain to produce CTS and vitamin K compounds.
6. Lower costs and mutual benefits to both the Chrome Tanning salts and the Vitamin K production processes, and the obvious advantage of not having to import and transport alternative raw materials.

2.2.4 NO-GO ALTERNATIVE

The no-go option refers to the alternative of the proposed development not going ahead at all. The baseline status quo is maintained in this case.

The no-go alternative will result in the elimination of the following desirable facets of the proposed activities, namely:

- The facility will not seize the opportunity to manufacture products that are further up the value chain.

- The macro-economic advantages of producing higher value export products would be lost.
- The facility is expected to provide skilled and unskilled employment opportunities during the construction and operational phases;
- The proposed CTS and Vitamin K Production facility is expected to stimulate economic development on both local scale (namely local job creation, and local economic stimulus) and on a national scale (namely beneficiation of chrome ore to produce high value processed products for export).
- The facility will utilise sodium dichromate which is currently produced on site and transported off site as a liquid, the use of this liquid on site will reduce the transport of a hazardous liquid by road to ports for export. This would be offset by the transport of the proposed products which are less hazardous.

It is notable that the potential negative environmental impacts as detailed further in this report would also be avoided.

The negative impacts that would be avoided by the no-go option are anticipated to be within acceptable levels provided the management measures put forward in the EMPr are implemented, and therefore do not outweigh the desirable facets listed above.

The no-go option is therefore not a desirable alternative.

3 NEED AND DESIRABILITY

3.1 NEED AND DESIRABILITY OF THE PROPOSED PROJECT

One of the primary products of the existing operations at Brother CISA is sodium dichromate. Currently a sodium dichromate liquid solution is produced after which it is heated to evaporate water and create a concentrated solution which is then crystallised to form solid sodium dichromate which is then packaged for distribution to customers.

The proposed expansion to include Chrome Tanning Salts and Vitamin K production will allow for the direct use of the sodium dichromate solution as a raw material. (As shown in Figure 2-1). This will eliminate the need to use thermal energy to concentrate and crystallise the solution. It will also eliminate transport costs from the value chain of the production of Chrome Tanning Salts and Vitamin K.

The following desirable aspects would be realised by the proposed expansion:

- The facility is expected to provide skilled and unskilled employment opportunities during the construction and operational phases;
- The proposed CTS and Vitamin K Production facility is expected to stimulate economic development on both local scale (namely local job creation, and local economic stimulus) and on a national scale (namely beneficiation of chrome ore to produce high value processed products for export).
- The facility will utilise sodium dichromate which is currently produced on site and transported off site as a liquid, the use of this liquid on site will reduce the transport of a hazardous liquid by road.

3.2 NEED AND DESIRABILITY IN THE CONTEXT OF THE PREFERRED LOCATION

The proposed upgrades are planned to take place within the current boundaries of the industrial facility. It is both desirable and necessary for the preferred location to be within the current plant boundary, due to the following reasons:

- The Brother CISA facility is existing and operational with services and utilities infrastructure in place.
- The area to be used is part of the disturbed footprint of the facility and no further clearing of undeveloped land is required.
- The facility currently manufactures sodium dichromate which is the most significant raw material of the Chrome Tanning Salts and Vitamin K production processes.

3.3 STRATEGIC NEED AND DESIRABILITY

The following aspects are also of significance in respect of the strategic development planning for the municipality and the South African economy at large:

- The Newcastle Chemical Park has been subject to the loss of significant industrial operations over the past 10 years and thus the proposed expansion may provide some offset the economic decline and job losses.
- The Newcastle Local Municipality Integrated Development Plan (IDP) notes that there has been a "General decline in the manufacturing sector due to structural

changes coupled with the poor performance of global financial markets". The IDP also notes that Newcastle has also been identified, within the Strategic Infrastructure Project (SIP), as one of the Industrial hubs with particular emphasis on the manufacturing sector which is textile and chemicals.

- The proposed development represents direct capital investment with a view to long term economic sustainability of the plant and related upstream and downstream economies as well as immediate job creation.

4 LEGAL AND POLICY FRAMEWORK

4.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998)

The National Environmental Management Act, 1998 (Act No. 107 of 1998, as amended) (NEMA) is South Africa's overarching environmental legislation and contains a comprehensive legal framework to give effect to the environmental rights contained in section 24 of The Constitution. Section 2 of NEMA contains environmental principles that form the legal foundation for sustainable environmental management in South Africa.

4.1.1 DUTY OF CARE

NEMA also places a duty of care on all persons who may cause significant pollution or degradation of the environment. Specifically, Section 28 of the Act states:

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

(2) Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which-

(a) any activity or process is or was performed or undertaken; or

(b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment.

(3) The measures required in terms of subsection (1) may include measures to-

(a) investigate, assess and evaluate the impact on the environment;

(b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;

(c) cease, modify or control any act, activity or process causing the pollution or degradation;

(d) contain or prevent the movement of pollutants or the causant of degradation;

(e) eliminate any source of the pollution or degradation; or

(f) remedy the effects of the pollution or degradation."

Consequently, the applicant must take "reasonable steps" to prevent pollution or degradation of the environment which may result from the existing or proposed mining and related activities. These reasonable steps include the investigation and evaluation of the potential impact and identification of means to prevent an unacceptable impact on the environment, and to contain or minimise potential impacts where they cannot be eliminated.

4.1.2 EIA & ENVIRONMENTAL AUTHORISATION

NEMA introduces the principle of integrated environmental management that is achieved through the environmental assessment process in Section 24, which stipulates that certain identified activities may not commence without an Environmental Authorisation (EA) from the competent authority. Section 24(1) of NEMA requires applicants to consider, investigate, assess and report the potential environmental impact of these activities. The requirements for the investigation, assessment and communication of potential environmental impacts are contained in the so-called EIA Regulations (GN R.982, GN R. 983, GN R. 984 and GN R. 985; 4 December 2014, as amended by GN R.324, GN .R325, GN R.326 and GN R.327 of 2017 respectively). Based on the potential significance of impacts, the Regulations identify specific activities that are either subject to a Basic Assessment process or Scoping and EIA process.

The competent authority in this respect is the KZN Department of Economic Development, Tourism and Environmental Affairs (KZN EDTEA). The proposed facility requires an Environmental Authorisation. The applicable listed activities are presented in Table 4-1.

Table 4-1: Activities Requiring an EA in terms of Listing Notice 1 (GN R. 983 as amended)	
Activity 34	"The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding— (i) where the facility, infrastructure, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; (ii) the expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or the expansion is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will be increased by 50 cubic meters or less per day." **Reason:** The site's AEL will need to be amended.
Activity 51	The expansion and related operation of facilities for the storage, or storage and handling, of a dangerous good, where the capacity of such storage facility will be expanded by more than 80 cubic metres. **Reason:** Dangerous goods storage capacity will be increased to accommodate various dangerous goods as previously presented in Table 2-1 and Table 2-2.

Activities under listing notice 1 require a Basic Assessment process to be undertaken.

4.2 NATIONAL ENVIRONMENTAL AIR QUALITY ACT (ACT 39 OF 2004)

Air Quality Management in South Africa is primarily regulated through the National Environmental Air Quality Act (NEMAQA) {Act 39 of 2004, as amended}. The object of this Act is:

(a) to protect the environment by providing reasonable measures for—
(i) the protection and enhancement of the quality of air in the Republic;
(ii) the prevention of air pollution and ecological degradation; and
(iii) securing ecologically sustainable development while promoting justifiable economic and social development; and
(b) generally, to give effect to section 24(b) of the Constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of people.

NEMAQA defines atmospheric emissions as

"atmospheric emission" or "emission" means any emission or entrainment process emanating from a point, non-point or mobile source that results in air pollution;

Air pollution as:

""air pollution" means any change in the composition of the air caused by smoke, soot, dust (including fly-ash), cinders, solid particles of any kind, gases, fumes, aerosols and odorous substances;"

NEMAQA is an effects-based legislation; consequently, activities that result in atmospheric emissions are to be managed through the setting of environmental health based ambient air quality standards. Facilities with potential impacts on air quality should ideally be assessed not only in terms of its individual contribution, but in terms of its additive contribution to baseline ambient air quality i.e. cumulative effects must be considered.

4.2.1 NATIONAL AMBIENT AIR QUALITY STANDARDS

According to S9 of NEMAQA:

"(1) The Minister, by notice in the Gazette-
(a) must identify substances or mixtures of substances in ambient air which through ambient concentrations, bioaccumulation, deposition or in any other way, present a threat to health, well-being or the environment or which the Minister reasonably believes present such a threat; and
(b) must, in respect of each of those substances or mixtures of substances, establish national standards for ambient air quality, including the permissible amount or concentration of each such substance or mixture of substances in ambient air; …"

The Minister of Water and Environmental Affairs published limits for ambient air quality in Government Notice № 1210 of 24 December 2009, in terms of S9(1) of NEMAQA, as shown in Table 4-2.

Table 4-2: National Ambient Air Quality Standards - GN 1210:2009

Pollutant	Averaging period	Conc. µg/m³	FOE*	Compliance date
PM_{10}	24-hours	75	4	Immediate
	Annual	40	0	Immediate

NO_2	1-hour	200	88	Immediate
	Annual	40	0	Immediate
SO_2	10-min (running)	500	526	Immediate
	1-hour	350	88	Immediate
	24-hours	125	4	Immediate
	Annual	50	0	Immediate
CO	1-hour	30	88	Immediate
	8-hours (running)^	10	11	Immediate
* FOE – Permitted Frequency of Exceedance in occurrences per year ^ Calculated on 1-Hourly averages.				

The Ministry of Water and Environmental Affairs further published limits for $PM_{2.5}$ on the 29th June 2012, in terms of S9(1) of NEMAQA, as shown in Table 4-3.

Table 4-3: National Ambient Air Quality Standards for $PM_{2.5}$ - GN 486:2012

Pollutant	Averaging period	Conc. µg/m³	FOE*	Compliance date
$PM_{2.5}$	24-hours	40	4	Immediate
		25	4	01 January 2030
	Annual	20	0	Immediate
		15	0	01 January 2030
* FOE – Permitted Frequency of Exceedance in occurrences per year				

4.2.2 MINIMUM EMISSION STANDARDS AND ATMOSPHERIC EMISSIONS LICENSING

Minimum Emission Standards and Atmospheric Emissions Licensing S21 of NEMAQA provides for the minister (or MEC) to:

"…publish a list of activities which result in atmospheric emissions and which the Minister or MEC reasonably believes have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage;..."

S22 of NEMAQA states that no person may, without a provisional atmospheric emission licence or an atmospheric emission licence, conduct a listed activity.

Accordingly, the minister published the *"List Of Activities Which Result In Atmospheric Emissions Which Have Or May Have A Significant Detrimental Effect On The Environment, Including Health, Social Conditions, Economic Conditions, Ecological Conditions Or Cultural Heritage"*. The list of activities was published in GN 248 of 2010, and subsequently superseded by GN 893 on 22 November 2013, and subsequently amended by GN 551 in 2015, in accordance with S21 of NEMAQA.

Brother CISA's currently licenced for the following listed (Atmospheric Emissions Licence Number Amajuba/ Lanxess/2011/01):

- Subcategory 4.15 (Processing of chromium to produce chromium chemicals),

- Subcategory 4.1 (Drying of chromite ore) of the listings.
- Subcategory 4.9 (Smelting of residue to produce a high chrome steel) and

The following apply to the proposed expansion:

- Category 7: Inorganic Chemicals Industry; Subcategory 7.2: *Production of Acids.*

  Reason: Brother CISA proposes to use more than 100 tonnes/annum of sulfuric acid (H_2SO_4) in their chromium salts manufacturing process.
- Category 7: Inorganic Chemicals Industry; Subcategory 7.4: *Production, Use in Production or Recovery of Antimony, Arsenic, Beryllium, Cadmium, Chromium, Cobalt, Lead, Mercury, and or Selenium, by the Application of Heat*

  Reason: Brother CISA proposes to produce more than 1 ton Chrome Tanning Salts per month.

The required air emission standards, set in terms of the NEMAQA S21 Minimum Emission Standards, applicable to the proposed facility are given in Table 4-4. The standards for "new plant" will apply.

Table 4-4: GN 893:2013, as amended - Subcategory 7.2

Title	Subcategory 7.2: Production of Acids
Description:	The production, bulk handling and or use in manufacturing of hydrofluoric, hydrochloric, nitric and sulphuric acid (including oleum) in concentration exceeding 10%. Processes in which oxides of sulphur are emitted through the production of acid sulphites of alkalis or alkaline earths or through the production of liquid sulphur or sulphurous acid. Secondary production of hydrochloric acid through regeneration.
Application:	All installations producing, handling and or using more than 100 tons per annum of any of the listed compounds (Excluding metallurgical processes related activities regulated under category 4).

Substance or mixture of substances		**Plant status**	**mg /Nm³ at 273 K, 101.3 kPa**
Common name	**Chemical symbol**		
Total fluoride measured as Hydrogen Fluoride (from processes in which HF is evolved)	F as HF	New	5
		Existing	30
Hydrogen chloride (from primary production of hydrochloric acid)	HCl	New	15
		Existing	25
Hydrogen chloride (from secondary production of hydrochloric acid)	HCl	New	30
		Existing	100
Sulphur Dioxide	SO_2	New	350
		Existing	2800
Sulphuric acid mist and sulphur trioxide expressed as SO_3 (from processes in which SO_3 is evolved).	SO_3	New	25
		Existing	100
Oxides of Nitrogen		New	350

Table 4-4: GN 893:2013, as amended - Subcategory 7.2			
	NOx expressed as NO_2	Existing	2000

Table 4-5: GN 893:2013, as amended - Subcategory 7.4			
Title	Subcategory 7.4: Production, Use in Production or Recovery of Antimony, Arsenic, Beryllium, Cadmium, Chromium, Cobalt, Lead, Mercury, and or Selenium, by the Application of Heat.		
Description	Production, use or recovery of antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, mercury, selenium, thallium and their salts not covered elsewhere, excluding their use as catalyst.		
Application	All installations producing or using more than 1 ton per month.		
Substance or mixture of substances		**Plant Status**	**mg/Nm³ at 273 K and 101.3 kPa.**
Common name	**Chemical symbol**		
Particular matter	N/A	New	10
		Existing	25

4.3 MAJOR HAZARD INSTALLATION REGULATIONS

The Occupational Health and Safety Act (OHSA) 1993 (Act 85 of 1993) regulations include Regulation 1179 (Hazardous Chemical Substances) and Regulation 7122 (Major Hazard Installations). It is notable that this legislation falls within the jurisdiction of the Department of Labour and is in the context of occupational health rather than environmental management. However, this is addressed herein from a precautionary perspective as there may be an environmental bearing and is particularly informative for the storage of dangerous goods.

A "hazardous chemical substance" is defined in Government Notice R.1179 Hazardous Chemical Substances Regulations (1995) as any toxic, harmful, corrosive, irritant or asphyxiant substance, or a mixture of such substances for which (a) an occupational exposure limit is prescribed, or (b) an occupational exposure limit is not prescribed; but which creates a hazard to health.

A 'major hazard installation' means an installation:
(a) where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily; or
(b) where any substance is produced, used, handled or stored in such a form and quantity that it has the potential to cause a major incident."

The OHSAct (85) of 1993 and its Major Hazard Installation (MHI) Regulations (July 2001) requires employers, self-employed persons and users, who have on their premises, either permanently or temporarily, a major hazard installation or a quantity of a substance which may pose a risk that could affect the health and safety of employees and the public, to conduct a risk assessment in accordance with the legislation.

The storage quantities for raw materials and products are shown in Table 2-1 and Table 2-2 respectively. It is notable that "dangerous goods" is defined as "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 hazards, health hazards or environmental hazards;"

Although some of the materials are not listed in the SANS 10234 supplement of 2008 they may be assessed as being hazardous in terms of SANS 10234 classification procedures.

The facility's Major Hazard Installation Risk Assessment was updated to include the proposed additional dangerous goods storage quantities. A summary of the results can be found under section 8.4.

4.4 NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008 (ACT 59 OF 2008)

The NEM:WA defines 'Waste' as

"*(a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or*

(b) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette, but any waste or portion of waste, referred to in paragraphs (a) and (b), ceases to be a waste-

(i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered;

(ii) where approval is not required, once a waste is, or has been re-used, recycled or recovered;

(iii) where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or,

(iv) where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste.".

S16 of the Act is of particular relevance to this application and requires as follows:

"*(1) A holder of waste must, within the holder's power, take all reasonable measures to-*

(a) avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;

(b) reduce, re-use, recycle and recover waste;

(c) where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;

(d) manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts;

(e) prevent any employee or any person under his or her supervision from contravening this Act; and

(f) prevent the waste from being used for any unauthorised purpose.

(3) The measures contemplated in this section may include measures to-

(a) investigate, assess and evaluate the impact of the waste in question on health or the environment;

(b) cease, modify or control any act or process causing the pollution, environmental degradation or harm to health;

(c) comply with any norm or standard or prescribed management practice;

(d) eliminate any source of pollution or environmental degradation; and

(e) remedy the effects of the pollution or environmental degradation."

No activities requiring a Waste Management Licence will be triggered by the proposed upgrades.

4.5 NATIONAL WATER ACT (ACT 36 OF 1998) {NWA}

The National Water Act, (Act 36 of 1998) {NWA}, aims to manage national water resources in order to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources is protected, and integrated management of water resources takes place.

In terms of the National Water Act, Act No. 36 of 1998 (NWA) a water use licence is required for:

(a) taking water from a water resource;

(b) storing water;

(c) impeding or diverting the flow of water in a watercourse;

(d) engaging in a stream flow reduction activity contemplated in section 36;

(e) engaging in a controlled activity identified as such in section 37 (1) or declared under section 38 (1);

(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;

(g) disposing of waste in a manner which may detrimentally impact on a water resource;

(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;

(i) altering the bed, banks, course or characteristics of a watercourse;

(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and

(k) using water for recreational purposes.

The proposed expansion will take place within the disturbed footprint of the site. Facilities for the storage of water will however be developed for capturing storm water as a precaution to recirculate into the plant. A fire suppression system, including a system of water sprays, will be installed and thus an emergency water storage facility will be installed to capture water in the event of the fire system being activated. Captured water would be recirculated into the process for use as process water. There will be no discharge of contaminated stormwater.

The stormwater and firewater dams are part of on the current Water Use Licence Application process underway with the Department of Water and Sanitation.

4.6 HERITAGE

4.6.1 NATIONAL HERITAGE RESOURCES ACT, 1999 (ACT 25 OF 1999)

The NHRA aims to promote good management of the national estate, and to enable and encourage communities to nurture and conserve their legacy, so that it may be bequeathed to future generations.

The Act protects as cultural heritage resources such as:

- a. Archaeological artefacts, rock structures, structures and sites older than 100 years;
- b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography;
- c. Objects of decorative and visual arts;
- d. Military objects, structures and sites older than 75 years;
- e. Historical objects, structures and sites older than 60 years;
- f. Proclaimed heritage sites;
- g. Graveyards and graves older than 60 years;
- h. Meteorites and fossils; and
- i. Objects, structures and sites or scientific or technological value.

A Heritage Impact Assessment (HIA) is the process to be followed in order to determine whether any heritage resources are located within the area of interest, in particular as per section 38(1), any development categorised as:

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50m in length;

(c) any development or other activity which will change the character of a site -

(i) exceeding 5 000m^2 in extent; or

(ii) involving three or more existing erven or subdivisions thereof; or.

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000m² in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

Any person intending to undertake the above must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

The responsible Heritage Resources Authority must, within 14 days of receipt of the notification, indicate whether submission of an Impact Assessment Report is required, and specify the information to be contained in the report.

The responsible Heritage Resources Authority must then decide:
(a) whether or not the development may proceed;

(b) any limitations or conditions to be applied to the development;

(c) what general protections in terms of this Act apply, and what formal protections may be applied, to such heritage resources;

(d) whether compensatory action is required in respect of any heritage resources damaged or destroyed as a result of the development; and

(e) whether the appointment of specialists is required as a condition of approval of the proposal.

However, according to S38(8), the above does not apply where an Environmental Impact Assessment is required, provided that the consenting Authority must ensure that the evaluation fulfils the requirements of the relevant Heritage Resources Authority in terms of Subsection (3), and any comments and recommendations of the relevant Heritage Resources Authority with regard to such development have been taken into account prior to the granting of the consent.

4.6.2 KWAZULU-NATAL AMAFA AND RESEARCH INSTITUTE ACT (ACT 5 OF 2018)

The Kwazulu-Natal Heritage Act has been repealed by the KwaZulu-Natal AMAFA and Research Institute Act as of November 2018.

Where the Act does not regulate a matter pertaining to the protection or management of heritage resources in the Province, the provisions of the National Heritage Resources Act, 1999 (Act No. 25 of 1999), and the National Heritage Council Act, 1999 (Act No. 11 of 1999), apply in the Province. Any reference to "provincial heritage resources authority" in the National Heritage Resources Act, 1999, must, unless clearly inappropriate, be construed as reference to the Amafa aKwaZulu-Natali Heritage Council.

"General protection: Structures — No structure which is, or which may reasonably be expected to be older than 60 years, may be demolished, altered or added to without the prior written approval of the Council having been obtained on written application to the Council.

Where the Council does not grant approval, the Council must consider special protection in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
The Council may, by notice in the Gazette, exempt—

- A defined geographical area; or
- defined categories of sites within a defined geographical area, from the provisions of subsection where the Council is satisfied that heritage resources falling in the defined geographical area or category have been identified and are adequately protected in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
- A notice referred to in subsection (2) may, by notice in the Gazette, be amended or withdrawn by the Council.

General protection: Graves of victims of conflict — No person may damage, alter, exhume, or remove from its original position—

- the grave of a victim of conflict;
- a cemetery made up of such graves; or
- any part of a cemetery containing such graves, without the prior written approval of the Council having been obtained on written application to the Council.
- General protection: Traditional burial places —
- No grave —
- not otherwise protected by this Act; and
- not located in a formal cemetery managed or administered by a local authority, may be damaged, altered, exhumed, removed from its original position, or otherwise disturbed without the prior written approval of the Council having been obtained on written application to the Council.

The Council may only issue written approval once the Council is satisfied that—

- the applicant has made a concerted effort to consult with communities and individuals who by tradition may have an interest in the grave; and
- the applicant and the relevant communities or individuals have reached agreement regarding the grave.

General protection: Battlefield sites, archaeological sites, rock art sites, palaeontological sites, historic fortifications, meteorite or meteorite impact sites.—

- No person may destroy, damage, excavate, alter, write or draw upon, or otherwise disturb any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.

- Upon discovery of archaeological or palaeontological material or a meteorite by any person, all activity or operations in the general vicinity of such material or meteorite must cease forthwith and a person who made the discovery must submit a written report to the Council without delay.

- The Council may, after consultation with an owner or controlling authority, by way of written notice served on the owner or controlling authority, prohibit any activity considered by the Council to be inappropriate within 50 metres of a rock art site.

- No person may exhume, remove from its original position or otherwise disturb, damage, destroy, own or collect any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.

- No person may bring any equipment which assists in the detection of metals and archaeological and palaeontological objects and material, or excavation equipment onto any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, or meteorite impact site, or use similar detection or excavation equipment for the recovery of meteorites, without the prior written approval of the Council having been obtained on written application to the Council.

- The ownership of any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site, on discovery, vest in the Provincial Government and the Council is regarded as the custodian on behalf of the Provincial Government." (KZN Heritage Act of 2008)

4.7 NOISE

The Noise Control Regulations (R 154 GG 13717 of 10 January 1992) promulgated in terms of ECA, defines:

- Nuisance noise, as "*any sound which disturbs or impairs or may disturb or impair the convenience or peace of any person*"
- Disturbing noise, as "*any noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more*".

Regulation 4 states '*No person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof*.' In addition, Section 28 of NEMA imposes a 'duty of care' on every person who may cause significant pollution to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

4.8 BIODIVERSITY

Biodiversity Legislation includes:

- National Forests Act (Act No. 84 of 1998)
- Conservation of Agricultural Resources Act (Act No. 43 of 1983)
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004)

The proposed activities will be undertaken wholly within the disturbed footprint of the site. Consequently, the potential for biodiversity impacts is negligible.

4.9 THE CONSERVATION OF AGRICULTURAL RESOURCES ACT

As per the Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983), Conservation is defined as: "*in relation to the natural agricultural resources, includes the protection, recovery and reclamation of those resources*;"

The objectives of the CARA, as stated in section 2 of the Act, entitled "Objects of Act", are:

"*The objects of this Act are to provide for the conservation of the natural agricultural resources of the Republic by the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants*."

The objectives of CARA are noted, and the proposed project will strive to meet these objectives as far as practicably possible. Of most significance to the project are the provisions stated in Regulation 5 of the Act for the "Prohibition of spreading weeds", which states that:

No person shall-
(a) sell, agree to sell or offer, advertise, keep, exhibit, transmit, send, convey or deliver for sale, or exchange for anything or dispose of to any person in any manner for a consideration, any weed; or
(b) in any other manner whatsoever disperse or cause or permit the dispersal of any weed from any place in the Republic to any other place in the Republic.

The site falls within an established industrial site which does not bear any agricultural potential. The control of weeds may be relevant around the construction footprint where areas have not been paved but the soil may have been disturbed by construction activities.

4.10 NATIONAL ENVIRONMENTAL MANAGEMENT: PROTECTED AREAS ACT

The aim of the National Environmental Management: Protected Areas Act (NEMPA) (Act No. 57 of 2003) is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural seascapes. The purpose of a Protected Environment is amongst others to protect a specific ecosystem outside a special nature reserve world heritage site or nature reserve and also to ensure the use of the natural resources in the area is sustainable.

The proposed site does not occur within or near a Protected Area.

5 PUBLIC PARTICIPATION

5.1 INTRODUCTION

Public participation provides the opportunity for interested and affected parties (IAPs) to participate in the Environmental Authorisation process on an informed basis, and to ensure that their concerns are considered during the environmental impact assessment process. In so doing, a sense of ownership of the project is vested in both the project proponent and interested or affected parties. The Public Participation Process is aimed at achieving the following:

- Provide opportunities for IAPs to obtain information about the expected environmental impacts of the proposed development.
- Establish a formal platform for IAPs to raise queries and give input regarding the environmental impact of the project.
- Utilise the opportunity to formulate ways for reducing or mitigating any negative environmental impacts of the project, and for enhancing its benefits.
- Enable the applicant to consider the needs, preferences and values of IAPs in their decisions.
- Ensure transparency and accountability in decision-making.

5.2 STAKEHOLDER NOTIFICATION

Public Participation undertaken to date includes:

- Pre-identification of interested and affected parties (IAPs) (See Figure 5-2 for preidentified nearby land owners/occupiers).
- Advertising the proposed project and associated Basic Assessment process as follows (See Appendix 2.2):
    - English and isiZulu advertisements in the Newcastle Advertiser published on Friday 3rd July 2020;
    - English and isiZulu advertisements in The Star published on Thursday 2nd July 2020;
    - isiZulu advertisements in the Amajuba Eyethu (a local isiZulu newspaper) published on 17th July 2020
    - isiZulu announcements on Radio NN and Abusekho Ubunzima Christian Radio on 25th August 2020;
- English and isiZulu A2-size site notices erected at the following locations (See Appendix 2.1 for proof of these notices, See Figure 5-1 for the locations):
    - The entrance to Newcastle Chemicals Complex;
    - The intersection of the Madadeni Road and Karbochem Road to be visible to pedestrians ;
    - The entrance to Roy Point cemetery;
    - A high foot traffic area near Newcastle Mall;
    - Outside the Boxer Superstore in Madadeni.

The following is to be undertaken through and after distribution of the draft BAR to IAPs:

- Communication with Amajuba District Municipality, Newcastle Local Municipality and other relevant government departments that administer laws relating to a matter affecting the environment;
- Distribution of Draft Basic Assessment Report (BAR) for public review for 30 days;
- Addressing of comments made by IAPs on BAR;
- Submission of Final Basic Assessment Report to Competent Authority;

5.3 SUMMARY OF ISSUES RAISED BY IAP'S

This is draft report as distributed to IAPs. A summary of issues raised will be included in the final report.

5.4 CONSULTATION WITH THE COMPETENT AUTHORITY

Table 5-1: Authority Consultation	
Process Phase	Details
Pre-Application	Pre-application meeting held with KZN EDTEA on **17th March 2020**
Application	Submit application – **6th July 2020**
	Receive confirmation of application – **17th July 2020**
Basic Assessment	Submit Draft Basic Assessment Report for comment **- CURRENT**
	Submit Basic Assessment Report to the competent authority
	Receive confirmation of acceptance of EIR
	Decision on application

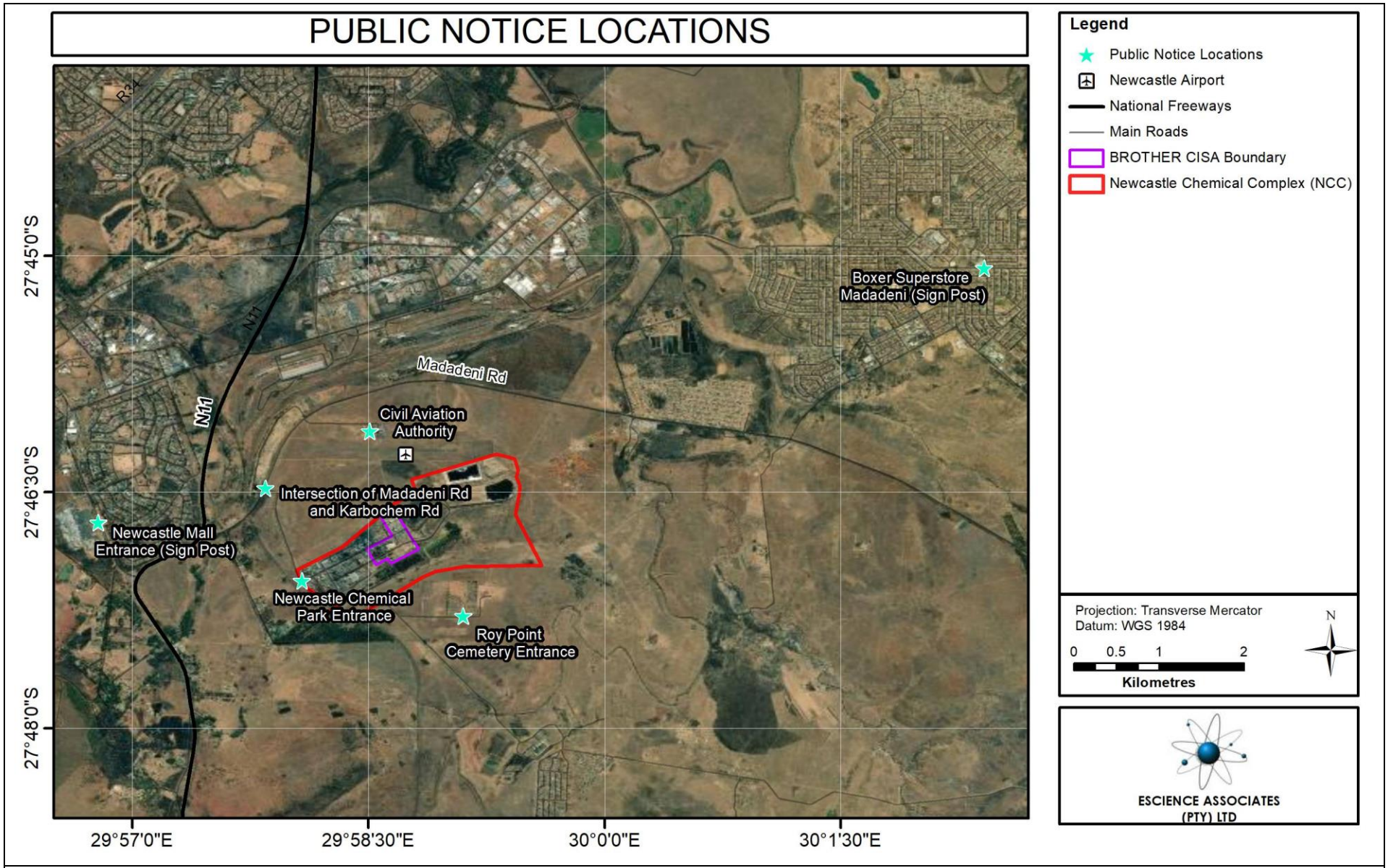


Figure 5-1: Public Notice Locations

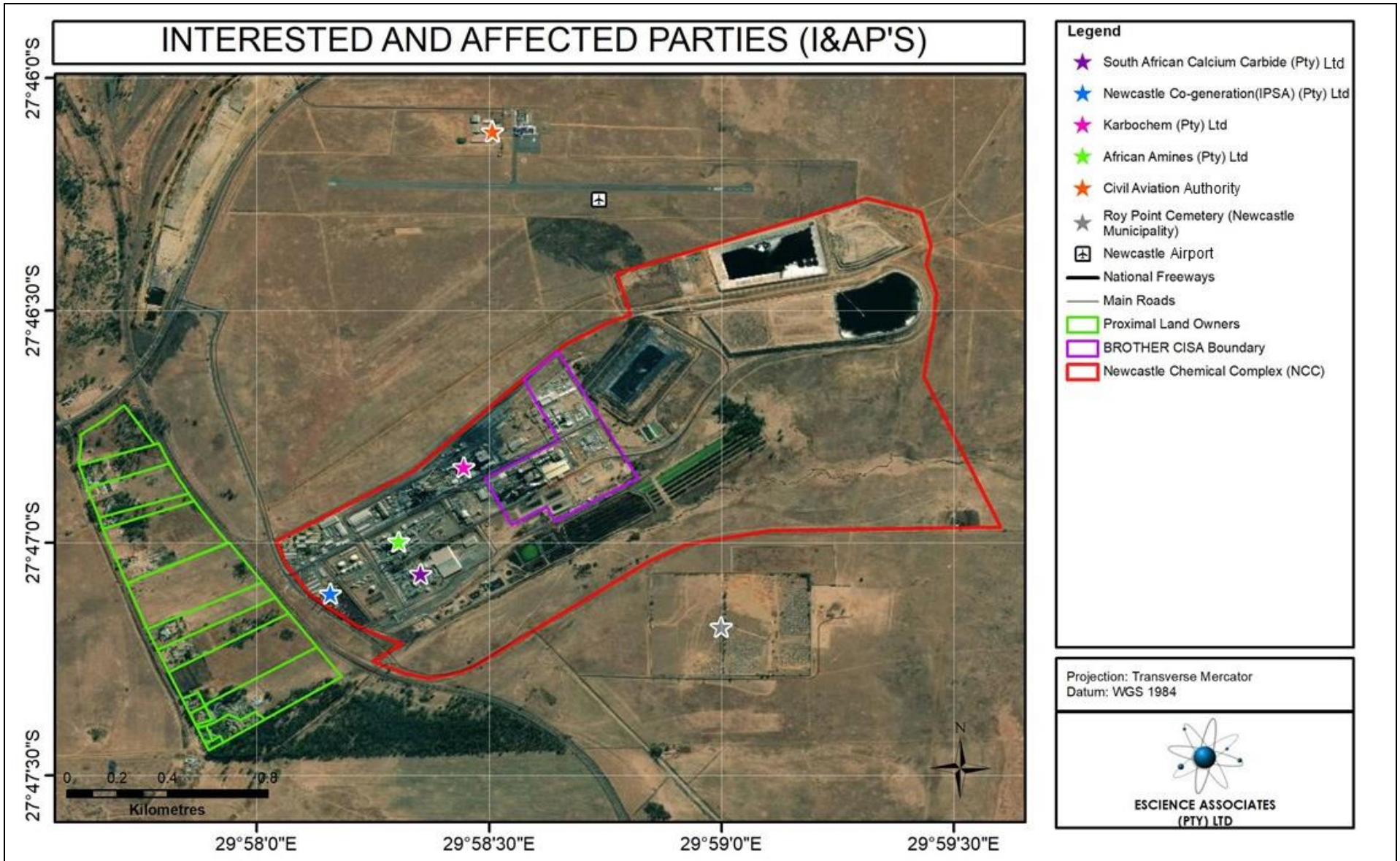


Figure 5-2: Locations of Pre-identified Nearby Land Owners/Occupiers

6 DESCRIPTION OF THE RECEIVING ENVIRONMENT

6.1 LOCATION AND SITE DESCRIPTION

The proposed site is located within the Newcastle Chemical Park, immediately south of the Newcastle Airport, in the town of Newcastle, in northern KwaZulu Natal. The site is accessed from Karbochem Road. Refer to Figure 1-1 for the location of the proposed site. The proposed expansion will take place within the existing property.

6.2 SURROUNDING LAND USE

The Newcastle Chemical Park is an industrial complex occupied by various industrial facilities although not all are in full operation and some have ceased operations:

- African Amines (Pty) Ltd;
- Karbochem (Pty) Ltd;
- KC Energy (Pty) Ltd;
- Brother CISA (Pty) Ltd;
- Newcastle Co-Generation; and,
- South African Calcium Carbide (SACC).

Existing disposal facilities border the north eastern side of the site. The area to the west is mostly open veld, with small holdings located across the Karbochem road approximately 1 km away.

Arbor Park is the closest residential area and is approximately 1.5 km to the north west of the proposed site. The suburb of Kwamathukuza is approximately 2.7km to the east of the proposed site, and the Newcastle CBD is approximately 4 km North East of the site.

Although the area immediately adjacent to the site consists largely of open veld, Newcastle airport lies to the north and Karbochem cemetery (Roy Point Cemetery) to the south of the site. Ngagane Water Purification Plant is situated 2.5km to the south of the Brother CISA facility. Within a 5km radius, the majority of the surrounding land to the south is undisturbed land and consists of industrial and residential use, with intermittent grasslands and shrubland to the north (Figure 6-1).

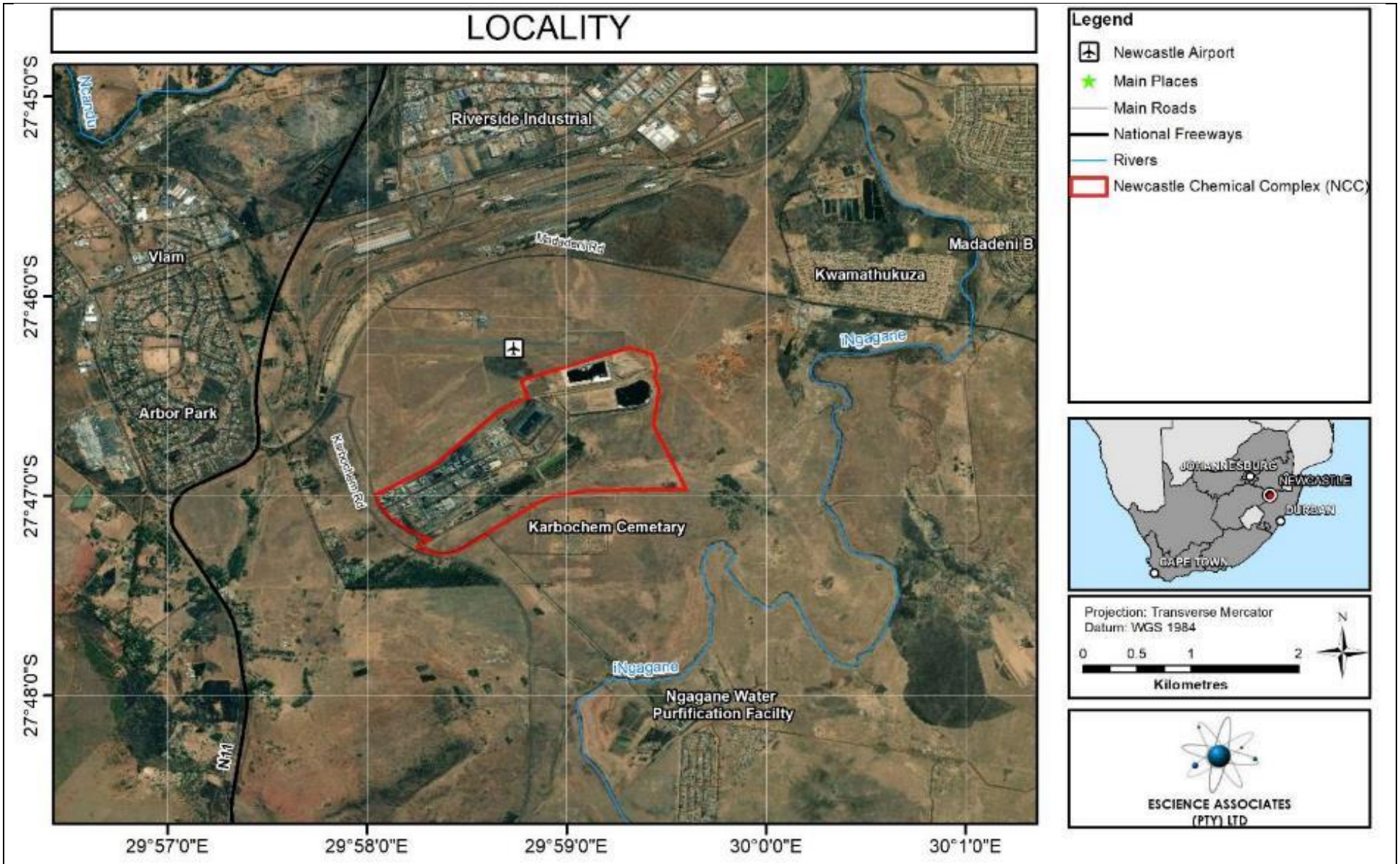


Figure 6-1: Satellite image – Site and immediate surroundings

6.3 CLIMATE

6.3.1 GENERAL DESCRIPTION OF CLIMATOLOGY AND METEOROLOGY

The climate and macro-scale air pollution dispersion potential of the Newcastle region is largely influenced by atmospheric conditions associated with the semi- permanent anticyclonic continental high-pressure cell located over the interior. Light variable winds occur over the region as a result of the anticyclone subsidence associated with the continental high pressure.

The tropical easterlies, and the occurrence of easterly waves and lows, affect the region throughout the year resulting in airflow with a north-easterly to north-westerly component, but their influence is generally weaker during winter months. During summer months, the anticyclonic belt weakens and shifts southwards, allowing the tropical easterly flow to resume its influence over the region.

In summer, unstable conditions result in mixing of air and rapid dispersion of pollutants in the atmosphere. Westerly waves and lows are largely responsible for the southerly wind component, which occurs over the interior. The winter months are characterized by atmospheric stability caused by a persistent high-pressure system. This high-pressure system results in subsidence, causing clear skies and pronounced temperature inversions at night. These inversions may be broken periodically by the passing of cold fronts. Cold fronts are typically followed by ridging highs which bring onshore flow and rain to the eastern half of the country.

The temperature inversion layer keeps the air pollutants trapped in the lower atmosphere, causing increasingly poor air quality. These inversions, which occur as a result of the anticyclone subsidence, suppress the diffusion and vertical dispersion of pollutants by reducing the depth of the mixing layer. Such inversions therefore play an important role in controlling the long-range transport, and recirculation of pollution. The lowest elevated inversion occurs at approximately the 700 hPa level (- 3 km above sea level) (Cosijn, 1995). Conditions in the winter months are highly unfavourable for the dispersion of atmospheric pollutants (Preston-Whyte and Tyson, 1988).

6.3.2 RAINFALL AND TEMPERATURE

Rainfall occurs predominantly in summer while the least amount of rain falls in the winter months. The rainfall data displayed is the average monthly rainfall over the period of 2010 – 2015 obtained from the World Weather Online website. The maximum mean-daily temperature occurred in December (23.5°C) whilst the minimum mean-daily temperature occurred in June (11.9°C). Summer temperatures are typically warmer, resulting in convection, with water vapour evaporation, and condensation completing the atmospheric water cycle processes. The maximum temperature in 2015 occurred in December at 38.9°C and the minimum temperature in 2015 occurred in June at -0.8°C. Precipitation in the form of showers and thundershowers are typical in this season.

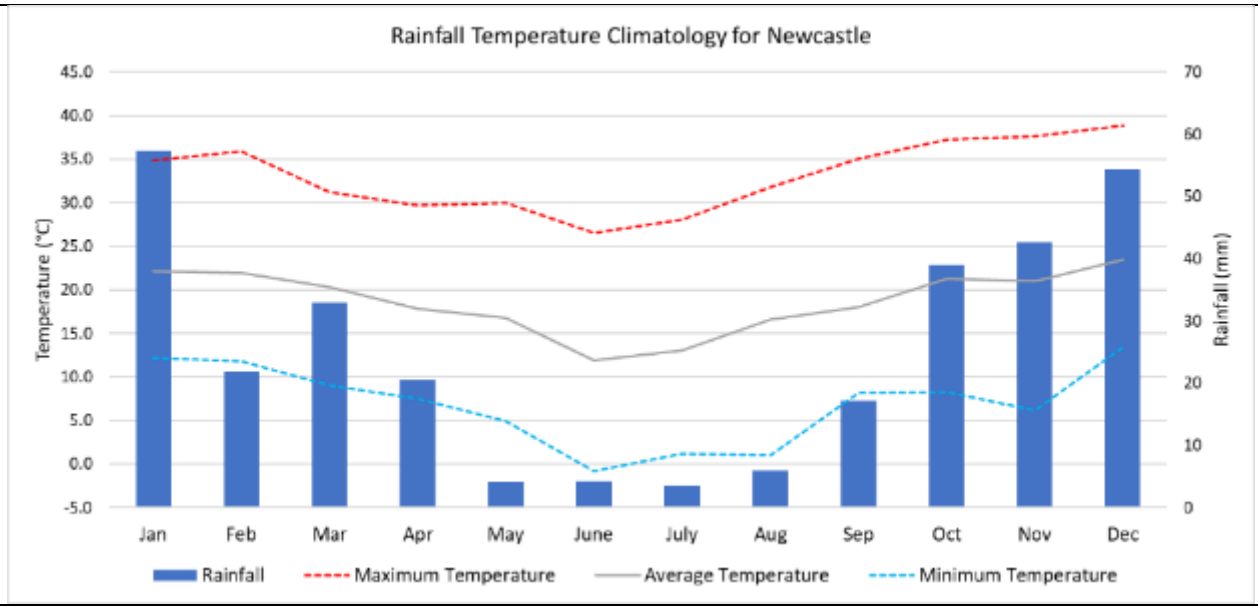


Figure 6-2: Climatic Data for Newcastle, KZN
(Average maximum and minimum temperatures at the Newcastle SAWS station for 2015 and average rainfall from World Weather Online website for 2010 - 2015.)

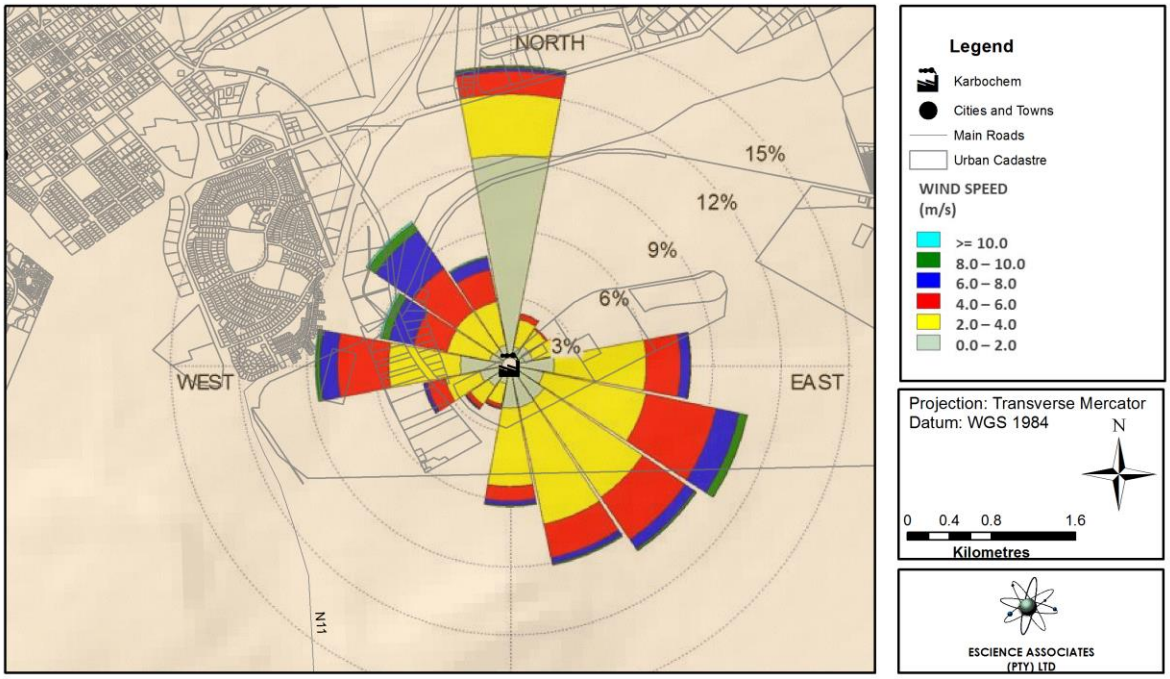
6.3.3 WIND

In general, calm, light wind speed conditions (0 – 3 m/s) are experienced in the lower lying valley regions of the modelling domain. Wind speed increases as terrain height increases. The Newcastle SAWS meteorological station is the nearest SAWS observation station to the Brother CISA plant location. The annual average wind speed measured at the Newcastle SAWS station in 2015 is 2.99 m/s.

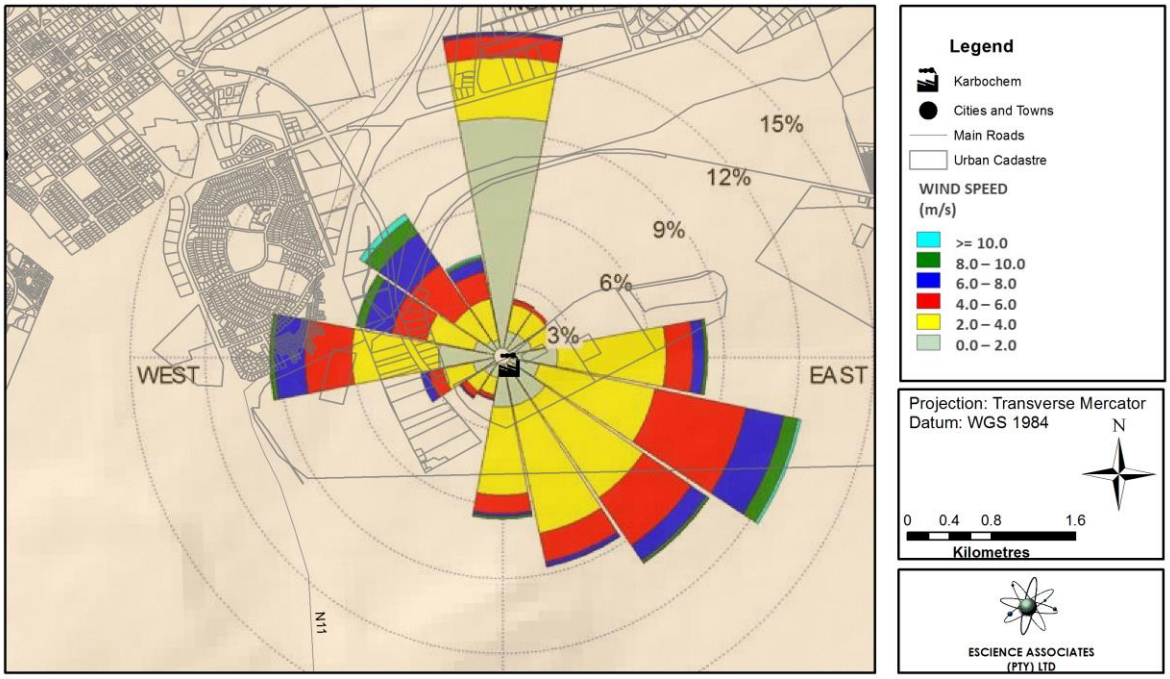
Wind roses have been developed from wind speed and wind direction data from the Newcastle SAWS meteorological stations in proximity to Brother CISA. These are presented in Figure 6-3. The data represents the full year of data collection for the years 2012 - 2015. The wind roses show the wind direction and distribution of wind speeds experienced in 2012 to 2015. The length of the colour-coded line is proportional to the frequency of occurrence of wind blowing from that direction. Wind speed classes are also colour coded and the length of each class/category is proportional to the frequency of occurrence of wind speed.

In general, wind speeds vary throughout the year, within each month and within each season, varying from calm 0.5 m/s – 1.4 m/s (25% frequency) to light 1 m/s – 2m/s to stronger gusts (>10 m/s). The resultant wind is predominantly east-west for the period of 2012 - 2015. The seasonal wind roses indicate the periods and wind patterns that contribute to this phenomenon and demonstrate the shifting wind pattern during the year (Figure 6-4).

2012 Annual Windrose



2013 Annual Windrose



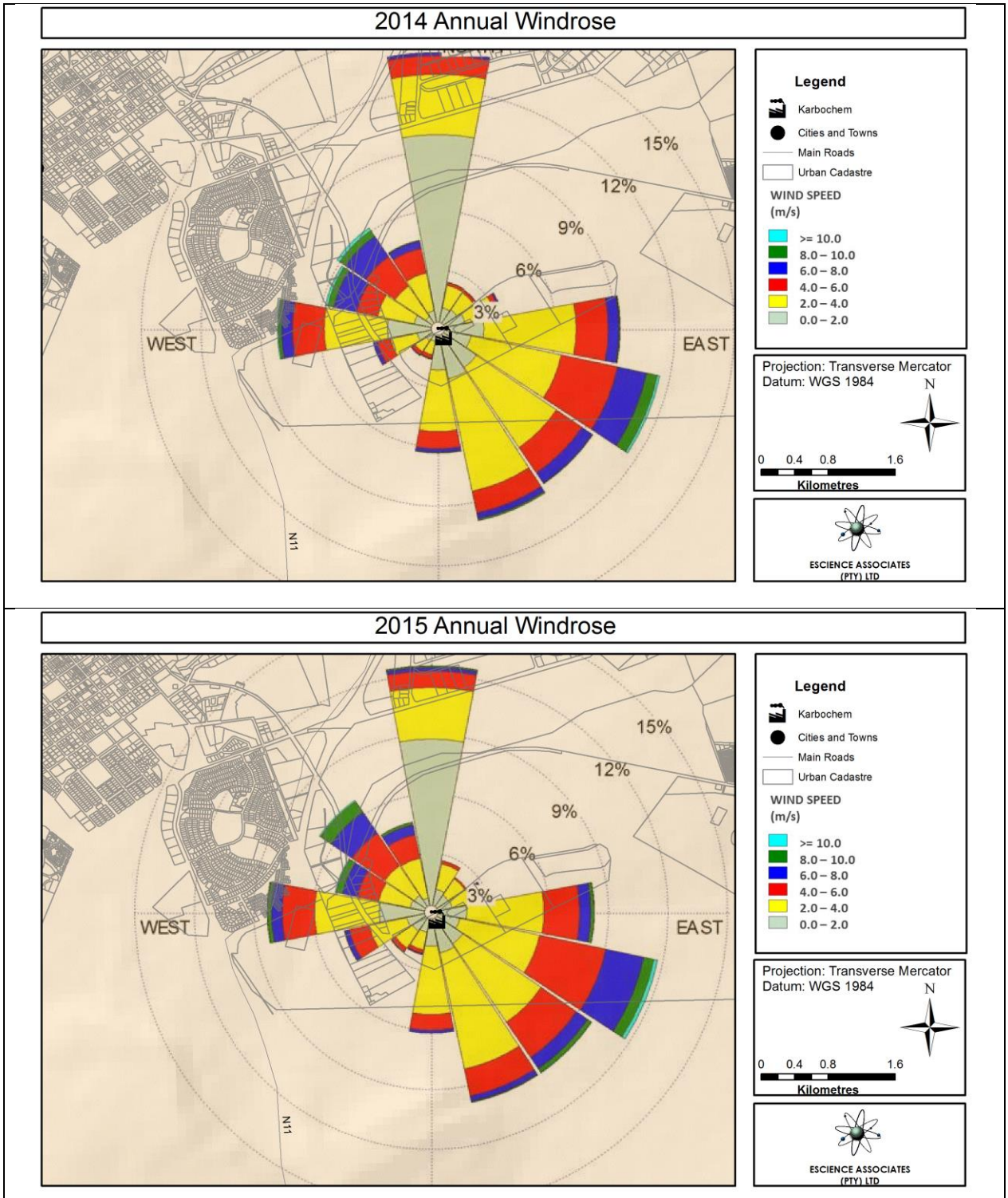
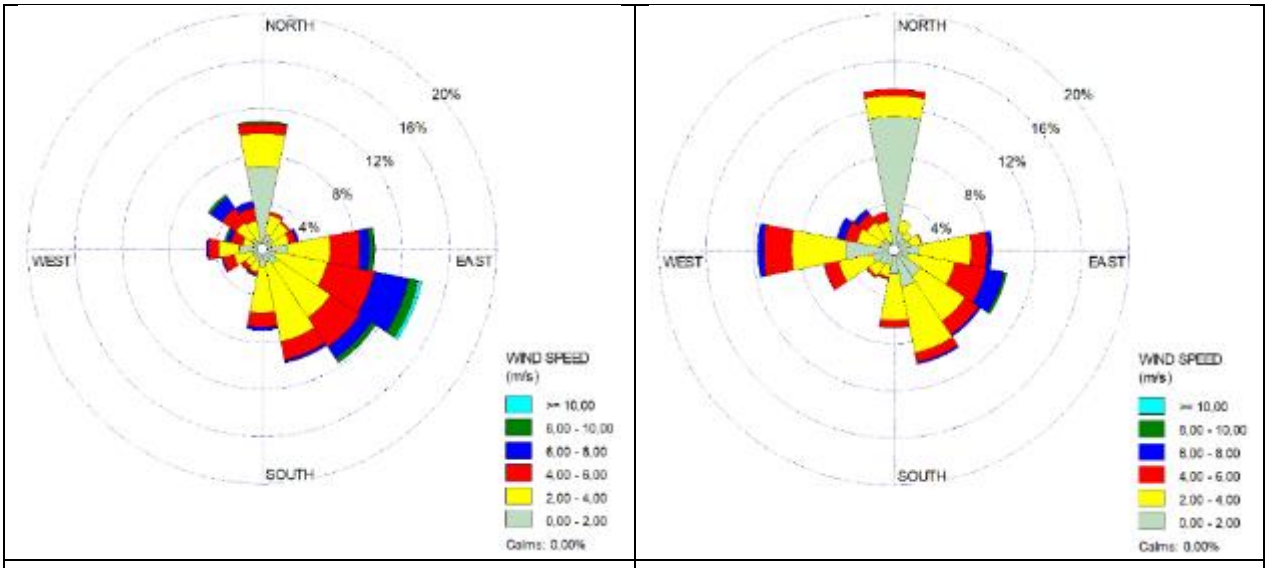
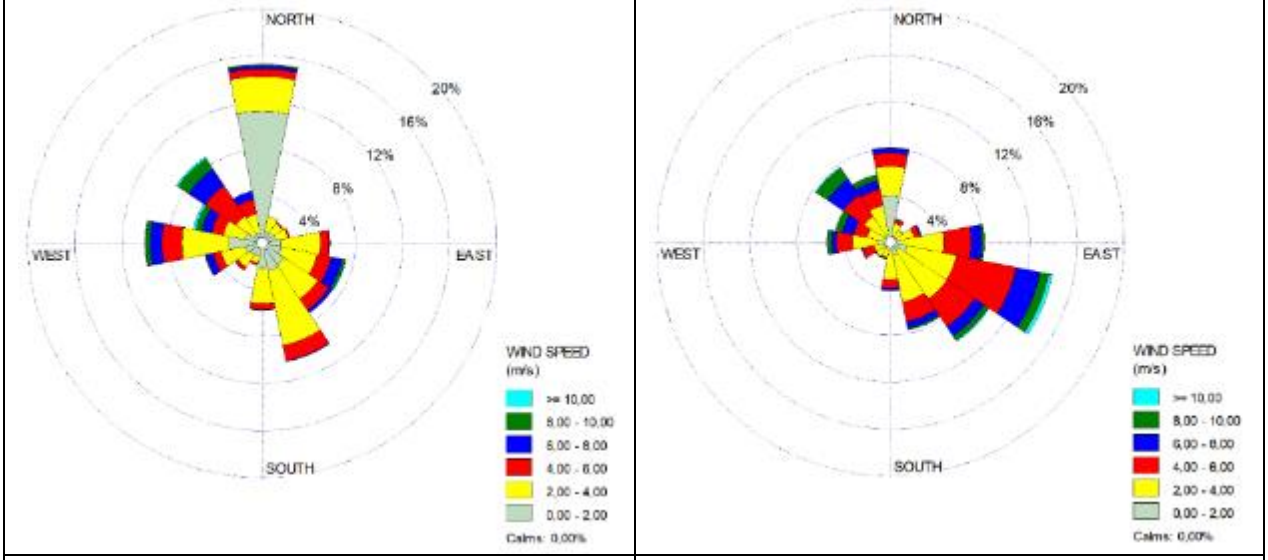


Figure 6-3: Wind roses from Newcastle SAWS station



Summer | **Autumn**



Winter | **Spring**

Figure 6-4: Seasonal Wind roses from Newcastle SAWS station measured data for 2015

6.4 REGIONAL GEOLOGY

According to the published 1:125 000 scale geological map of the area (2729D Newcastle) the site is underlain by sandstone and shale with coal seams of the Vryheid Formation, Ecca Group, Karoo Supergroup. Weathering of the sandstone is generally relatively limited and is associated with a thin surface cover. With the occurrence of shallow groundwater, pedogenic materials, such as hardpan ferricrete can be anticipated in the area. Some areas surrounding the site are underlain by dolerite, which weathers to clayey soils.

The area is underlain by sandstone, mudstone and shale of the Vryheid Formation, Ecca Group. It varies in thickness from 260 - 320 m. The disposition of the Karoo sediments locally is strongly influenced by the numerous dolerite intrusions, in the form of sheets and dykes. Limited alluvial deposits, seldom more than 2 m thick, generally occur along and in the channels of the larger streams and rivers (CSIR 1997).

6.5 TOPOGRAPHY

Figure 6-5 demonstrates the topography in the region of interest surrounding the Brother CISA site. The region forms part of South Africa's elevated inland plateau. The topography is relatively complex ranging from 900 mamsl in the east to elevations of above 2000 mamsl in the northwest with the central parts of the municipality at approximately 1200 m. The site and immediate surrounds slope towards the Karbochem spruit on the eastern border and the Nagane and Ncandu Rivers further north and east.

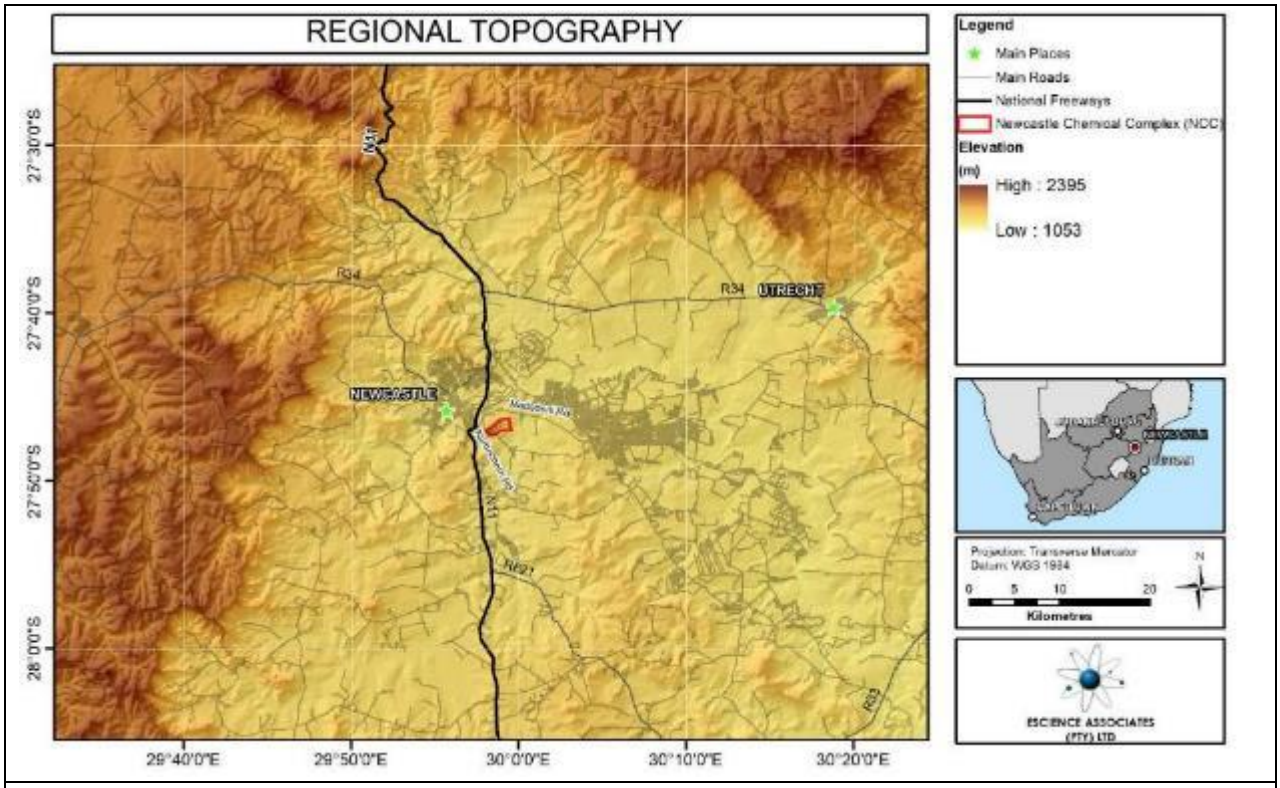


Figure 6-5: Topography map of the modelled area indicating complex terrain around the Brother CISA plant.

6.6 SURFACE WATER

6.6.1 WATER MANAGEMENT AREA

The site falls within the Pongola-Mzimkulu Water Management Area. It was previously within the Thukela Water Management Area as declared under the first edition of the National Water Resource Strategy. However, the Thukela Water Management Area has now been absorbed into the larger Pongola-Mzimkulu Water Management Area as per Government Notice 411 of 23 May 2014.

6.6.2 SURFACE WATER HYDROLOGY

The Newcastle Chemical Park occurs in the Buffalo River catchment, the most northerly secondary catchment of the Thukela River catchment. The Ngagane River flows north east toward Newcastle passing within about 2 km of the Newcastle Chemical Park.

The Chelmsford Dam is some 25 km to the south and upstream of the Newcastle Chemical Park. Mittal Steel is situated downstream of Karbochem and is a major user of water from

the Ngagane River. The Ncandu River, occasionally contaminated with various industrial runoff waters, flows in a north easterly direction some 6.5 km north west of the Newcastle Chemical Park. The Karbochem spruit flows in a north easterly direction, immediately to the south of the Newcastle Chemical Park, into the Ngagane River. It has little or no flow upstream of the Newcastle Chemical Park during dry periods. Downstream flow is predominantly discharged treated effluent and runoff from Karbochem.

6.6.3 SURFACE WATER QUALITY

There are numerous activities in the region that are responsible for contributing to the pollution of the water quality within the Ngagane Catchment, such as agricultural, historical and existing mining and industrial activities. The upper Buffalo River is the most impacted tributary in the Thukela and the water quality is reported to be poor down to its confluence with the Thukela (DWAF, 2004).

6.6.3.1 Karbochem Spruit Water Qualities

The 2017-2018 water qualities for the Karbochem Spruit are shown in Figure 6-6, Figure 6-7 and Figure 6-8 and described below.

The Electrical conductivity upstream increased from January 2018 till September 2018. The EC concentration decreases towards the mid- and downstream. The average EC concentration is 50.1 mS/m. (GPT, 2019)

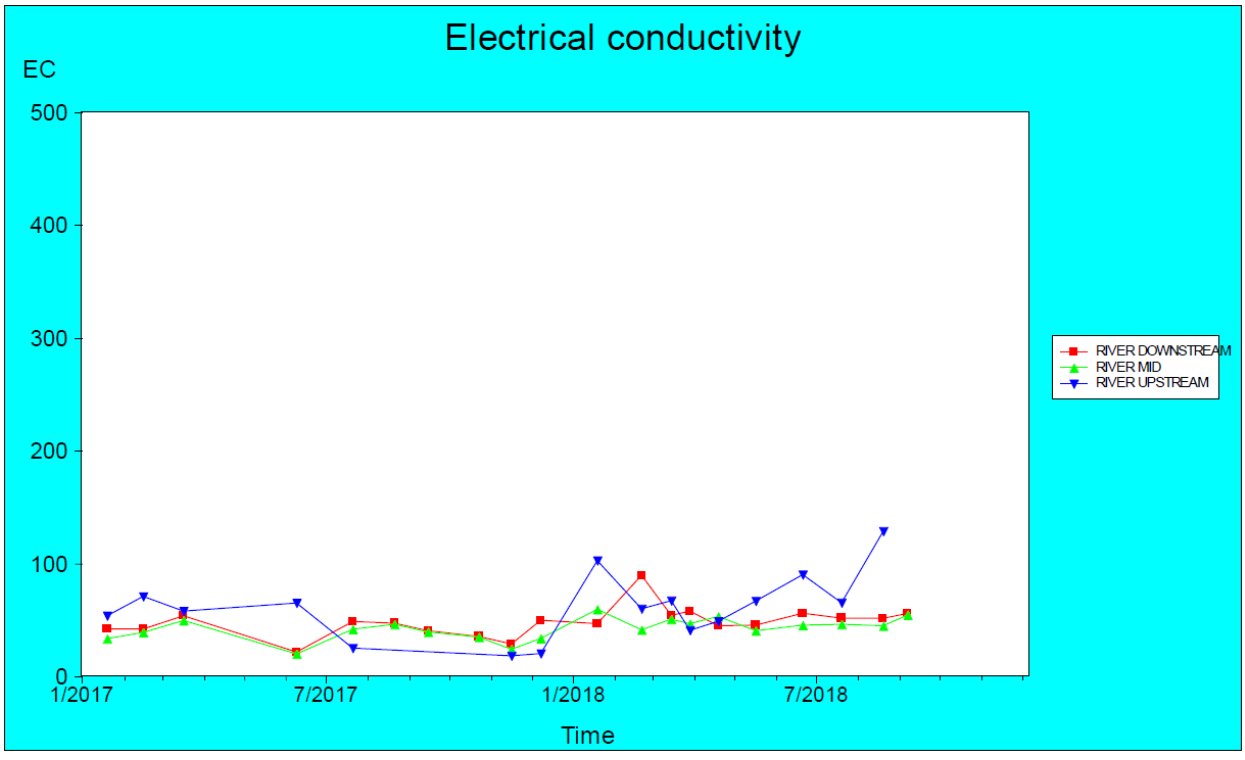


Figure 6-6: Electrical Conductivity of the Karbochem Spruit (GPT, 2019)

The sulphate concentration upstream increased from January 2018 till September 2018. The average sulphate concentration is 108.3 mS/m. (GPT, 2019)

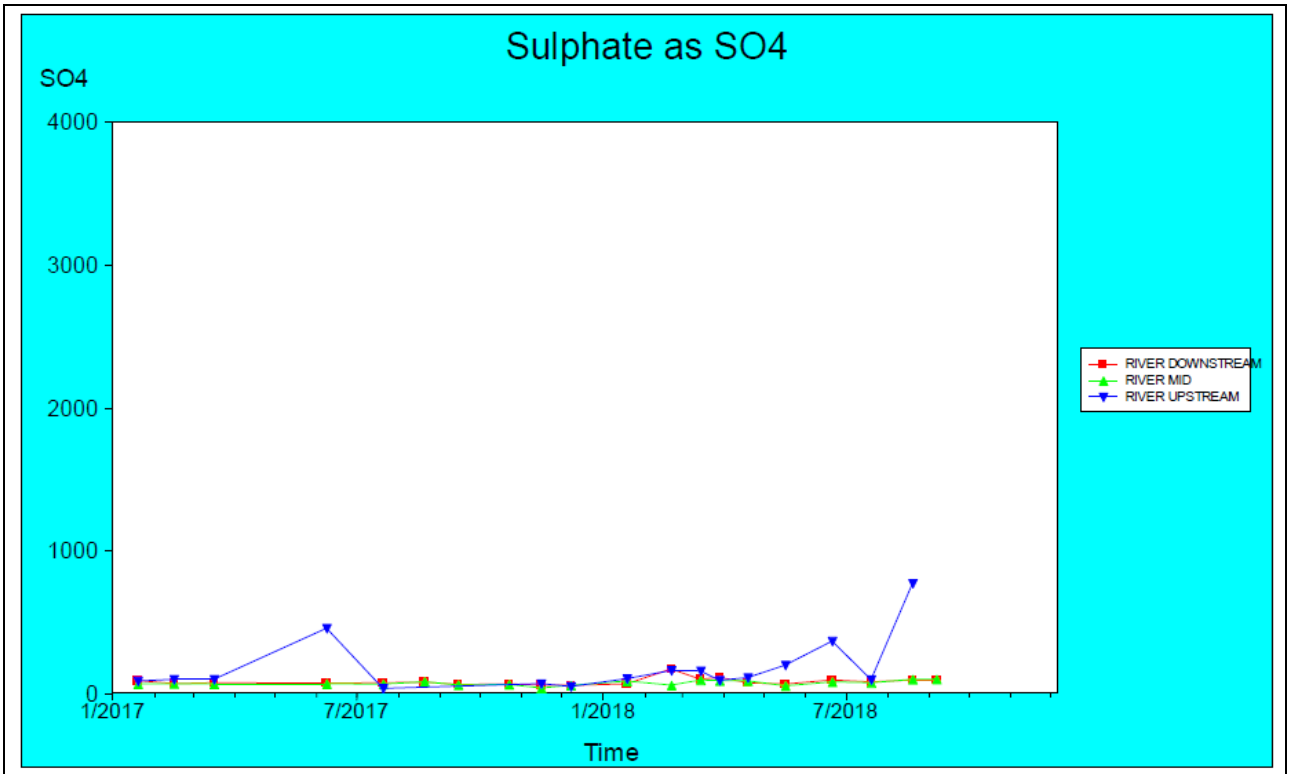


Figure 6-7: Sulphate Concentration of the Karbochem Spruit (GPT, 2019)

The pH value increased from June 2017. During April 2018, the upstream and downstream pH values increased significantly, followed by decreasing values till September 2018. The average pH value is 7.1 mg/l. (GPT, 2019)

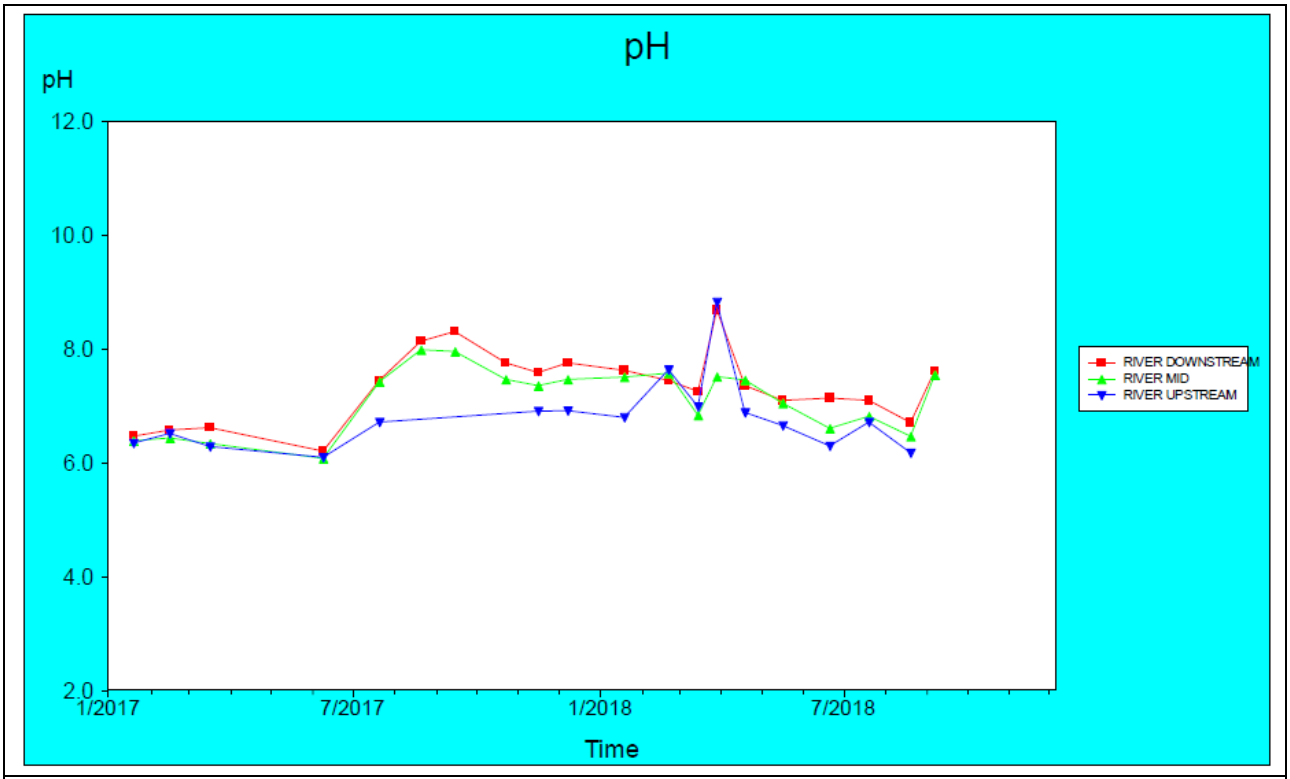


Figure 6-8: pH value of the Karbochem Spruit (GPT, 2019)

6.7 GROUNDWATER

According to the 1:500 000 hydrogeological map series 2726 Kroonstad (Baran and Jonck, 2000), of which a portion is shown in Figure 6-9, the area has reasonable to good groundwater resources. The area of the Newcastle Chemical Park is indicated as having more moderate yields, in the range of 0.5-2L/s.

An extract from the National Groundwater Database shows the borehole yields for all holes within 6km radius of the Newcastle Chemical Park. This confirms that although boreholes are generally low yielding or dry, there are some moderate (1-2L/s) and substantial (> 3L/s) yields. It is quite likely that these very holes are amongst those used to generate the 1:500 000 hydrogeological map yield classes.

Table 6-1: Extract from National Groundwater Database (from Meyer & Godfrey 1995).

Yield (l/s)	Number of Boreholes	Percentage of Boreholes
<0.01	21	55
<0.01 - 0.5	3	8
0.5 - 1.0	3	8
1.0 - 2.0	6	16
2.0 - 3.0	0	0
3.0 - 25.0	5	13

The hydrogeological map (Figure 6-9) indicates that groundwater is found in intergranular and fractured situations. This means that a combination of fracturing, weathering and some primary porosity account for the occurrence of groundwater. It is therefore likely that groundwater will be most abundant nearer to the surface, but that significant groundwater may still be found at greater depths in both fractures and bedrock.

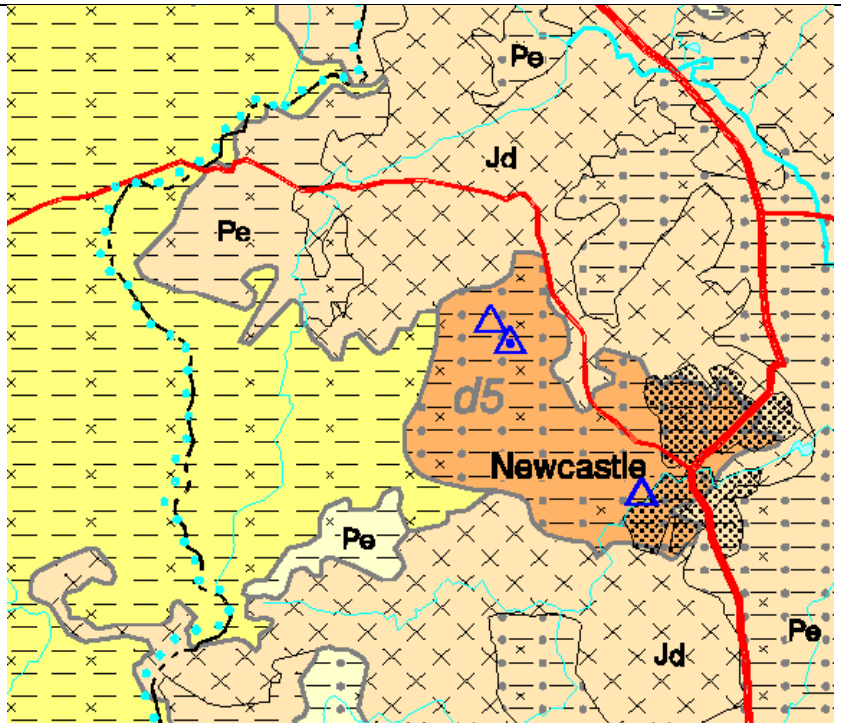


Figure 6-9: Extracts from the Kroonstad 1:500 000 hydrogeological sheet (Baran & Jonck, 2000).

6.7.1 GROUNDWATER FLOW

Groundwater flow is generally towards the south and south east and thus towards the Karbochem Spruit that flows to the north east. (Figure 6-10) (GPT, 2019)

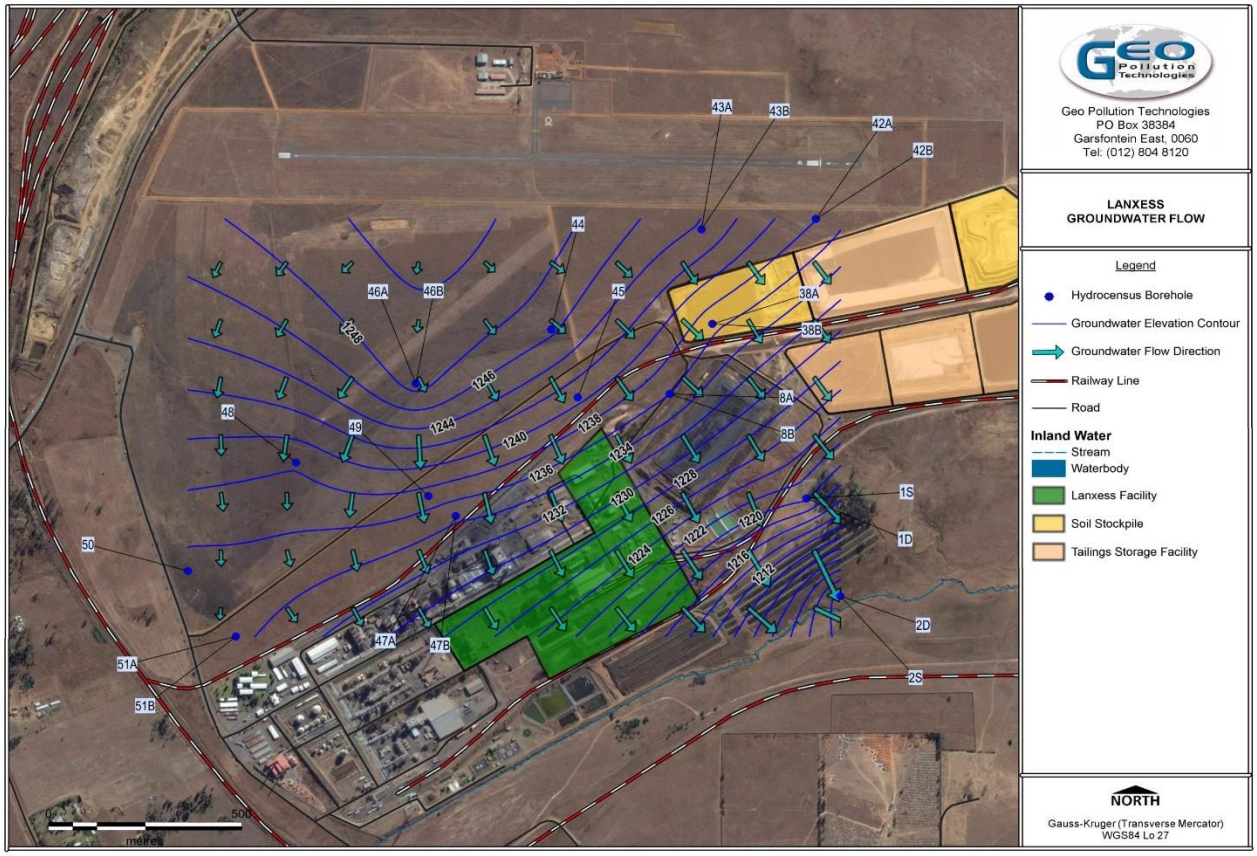


Figure 6-10: Groundwater Flow Direction (GPT, 2019)

6.7.2 GROUNDWATER USE

The site is largely surrounded by open land not under use by any person or is being used for purposes that do not require significant water, such as the Newcastle Airfield, or under waste disposal dams/dumps related to the industries at Newcastle Chemical Complex.

The most significant use of groundwater is likely to be environmental. Wetlands to the south-east of the facility are likely to be reliant upon this moisture.

6.8 SOCIO-ECONOMIC ENVIRONMENT

The following extracts are from the Newcastle Municipality Integrated Development Plan: 2013/2014 Review, dated 18 March 2013.

According to the most recent Community Survey (2016) conducted by Statistics SA, Newcastle Local Municipality (KZN252) remains the highest contributor in terms of population growth within Amajuba District Municipality. As of 2016, the population of Newcastle is recorded at 389 117 people, thus marking a 7,1 % increase (25 881 people) over a 5-year period from the year 2011 (363 236 people). This means that on average, Newcastle has experienced a 1,42% annual growth rate, which translates to 5 176 people

per year. Newcastle has also experienced a significant increase in the total youth proportion of the population. In terms of the wider KwaZulu-Natal Province, Newcastle ranks 2nd as the local municipality with the highest number of people when compared to other local municipalities, with the highest being the Msunduzi Local Municipality. The population of Newcastle is spread unevenly over 34 wards as per the outcomes of the recent ward delineation process by the Demarcation Board, marking a 3 wards increase.

Newcastle Local Municipality is well placed to benefit from regional economic growth given its strategic location at the nexus of major tourism, logistics, farming and industrial routes, and is amongst the seats of government in the KwaZulu-Natal Province. It is located halfway between Johannesburg and the harbours of Durban and Richards Bay, hence contributing to the export of manufactured goods and supply to the large Gauteng market. Newcastle is also endowed with good access infrastructure to the areas mentioned above, and such includes quality road and railway networks. The town is situated on the national rail route between the Durban Container Terminal and City Deep in the Gauteng Province, and has within its confines, a major rail exchange terminal, supporting railway stations and extensive goods conversion/warehousing facilities.

Unemployment rate in Newcastle Municipality is estimated at 37.4% of the total number of economically active people according to the Newcastle Municipality Integrated Development Plan: 2020/2021. This data is based on Stats SA census data from 2011.

During the period 2001 to 2011 there was a 23.04% decline in the level of unemployment within Newcastle, from 87 619 (60.48%) in 2001 to 37 686 (37.44%) in 2011. In terms of unemployment by gender, the highest concentration was recorded as being amongst the female population. With regards to formal employment by sector within Newcastle Municipality, trade/retail was recorded as the highest employer of the population at 8 888 as of July 2012, followed by Government services at 18 324. Government services as an employment sector is closely followed by manufacturing at 6 419, and subsequently finance at 5 375. As of 2013 the GDP of Newcastle was recorded as occupying 80.20% of the total GDP (0.7%) generated by Amajuba District within the KwaZulu-Natal Province. In terms of the Human Development Index (HDI – the composite measure of life expectancy, education, and income used to measure human development), Newcastle is recorded as sitting at 0.57 which is deemed by the United Nations Development Programme as being medium human development index.

Regarding the levels of poverty, Newcastle has also experienced a decrease from 56.0% in 2002, 51.0% in 2006 and 44,4% in 2012. In terms of the most recent stats from Global Insight (2018), a very high majority of the households in Newcastle (70%) earn a combined income of less than R40,000 per annum, which translates to an average of R3 300 per month. This is significantly below the national average of household income, which is R103 204 per year, or R8,600 per month. This has implications on the Indigent Support provided by the municipality to the community of Newcastle as there are a growing number of households that earn a combined annual income of a maximum of R40,000. In 2011 the total number of households earning less that R40,000 was 68%, which is 58 427 households out of 86 024 households, and it has since increased in 2018 to 70%, which is 61 436 households out of a total number of 90 347 households.

6.9 PALAEONTOLOGICAL, ARCHAEOLOGICAL AND CULTURAL IMPORTANCE

The site falls within an established industrial site. As the site has a long term industrial history, evidence of any cultural and archaeological nature which may be present is neither visible nor accessible. All portions of the property have already been extensively developed and modified through spoil heap stockpiling for backfilling, digging, landscape terracing and extensive on-site building construction. No archaeological heritage or fossils were identified anywhere within the proposed development area during the heritage specialist surveys.

7 DEFF ONLINE SCREENING TOOL

The National Department of Environment Forestry and Fisheries (DEFF) has developed a national screening tool that identifies potentially environmentally sensitive areas in and around the proposed site. The screening tool is publicly available at the following link:
https://screening.environment.gov.za/screeningtool/index.html#/pages/welcome

It is now a requirement that any application for environmental authorisation is accompanied by such a screening report. Table 7-1 shows the environmental sensitivities identified by the DEFF Online Screening Tool within the vicinity of the proposed development footprint.

Table 7-1: Environmental sensitivities identified by DEFF Online Screening Tool

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Agriculture Theme		X		
Animal Species Theme			X	
Aquatic Biodiversity Theme				X
Archaeological and Cultural Heritage Theme		X		
Civil Aviation Theme		X		
Plant Species Theme				X
Defence Theme				X
Terrestrial Biodiversity Theme	X			

The screening tool identified the following specialist studies that may be applicable to the proposed facility based on the site's classification, and the identified environmental sensitivities of the proposed development footprint:

- Agricultural Impact Assessment
- Landscape/Visual Impact Assessment
- Archaeological and Cultural Heritage Impact Assessment
- Palaeontology Impact Assessment
- Terrestrial Biodiversity Impact Assessment
- Aquatic Biodiversity Impact Assessment
- Hydrological Assessment
- Noise Impact Assessment
- Traffic Impact Assessment
- Health Impact Assessment
- Socio-Economic Assessment
- Ambient Air Quality Impact Assessment
- Air Quality Impact Assessment
- Plant Species Assessment
- Animal Species Assessment

It is the professional opinion of EScience Associates that the above listed studies are not all relevant based on the disturbed and developed nature of the site, the surrounding land

uses, and the nature of proposed activities as an addition to existing activities. The following specialist studies were identified as being relevant:

- Air Quality Impact Assessment in support of an Atmospheric Emission Licence (AEL) application as well in cognisance that emissions to atmosphere are likely to the environmental concern of most significance.
- Archaeological, Palaeontological and Cultural Heritage Screening Assessment. This will be required due to the fact that excavation may be required during construction, together with the fact that the area is deemed to be of high Archaeological and Cultural Heritage sensitivity.
- Major Hazard Installation Risk Assessment, due to the storage of dangerous goods.

Further to this the minister of Environment, Forestry and Fisheries published Government Notice 320 on 9th May 2020 – "Procedures For The Assessment And Minimum Criteria For Reporting On Identified Environmental Themes In Terms Of Sections 24(5)(A) And (H) And 44 Of The National Environmental Management Act, 1998, When Applying For Environmental Authorisation".

The gazette sets out various protocols to be followed for sensitive sites. In this case aviation sensitivity is of particular concern as the site falls within a 'high' aviation sensitivity as per the DEFF screening tool (Page 13 of the DEFF screening report). Accordingly, a specialist Civil Aviation Impact Assessment was commissioned as part of the Environmental Impact Assessment,

7.1 MOTIVATION FOR THE EXCLUSION OF VARIOUS SPECIALIST STUDIES IDENTIFIED BY THE DEFF SCREENING TOOL

As a precursor it must be noted that the proposed site is within the established industrial Newcastle Chemical Park. This industrial park was developed over 40 years, with the land having been cleared and levelled. The Brother CISA operations were commenced in 1996-7. The target area is an existing cleared and levelled area within which there already various facilities and activities related to Brother CISA's operations and its previously authorised expansions, as well construction activities which did not require authorisation (i.e. non-listed activities). There are no natural habitats of potential significance within the footprint.

The nature of the site is clear in the satellite image in Figure 7-1 below.

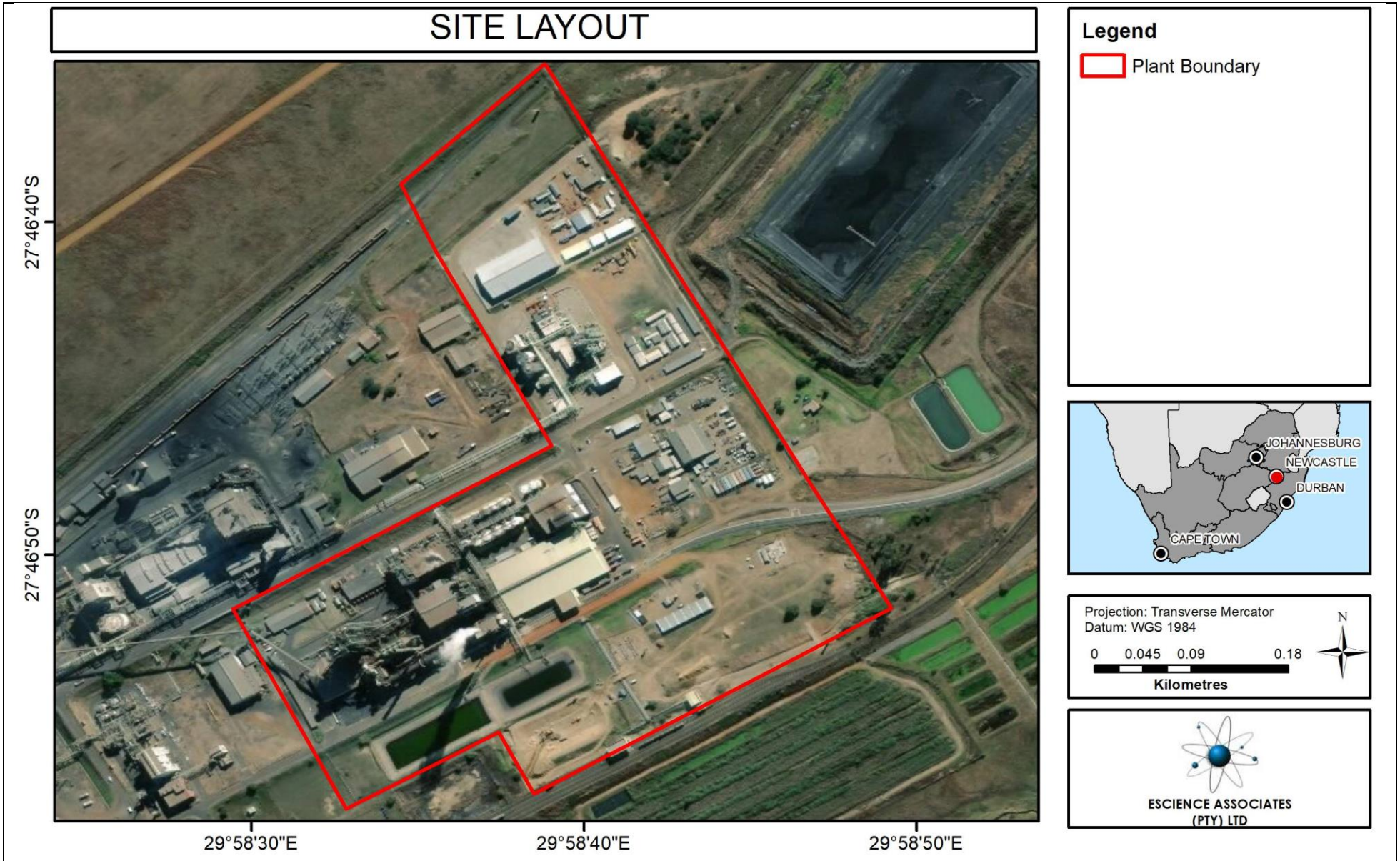


Figure 7-1: Satellite Image of Site

7.1.1 AGRICULTURAL IMPACT ASSESSMENT

The proposed activities will be undertaken wholly within the disturbed footprint of the site. Consequently, there will be no impact on agriculture or any sterilisation of arable land. An Agricultural Impact Assessment is therefore deemed unnecessary.

7.1.2 LANDSCAPE/VISUAL IMPACT ASSESSMENT

The proposed activities will be undertaken wholly within the disturbed footprint of the site. The facility is within a large heavy-industrial complex. The infrastructure will not be higher or more visible than any of the existing industrial infrastructure on site. There will thus be no changes to the sense of place and a Visual Impact Assessment is deemed unnecessary.

7.1.3 TERRESTRIAL BIODIVERSITY IMPACT ASSESSMENT

The proposed activities will be undertaken wholly within the disturbed footprint of the site. There are no natural habitats of potential significance within the footprint. There will be no clearance of vegetation. Consequently, the potential for terrestrial biodiversity impacts is negligible. A Terrestrial Biodiversity Impact Assessment is therefore deemed unnecessary.

7.1.4 AQUATIC BIODIVERSITY IMPACT ASSESSMENT

The proposed activities will be undertaken wholly within the disturbed footprint of the site. The facility will be contained within the existing dirty water containment area. Consequently, the potential for aquatic biodiversity impacts is negligible. An Aquatic Biodiversity Impact Assessment is therefore deemed unnecessary.

7.1.5 HYDROLOGICAL ASSESSMENT

The proposed activities will be undertaken wholly within the disturbed footprint of the site. The facility will be contained within the existing dirty water and stormwater separation infrastructure and will not cause additional run-off or other hydrological impacts. Consequently, a Hydrological Impact Assessment is deemed unnecessary.

7.1.6 NOISE IMPACT ASSESSMENT

The proposed activities will be undertaken at the existing facility within the boundaries of the industrial complex. The noise profile of the industrial complex is not expected to change. No 'disturbing noise' as defined in the Noise Control Regulations (GN.R 154 GG 13717 of 1992). A Noise Impact Assessment is therefore deemed unnecessary.

7.1.7 TRAFFIC IMPACT ASSESSMENT

The activity will result in additional road traffic through the delivery of raw materials to the facility and transport of products away from the facility, however, due to a number of business having closed at the Newcastle Chemicals Complex, the traffic has reduced significantly and thus the expected total trips to and from the facility is still expected to be lower than the number of trips when all businesses were operational in the past. It is therefore anticipated that there will not be a net increase in the amount of transport historically associated with the site. A Traffic Impact Assessment is therefore not deemed necessary.

7.1.8 HEALTH IMPACT ASSESSMENT

The only anticipated potential health impacts will be air quality related. These impacts are assessed within the Air Quality Impact Assessment.

7.1.9 SOCIO-ECONOMIC ASSESSMENT

The expansion is expected to be beneficial to the Brother CISA company resulting in increasing its sustainability. The nature and scope of the proposed development (an expansion of an existing industrial plant within an existing industrial complex) is such the socio-economic impact is not anticipated to be so significant in magnitude or complexity such that a socio-economic assessment would be necessary. A Socio-Economic Assessment is therefore deemed unnecessary.

7.1.10 PLANT SPECIES ASSESSMENT

The proposed activities will be undertaken wholly within the disturbed footprint of the site. There will be no clearance of vegetation. A Plant Species Assessment is therefore deemed unnecessary.

7.1.11 ANIMAL SPECIES ASSESSMENT

The proposed activities will be undertaken wholly within the disturbed footprint of the site. There are no natural habitats of potential significance within the footprint. There will be no clearance of vegetation or any disturbance of existing biodiversity habitat outside the footprint. An Animal Species Assessment is therefore deemed unnecessary.

8 SPECIALIST STUDIES

A summary of the specialist assessments is presented here. The complete specialist reports are attached in Appendix 4.

8.1 AIR QUALITY IMPACT ASSESSMENT

8.1.1 INTRODUCTION

A specialist air quality impact assessment was undertaken by EScience Associates (Pty) Ltd. A summary of the assessment is provided herein. The full Air Quality Impact Assessment can be found as Appendix 4.1 hereto.

8.1.2 METHODOLOGY

A best practice approach utilising computerised numerical dispersion modelling techniques to predict the maximum ground level pollutant concentrations was used. In this respect, an assessment of the temporal and spatial distributions of ground level pollutant concentrations was undertaken through the following process:

- A review of international and South African ambient air quality standards and guidelines as well as international risk factors for pollutants of concern against which the predicted impact of the process was evaluated;
- Sourcing meteorological data from surrounding South African Weather Service stations, processing meteorological data into a format suitable for meso-scale modelling inputting and providing a description of the climate and atmospheric conditions impacting on the atmospheric dispersion potential proximal to the site;
- Compilation of an emissions inventory for the proposed expansion.
- Dispersion modelling and compilation of isopleth maps indicating predicted ground level concentrations of expected pollutants according to the applicable averaging periods and frequency of exceedance where relevant; The U.S. EPA approved California Puff (CALPUFF) dispersion modelling suite was employed.
- Air quality impact assessment including a comparison of predicted concentrations with national legal requirements and National Ambient Air Quality Standards (NAAQS) and international guidelines where relevant.

Source specific data such as source type, height and diameter, emission rates and exit conditions (temperature, velocity and flow rate) are required for dispersion modelling.

An emissions inventory for current operations was formulated based on measured stack emissions data.

An emissions inventory for the proposed expansions was formulated based on applicable emissions standards and process information provided by Brother CISA.

It must be noted that the processes are undertaken within enclosed equipment and vessels with extraction via abatement equipment where applicable. No fugitive emission sources of potential significance have been identified, and therefore it is reasonably concluded that fugitive emissions will be insignificant.

In accordance with the Regulations Regarding Air Dispersion Modelling (GN.R 533 of 2014), three consecutive meteorological years, of the last five years were modelled (2017 to 2019).

8.1.2.1 POINT SOURCE PARAMETERS

Existing point source parameters are shown in Table 8-1. Proposed point source parameters are shown in Table 8-2. Note that the stacks are not all sequentially numbered as some stacks have been rerouted or combined overtime.

Table 8-1: Point Source Parameters - Existing

Point Source Number	Point Source Name	Latitude (UTM) South	Longitude (UTM) East	Height of release (magl)	Height above nearby building (m)	Diameter at stack tip/vent exit (m)	Actual gas exit temperature (°C)	Actual gas volumetric flow (m^3/hr)	Actual gas exit velocity (m/s)
LD 01	Ball Mill Off-Gas Bag House	6923.472	793.247	46.3	2	0.60	75.5	24 290	23.85
LD 02	Yellow Soda Ash Bag Filter / R04013	6923.479	793.263	35.4	2	0.07	64.5	5 750	21.90
LD 03	White Soda Ash Silo Extraction System	6923.483	793.255	35.4	2	0.065	31.0	1 072	4.60
LD 04	Kiln ESP / G05022	6923.473	793.312	50.0	15	3.10	214.0	263 447	9.70
LD 05	Wet Mill Scrubber	6923.484	793.370	30.0	30	1.00	90.5	35 425	12.55
LD 07	B/F enclosure extraction scrubber	6923.484	793.314	18.4	2	0.33	29.0	5 430	17.65
LD 08	Combined Stack Scrubber	6923.528	793.351	28.0	2	1.00	38.0	30 853	10.95
LD 09	SO_2 Scrubber	6293.528	793.351	21.9	2	0.38	29.0	6 104	14.95
LD 10	IMS Evaporator Stack	6923.519	793.318	27.0	2	0.21	98.0	2 577	20.67
LD 12	Sodium Bicarbonate Candle filter	6923.543	793.296	25.0	2	0.44	34.5	6 230	11.35
LD 14	Soda Calciner Candle filter	6923.541	793.302	24.9	2	0.44	44.5	7 025	12.85
LD 16	Calciner Off-gas scrubber	6923.546	793.335	24.0	2	0.44	75.0	1 925	3.55
LD 17	SDC crystal drying scrubber	6923.510	793.354	27.1	2	1.07	30.5	19 897	6.15

Table 8-1: Point Source Parameters - Existing

Point Source Number	Point Source Name	Latitude (UTM) South	Longitude (UTM) East	Height of release (magl)	Height above nearby building (m)	Diameter at stack tip/vent exit (m)	Actual gas exit temperature (°C)	Actual gas volumetric flow (m^3/hr)	Actual gas exit velocity (m/s)
LD 18	Hydrogen Scrubber	6923.613	793.432	15.8	2	0.21	28.5	397	3.50
LD 19	Oxygen Scrubber	6923.602	793.445	19.9	2	0.20	34.0	263.5	2.35
LD 20	CA crystallisation Vacuum pump	6923.591	793.441	17.3	2	0.14	29.0	177	3.15
LD 21	CA drying and packaging scrubber	6923.591	793.429	16.8	2	0.44	37.5	11 394	20.85
LD 22	Tank farm scrubber	6923.505	793.272	16.8	2	0.25	34.0	1 550	8.80
GB 1	Boiler Stack 1	6923.698	793.466	25.0	2	1.49	51.0	22 162	3.50
GB 2	CO_2 Absorption Stack	6923.701	793.471	25.0	2	0.80	40.0	30 435	16.65

Table 8-2: Point Source Parameters – Proposed

Point Source Number	Point Source Name	Latitude (UTM) South	Longitude (UTM) East	Height of release (magl)	Height above nearby building (m)	Diameter at stack tip/vent exit (m)	Actual gas exit temperature (°C)	Actual gas volumetric flow (m3/hr)	Actual gas exit velocity (m/s)
CTS1	CTS Organic Stack 1	6923.62554	793.53287	25	2	0.05	40	78.568	11.115
CTS2	CTS Organic Stack 2	6923.62554	793.53287	25	2	0.2	35	2256.4	20.0
CTS3	CTS Organic Stack 3	6923.62554	793.53287	25	2	0.08	60	202.1	11.2
CTS4	CTS Organic Stack 4	6923.62554	793.53287	25	2	0.08	35	287.1	15.9
CTS5	CTS Organic Stack 5	6923.62554	793.53287	25	2	0.08	35	204.2	11.3
CTS6	CTS Organic Stack 6	6923.62554	793.53287	25	2	0.05	35	109.7	15.5
CTS7	CTS Organic Stack 7	6923.62554	793.53287	25	2	0.08	35	279.7	15.5
CTS8	CTS Organic Stack 8	6923.62554	793.53287	25	2	0.2	70	1827.6	16.2
CTS9	CTS Organic Stack 9	6923.62554	793.53287	25	2	0.05	50	83.2	11.8
CTS10	CTS Organic Stack 10	6923.62554	793.53287	25	2	0.1	70	384.7	13.6
CTS11	CTS Organic Stack 11	6923.62554	793.53287	25	2	0.1	70	385.8	13.6

Table 8-2: Point Source Parameters – Proposed

Point Source Number	Point Source Name	Latitude (UTM) South	Longitude (UTM) East	Height of release (magl)	Height above nearby building (m)	Diameter at stack tip/vent exit (m)	Actual gas exit temperature (°C)	Actual gas volumetric flow (m3/hr)	Actual gas exit velocity (m/s)
CTS12	CTS Organic Stack 12	6923.62554	793.53287	25	2	0.25	200	2930.0	16.6
CTS13	CTS Organic Stack 13	6923.62554	793.53287	25	2	0.3	50	3426.6	13.5
CTS14	CTS Organic Stack 14	6923.62554	793.53287	25	2	0.25	100	2131.5	12.1
CTS15	CTS Organic Stack 15	6923.62554	793.53287	25	2	0.35	70	6282.1	18.1
CTS16	CTS Organic Stack 16	6923.62554	793.53287	25	2	2	100	220948.5	19.5
CTS17	CTS Inorganic Stack 1	6923.62554	793.53287	25	2	0.8	80	25860.8	14.3
CTS18	CTS Inorganic Stack 2	6923.62554	793.53287	25	2	2.2	60	243956.0	17.8

8.1.2.2 POINT SOURCE EMISSION RATES (NORMAL OPERATING CONDITIONS)

The current emissions rates are given in Table 8-3. These are based on measured stack emissions.

Emissions rates for the proposed activities are given in Table 8-4.

Table 8-3: Brother CISA current point sources emission rates

Point Source number	Point source name	Pollutant name	Average emission rate		Duration of emissions
			(g/s)	Averaging period	
LD 01	Ball Mill Off-Gas Bag House	PM	0.036	1 Hour	Continuous
		Cr^{+6}	BDL	1 Hour	Continuous
		NO_x	1.201	1 Hour	Continuous
		SO_2	0.042	1 Hour	Continuous
		VOC	0.000062	1 Hour	Continuous
LD 02	Yellow Soda Ash Bag Filter/R04013	PM	0.006	1 Hour	Continuous

Table 8-3: Brother CISA current point sources emission rates

Point Source number	Point source name	Pollutant name	Average emission rate		Duration of emissions
			(g/s)	Averaging period	
		Cr^{+6}	0.000001	1 Hour	Continuous
		NO_x	0.005	1 Hour	Continuous
		SO_2	0.00029	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
LD 03	White Soda Ash Silo Extraction System	PM	0.00040	1 Hour	Continuous
		Cr^{+6}	BDL	1 Hour	Continuous
		NO_x	0.001	1 Hour	Continuous
		SO_2	0.000060	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
LD 04	Kiln ESP/G05022	PM	0.075	1 Hour	Continuous
		Cr^{+6}	0.0002	1 Hour	Continuous
		NO_x	7.967	1 Hour	Continuous
		SO_2	1.588	1 Hour	Continuous
		VOC	0.009	1 Hour	Continuous
LD 05	Wet Mill Scrubber	PM	0.014	1 Hour	Continuous
		Cr^{+6}	0.0001	1 Hour	Continuous
		NO_x	0.026	1 Hour	Continuous
		SO_2	0.002	1 Hour	Continuous
		VOC	0.0000045	1 Hour	Continuous
LD 07	B/F Enclosure Extraction Scrubber	PM	0.002	1 Hour	Continuous
		Cr^{+6}	0.0000006	1 Hour	Continuous

Table 8-3: Brother CISA current point sources emission rates

Point Source number	Point source name	Pollutant name	Average emission rate		Duration of emissions
			(g/s)	Averaging period	
		NO_x	0.005	1 Hour	Continuous
		SO_2	0.0003	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
LD 08	Combined Stack Scrubber	PM	0.012	1 Hour	Continuous
		Cr^{+6}	0.00001	1 Hour	Continuous
		NO_x	0.027	1 Hour	Continuous
		SO_2	0.002	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
LD 09	SO_2 Scrubber	PM	0.002	1 Hour	Continuous
		Cr^{+6}	0.000002	1 Hour	Continuous
		NO_x	0.006	1 Hour	Continuous
		SO_2	0.0003	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
LD 10	IMS Evaporator Stack	PM	0.006	1 Hour	Continuous
		Cr^{+6}	0.0000000004	1 Hour	Continuous
		NO_x	0.031	1 Hour	Continuous
		SO_2	0.003	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
LD 12	Sodium Bicarbonate Candle Filter	PM	0.002	1 Hour	Continuous
		Cr^{+6}	0.00009	1 Hour	Continuous

Table 8-3: Brother CISA current point sources emission rates

Point Source number	Point source name	Pollutant name	Average emission rate		Duration of emissions
			(g/s)	Averaging period	
		NO_x	0.006	1 Hour	Continuous
		SO_2	0.0003	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
LD 14	Soda Calciner Candle Filter	PM	0.011	1 Hour	Continuous
		Cr^{+6}	0.000009	1 Hour	Continuous
		NO_x	0.006	1 Hour	Continuous
		SO_2	0.0004	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
LD 16	Calciner Off-Gas Scrubber	PM	0.0005	1 Hour	Continuous
		Cr^{+6}	0.00002	1 Hour	Continuous
		NO_x	0.001	1 Hour	Continuous
		SO_2	0.00009	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
LD 17	SDC Crystal Drying Scrubber	PM	0.042	1 Hour	Continuous
		Cr^{+6}	0.00003	1 Hour	Continuous
		NO_x	0.018	1 Hour	Continuous
		SO_2	0.0006	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
LD 18	Hydrogen Scrubber	PM	0.00005	1 Hour	Continuous
		Cr^{+6}	0.00000007	1 Hour	Continuous
		NO_x	0.0005	1 Hour	Continuous

Table 8-3: Brother CISA current point sources emission rates

Point Source number	Point source name	Pollutant name	Average emission rate		Duration of emissions
			(g/s)	Averaging period	
		SO_2	0.238	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
LD 19	Oxygen Scrubber	PM	0.00006	1 Hour	Continuous
		Cr^{+6}	0.000005	1 Hour	Continuous
		NO_x	0.0002	1 Hour	Continuous
		SO_2	0.00001	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
LD 20	CA Crystallization Vacuum pump	PM	0.00005	1 Hour	Continuous
		Cr^{+6}	0.0000007	1 Hour	Continuous
		NO_x	0.0002	1 Hour	Continuous
		SO_2	0.00001	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
LD 21	CA Drying and Packaging Scrubber	PM	0.004	1 Hour	Continuous
		Cr^{+6}	0.00007	1 Hour	Continuous
		NO_x	0.013	1 Hour	Continuous
		SO_2	0.0006	1 Hour	Continuous
		VOC	0.022	1 Hour	Continuous
LD 22	Tank Farm Scrubber	PM	0.002	1 Hour	Continuous
		Cr^{+6}	BDL	1 Hour	Continuous
		NO_x	0.000005	1 Hour	Continuous

Table 8-3: Brother CISA current point sources emission rates

Point Source number	Point source name	Pollutant name	Average emission rate		Duration of emissions
			(g/s)	Averaging period	
		SO_2	0.0000003	1 Hour	Continuous
		VOC	BDL	1 Hour	Continuous
GB 1	Boiler Stack 1	PM	0.057	1 Hour	Continuous
		Cr^{+6}	BDL	1 Hour	Continuous
		NO_x	0.375	1 Hour	Continuous
		SO_2	0.164	1 Hour	Continuous
		VOC	0.0002	1 Hour	Continuous
GB 3	CO_2 Absorption Stack	PM	0.304	1 Hour	Continuous
		Cr^{+6}	BDL	1 Hour	Continuous
		NO_x	1.325	1 Hour	Continuous
		SO_2	0.283	1 Hour	Continuous
		VOC	0.0002	1 Hour	Continuous

BDL – Below Detectable Limit. The stack test reports indicate the that the pollutant was not detectable.

Table 8-4: Brother CISA point sources emissions rates for proposed activities

Point Source number	Point source name	Pollutant name	Average emission rate			Duration of emissions
			(mg/Nm³)	(g/s)	Averaging period	
CTS1	CTS Organic Stack 1	Sulphuric Acid (H_2SO_4) (reported as SO_3)	25	0.000476	1 Hour	Continuous
		Chromic Acid (H_2CrO_4) (reported as Cr^{+6})	0.035	0.00000067	1 Hour	Continuous
CTS2	CTS Organic Stack 2	H_2SO_4 (reported as SO_3)	25	0.0139	1 Hour	Continuous
		H_2CrO_4 (reported as Cr^{+6})	0.035	0.0000194	1 Hour	Continuous
CTS3	CTS Organic Stack 3	N-Heptane (reported as VOC)	40 000	1.84	1 Hour	Continuous
CTS4	CTS Organic Stack 4	N-Heptane (reported as VOC)	40 000	2.83	1 Hour	Continuous
		SO_2	350	0.0247	1 Hour	Continuous
CTS5	CTS Organic Stack 5	SO_2	350	0.0176	1 Hour	Continuous
		Ethanol (C_2H_5OH) (reported as VOC)	40 000	2.01	1 Hour	Continuous
CTS6	CTS Organic Stack 6	SO_2	350	0.00945	1 Hour	Continuous
		C_2H_5OH (reported as VOC)	40 000	1.08	1 Hour	Continuous
CTS7	CTS Organic Stack 7	H_2SO_4 (reported as SO_3)	25	0.00172	1 Hour	Continuous
		SO_2	350	0.0241	1 Hour	Continuous
CTS8	CTS Organic Stack 8	C_2H_5OH (reported as VOC)	40 000	16.2	1 Hour	Continuous
		MNB (reported as PM)	10	0.00404	1 Hour	Continuous
CTS9	CTS Organic Stack 9	SO_2	350	0.00683	1 Hour	Continuous
		C_2H_5OH (reported as VOC)	40 000	0.781	1 Hour	Continuous
		MSB (reported as PM)	10	0.000195	1 Hour	Continuous
CTS10	CTS Organic Stack 10	SO_2	350	0.0298	1 Hour	Continuous
		C_2H_5OH (reported as VOC)	40 000	3.40	1 Hour	Continuous
CTS11	CTS Organic Stack 11	SO_2	350	0.0299	1 Hour	Continuous
		C_2H_5OH (reported as VOC)	40 000	3.41	1 Hour	Continuous
CTS12	CTS Organic Stack 12	CO_2	127315	59.8	1 Hour	Continuous
		NH_3	50	0.0235	1 Hour	Continuous
		NO_X	50	0.0235	1 Hour	Continuous

Table 8-4: Brother CISA point sources emissions rates for proposed activities

Point Source number	Point source name	Pollutant name	Average emission rate			Duration of emissions
			(mg/Nm³)	(g/s)	Averaging period	
CTS13	CTS Organic Stack 13	H_2SO_4 (reported as SO_3)	25	0.0201	1 Hour	Continuous
		H_2CrO_4 (reported as Cr^{+6})	0.035	0.0000282	1 Hour	Continuous
		MNQ (reported as PM)	10	0.00804	1 Hour	Continuous
CTS14	CTS Organic Stack 14	H_2SO_4 (reported as SO_3)	25	0.0108	1 Hour	Continuous
		H_2CrO_4 (reported as Cr^{+6})	0.035	0.0000152	1 Hour	Continuous
		CO_2	92177	39.9	1 Hour	Continuous
		MNQ (reported as PM)	10	0.00433	1 Hour	Continuous
CTS15	CTS Organic Stack 15	H_2SO_4 (reported as SO_3)	25	0.0347	1 Hour	Continuous
		MNQ (reported as PM)	10	0.0139	1 Hour	Continuous
CTS16	CTS Organic Stack 16	H_2SO_4 (reported as SO_3)	25	1.12	1 Hour	Continuous
		Cr(OH)SO4 (reported as PM)	10	0.449	1 Hour	Continuous
		Na_2SO_4 (reported as PM)	10	0.449	1 Hour	Continuous
CTS17	CTS Inorganic Stack 1	Cr^{+6}	0.01	0.0000556	1 Hour	Continuous
		SO_3	25	0.139	1 Hour	Continuous
		SO_2	350	1.94	1 Hour	Continuous
		$Cr(OH)SO_4$ (reported as PM)	10	0.0556	1 Hour	Continuous
		Na_2SO_4 (reported as PM)	10	0.0556	1 Hour	Continuous
CTS18	CTS Inorganic Stack 2	SO_3	25	1.39	1 Hour	Continuous
		SO_2	350	19.4	1 Hour	Continuous
		$Cr(OH)SO_4$ (reported as PM)	10	0.0556	1 Hour	Continuous
		Na_2SO_4 (reported as PM)	10	0.0556	1 Hour	Continuous

8.1.3 IMPACT DISCUSSION & SIGNIFICANCE ASSESSMENT

Three scenarios were modelled:

i. **Scenario 1: Proposed Sources -** All proposed sources modelled at the minimum emission standards for the applicable regulated emissions per source as stipulated by Subcategory 7.2 and Subcategory 7.4 in GN893:2013, as amended.
ii. **Scenario 2: Baseline -** All current sources modelled at the measured emission rates as per the stack test reports.
iii. **Scenario 3: Cumulative = Baseline** + **Proposed Sources -** All proposed sources modelled at the minimum emission standards and all current sources modelled at the measured emission rates as per the stack test reports.

Only the results for the cumulative scenario (Scenario 3) are presented herein. The results for scenarios 1 and 2 on their own can be found in the full report as Appendix 4.1.

It is important to note that where there are no South African ambient air quality standards for the pollutant being assessed, ambient air quality standards and guidelines have been based on a literature review of international standards. In these instances the strictest standard is applied in accordance with a precautionary and risk averse approach as per the principles of the National Environmental Management Act (Act 107 of 1998).

8.1.3.1 PREDICTED CONCENTRATIONS FOR PM_{10}

Particulate emissions have not been fractioned to indicate the percentage of PM_{10} in the total particulates measured. For the purposes of this assessment it was conservatively assumed that all particulates measured are PM_{10}.

PREDICTED 24 HOUR CONCENTRATIONS FOR PM_{10}

The predicted ambient impact from the operations is within the NAAQS limit of 75 µg/m^3 for the 24-hour averaging interval.

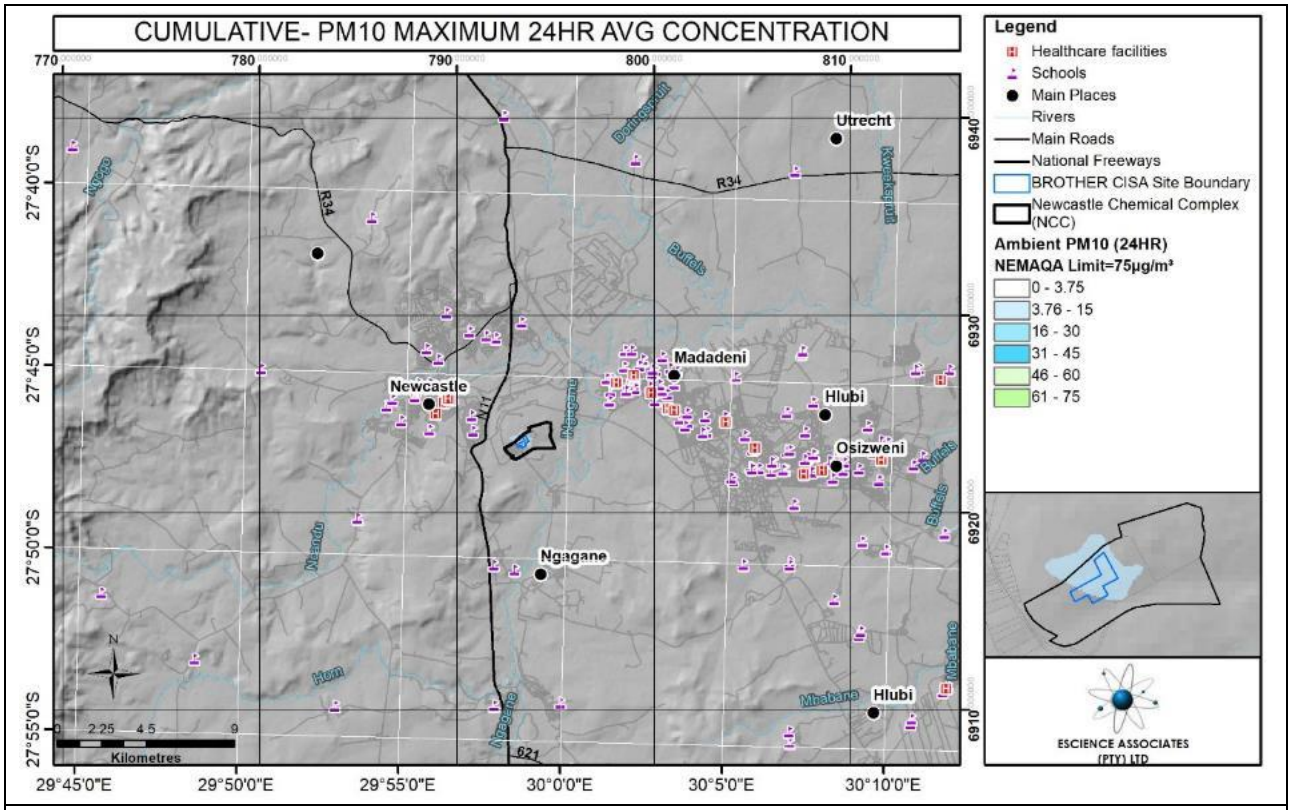


Figure 8-1: Scenario 3 Predicted PM_{10} 24-hour maximum modelled ambient concentration.

PREDICTED ANNUAL CONCENTRATIONS FOR PM_{10}

The predicted ambient impact from the operations is within the NAAQS limit of 40 µg/m^3 for the annual averaging interval. For the three years assessed (2017 through to 2019) the maximum PM_{10} concentration occurring over the area for the annual averaging period is 1.72 µg/m^3.

8.1.3.2 PREDICTED CONCENTRATIONS FOR PM2.5

Particulate emissions have not been fractioned to indicate the percentage of $PM_{2.5}$ in the total particulates measured. For the purposes of this assessment it was conservatively assumed that all particulates measured are $PM_{2.5}$.

PREDICTED 24 HOUR CONCENTRATIONS FOR $PM_{2.5}$

The predicted ambient impact from the operations is within the NAAQS limit of 40 µg/m^3 for the 24-hour averaging interval.

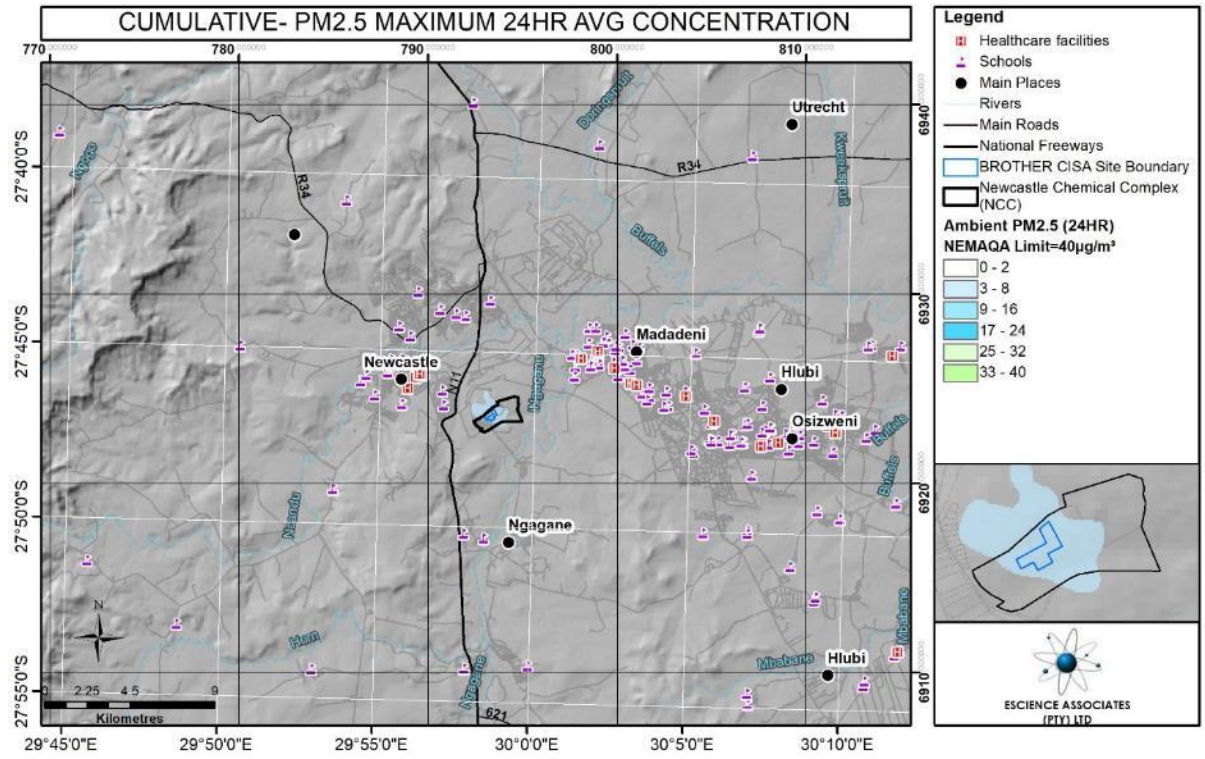


Figure 8-2: Scenario 3 Predicted $PM_{2.5}$ 24-hour maximum modelled ambient concentration.

PREDICTED ANNUAL CONCENTRATIONS FOR $PM_{2.5}$

The predicted ambient impact from the operations is within the NAAQS limit of 20 µg/m^3 for the annual averaging interval. For the three years assessed (2017 through to 2019) the maximum $PM_{2.5}$ concentration occurring over the area for the annual averaging period is 1.72 µg/m^3.

8.1.3.3 PREDICTED CONCENTRATIONS FOR SO_2

PREDICTED 1 HOUR CONCENTRATIONS FOR SO_2

There are predicted exceedances the NAAQS limit of 350 µg/m^3 for the 1-hour averaging interval, however the predicted exceedances are all within the industrial boundary (Figure 8-3). Furthermore, the predicted number of exceedances is within the regulatory permissible number of exceedances over the period (88 exceedances allowed per annum), over the modelling period (Figure 8-4).

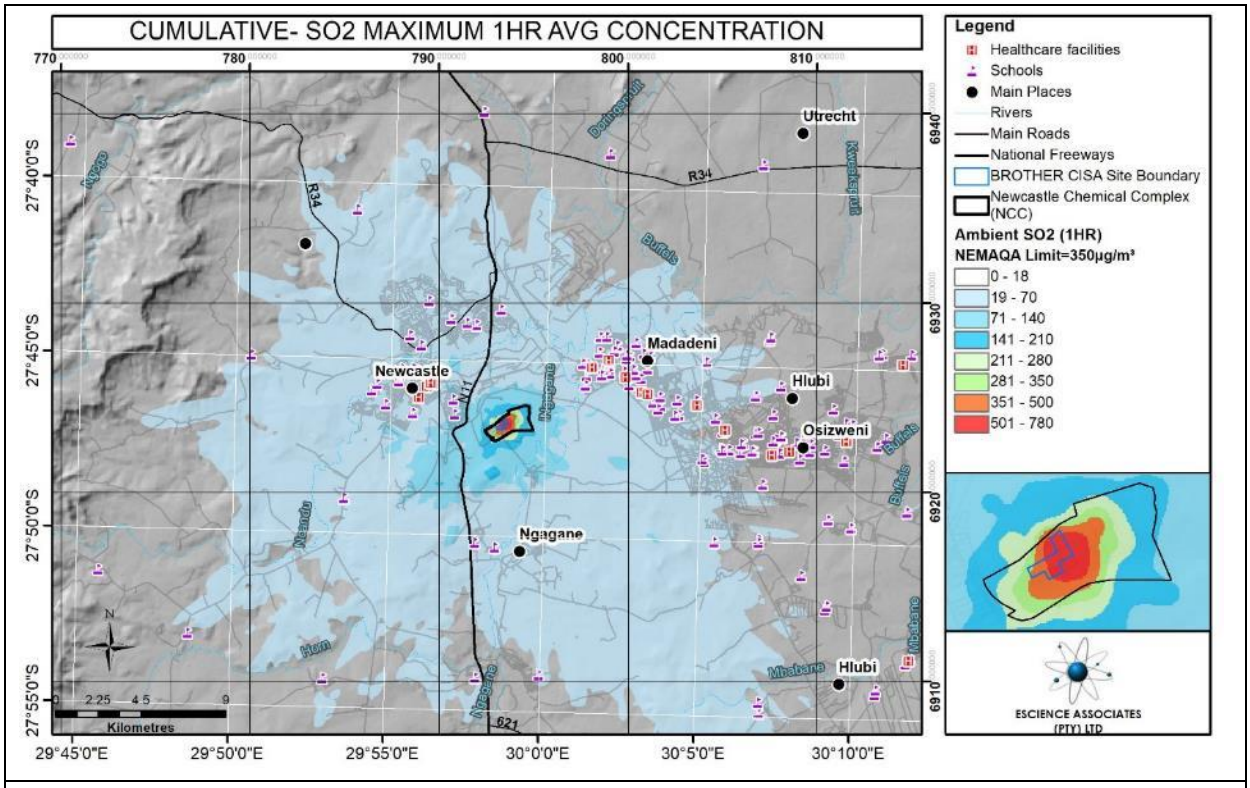


Figure 8-3: Scenario 3 Predicted SO_2 1-Hour maximum modelled ambient concentration.

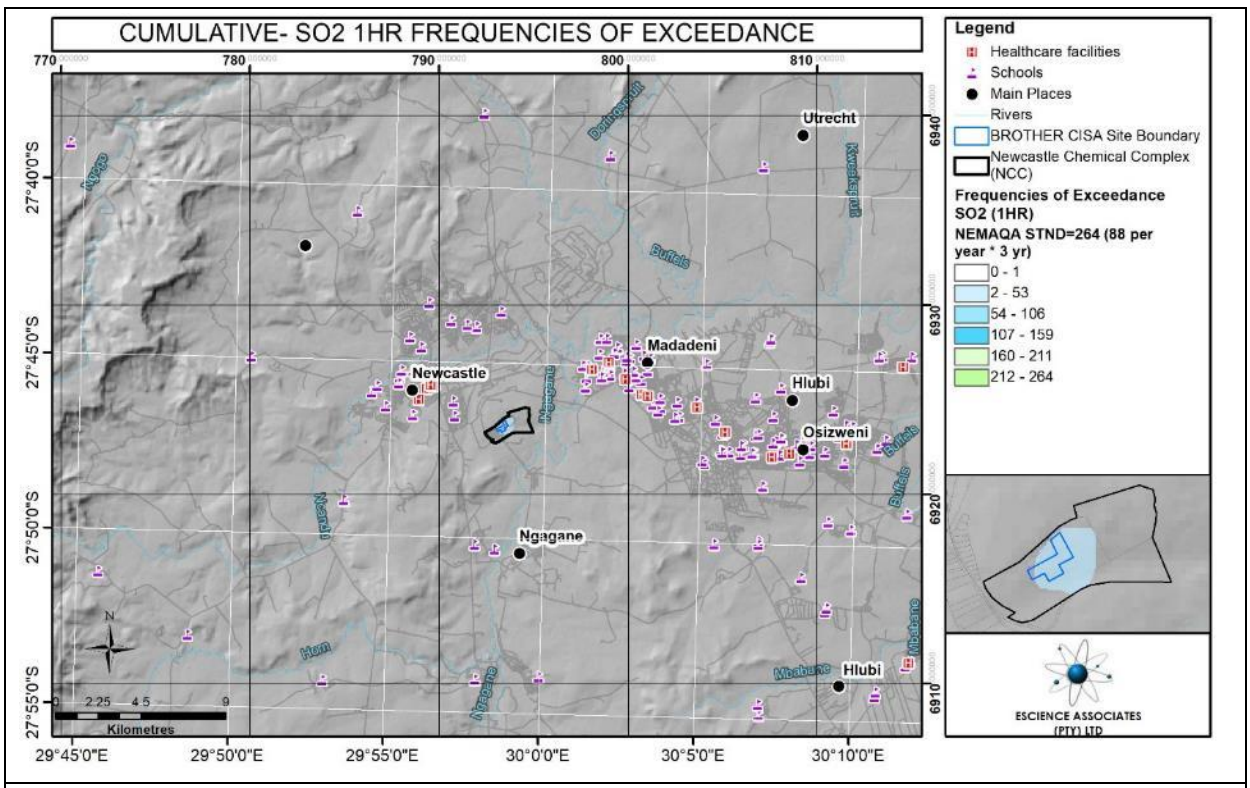


Figure 8-4: Scenario 3 Predicted SO_2 1-Hour maximum modelled ambient number of exceedances.

PREDICTED 24 HOUR CONCENTRATIONS FOR SO_2

The predicted ambient impact from the operations is within the NAAQS limit of 125 µg/m^3 for the 24-hour averaging interval (Figure 8-5).

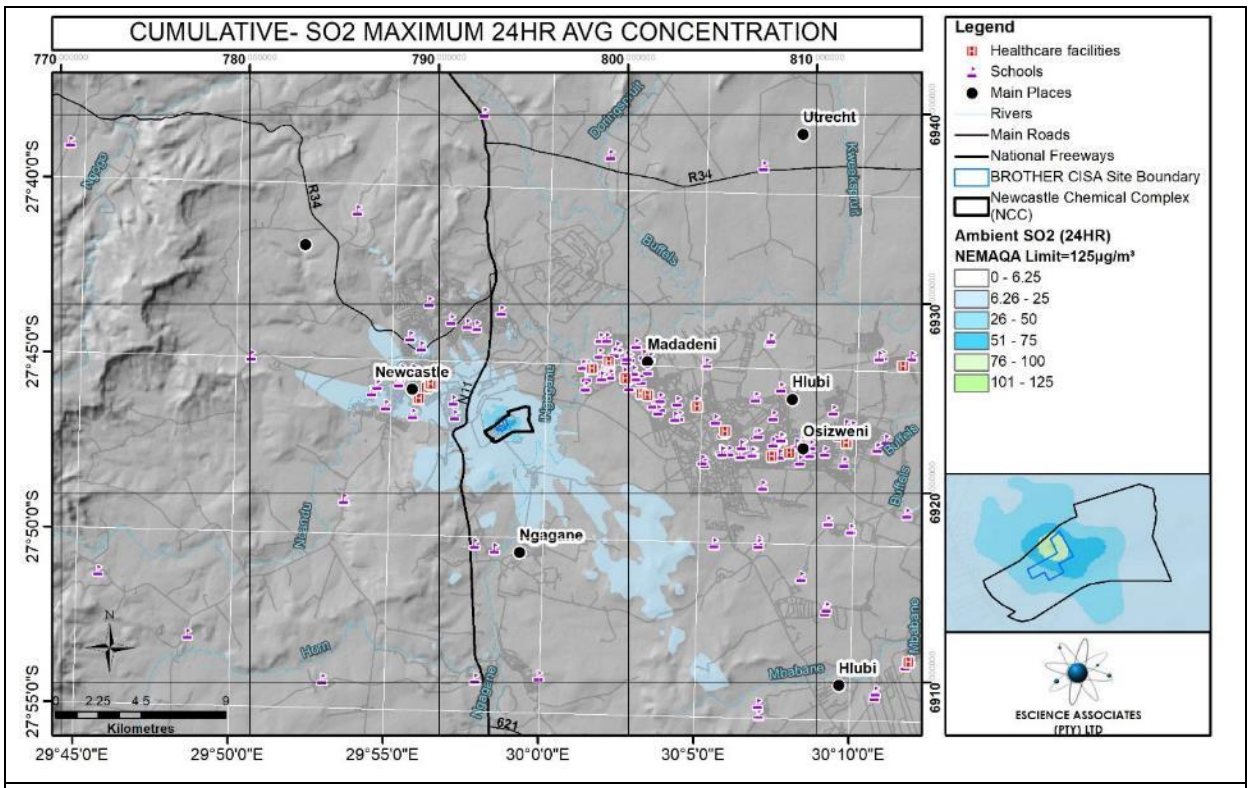


Figure 8-5: Scenario 3 Predicted SO_2 24-Hour maximum modelled ambient concentration.

PREDICTED ANNUAL CONCENTRATIONS FOR SO_2

The predicted ambient impact from the operations is within the NAAQS limit of 50 µg/m^3 for the annual averaging interval as well (Figure 8-6).

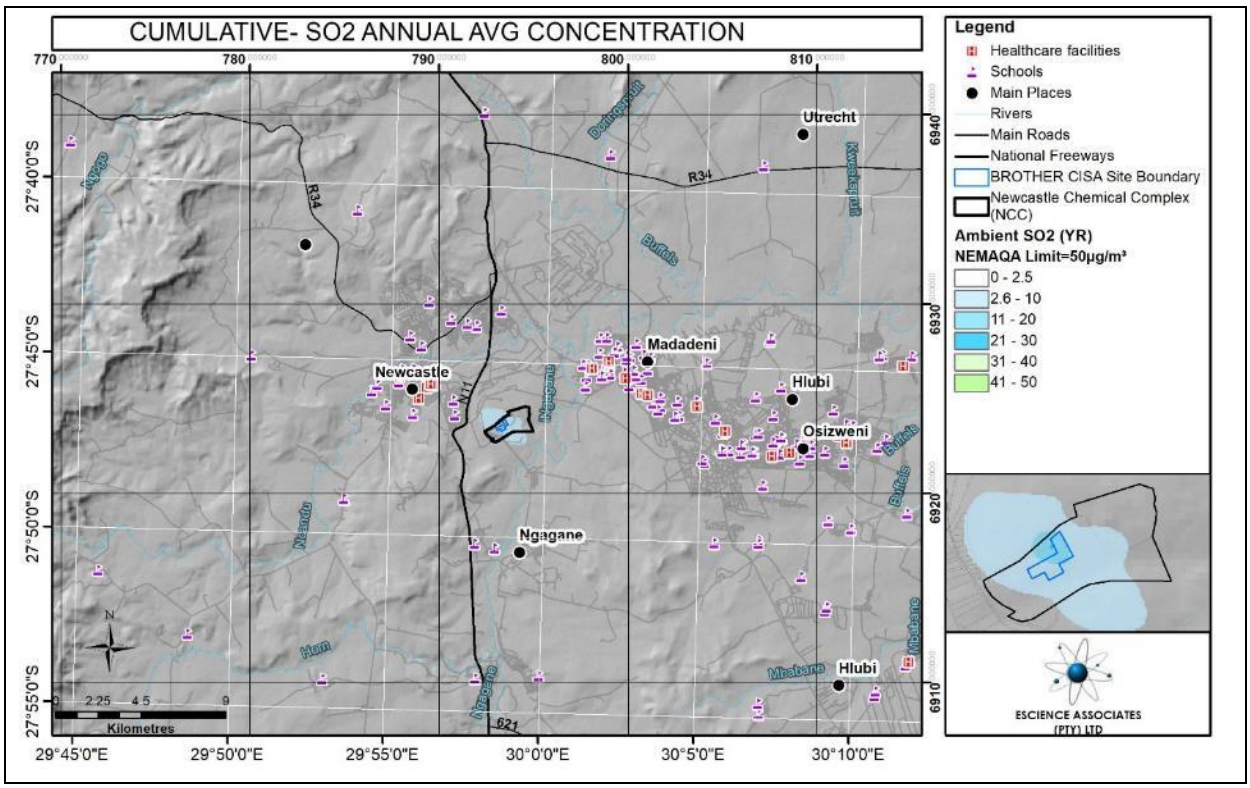


Figure 8-6: Scenario 3 Predicted SO_2 annual maximum modelled ambient concentration.

8.1.3.4 PREDICTED CONCENTRATIONS FOR NO_2

8.1.3.5 PRE-AMBLE NITROUS OXIDES

The national ambient air quality standards regulate ambient concentrations of NO_2. It must be noted that NO_x represents all oxides of nitrogen species. NO_x gases are composed of chemical species other than NO_2 which is typically in the order of only 5 to10% of NO_x emitted from combustion sources. The primary NO_x constituent of these off-gases is typically NO (approximately 90% to 95%). NO will eventually be oxidised to NO_2 in the atmosphere, and the rate of conversion is dictated by the kinetics of reaction in the atmosphere. The downwind concentration of NO_2 from the source is thus generally over-estimated by assuming that all NO_x emissions are NO_2 (various sources – Cooper et al, Yu et al, Hori et al). The implication is that the modelled results have over predicted the NO_2 ambient concentration and the true ambient concentration of NO_2 is significantly less.

In terms of the Regulations Regarding Air Dispersion Modelling (GN. R 533 of 2014), the dispersion model used for this air quality impact assessment, and in general all of those recommended, do not have sufficiently detailed descriptions of atmospheric chemistry to robustly account for NO to NO_2 conversion and thus the predicted NO_x concentration must be equated to NO_2, using a conversion factor. A tiered screening approach is recommended to obtain annual average estimates of NO_2 from point sources as stipulated by the US EPA and other guidelines:

Tier 1: Total Conversion Method – Assume that all NO_x is converted to NO_2.
Tier 2: Ambient Ratio Method – Assume a national ratio of NO_2/NO_x of 0.80.

In the absence of reliable and complete measured ambient data for NO and NO_2, the tier 2 conversion has been applied in this assessment.

PREDICTED 1 HOUR CONCENTRATIONS FOR NO_2

The predicted ambient impact from the operations is within the NAAQS limit of 200 µg/m^3 for the 1-hour averaging interval (Figure 8-7).

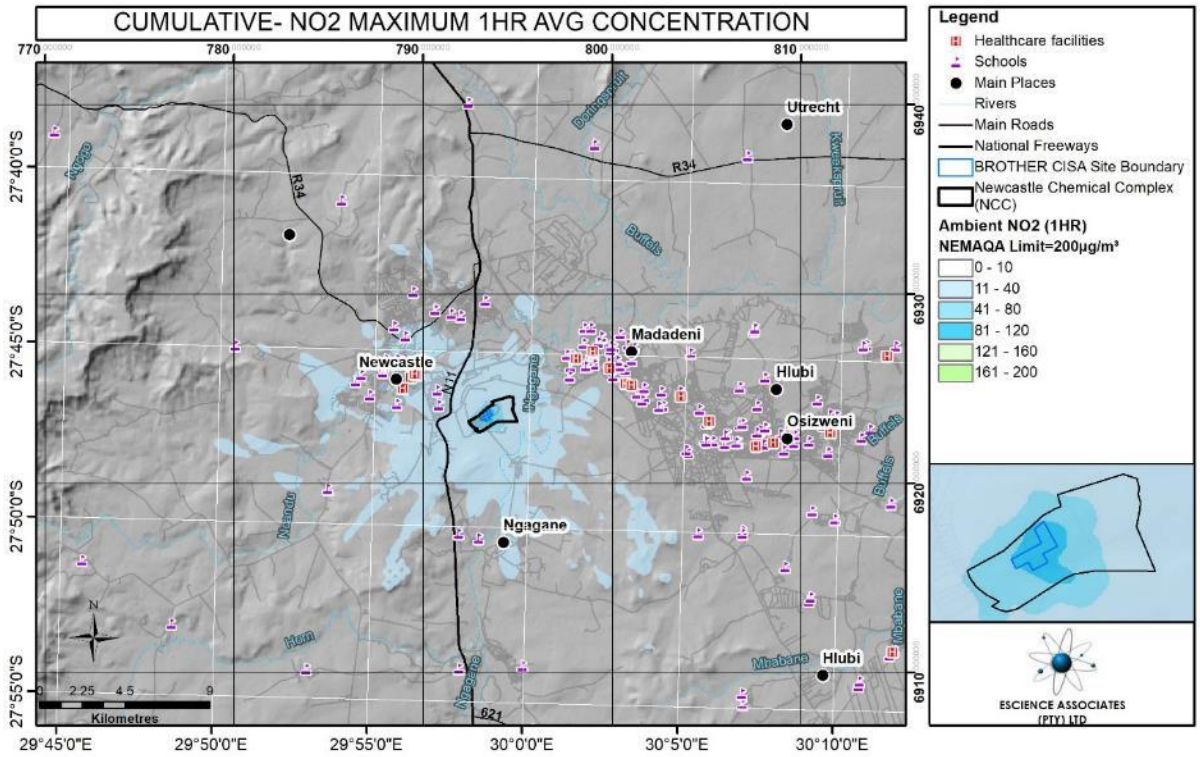


Figure 8-7: Scenario 3 Predicted NO_2 1-Hour maximum modelled ambient concentration.

PREDICTED ANNUAL CONCENTRATIONS FOR NO_2

The predicted ambient impact from the operations is within the NAAQS limit of 40 µg/m^3 for the annual averaging interval as well (Figure 8-8).

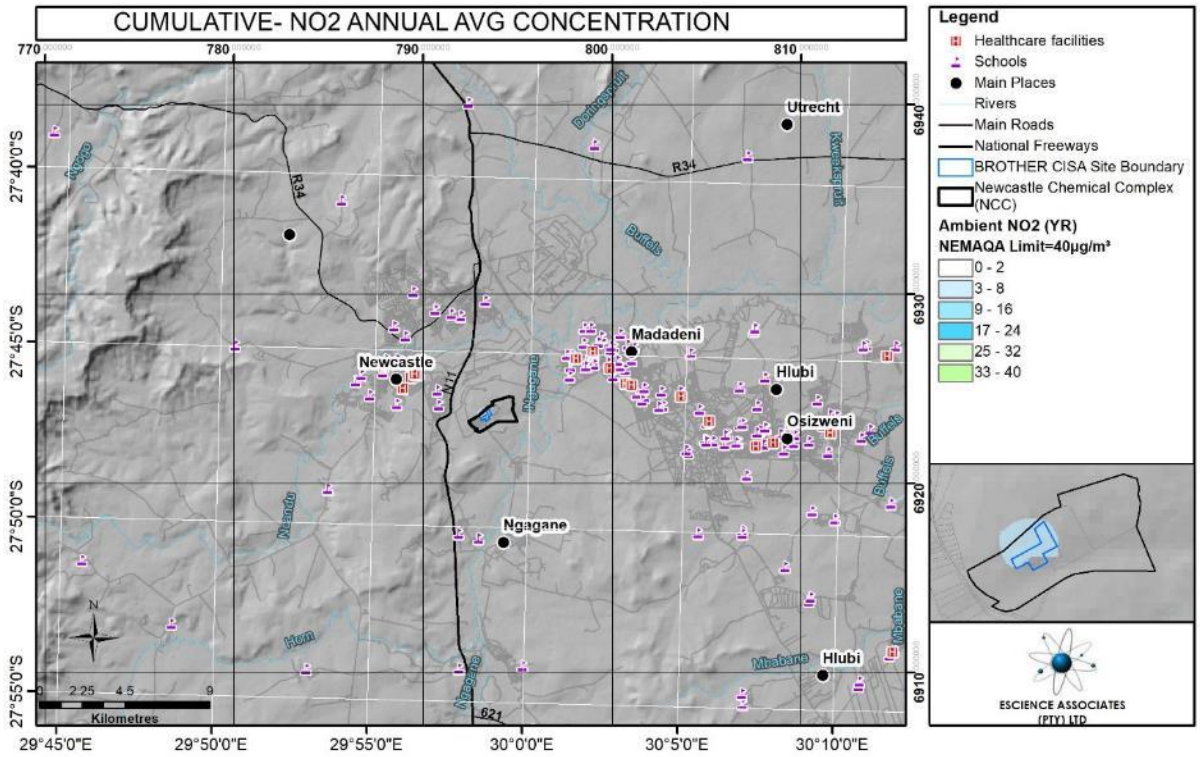


Figure 8-8: Scenario 3 Predicted NO_2 annual maximum modelled ambient concentration.

8.1.3.6 PREDICTED CONCENTRATIONS FOR Cr(VI)

PREDICTED 1 HOUR CONCENTRATIONS FOR Cr(VI)

The predicted ambient impact from the operations is within the Alberta, Canada Ambient Air Quality limit of 1 µg/m^3 for the 1-hour averaging interval (Figure 8-9).

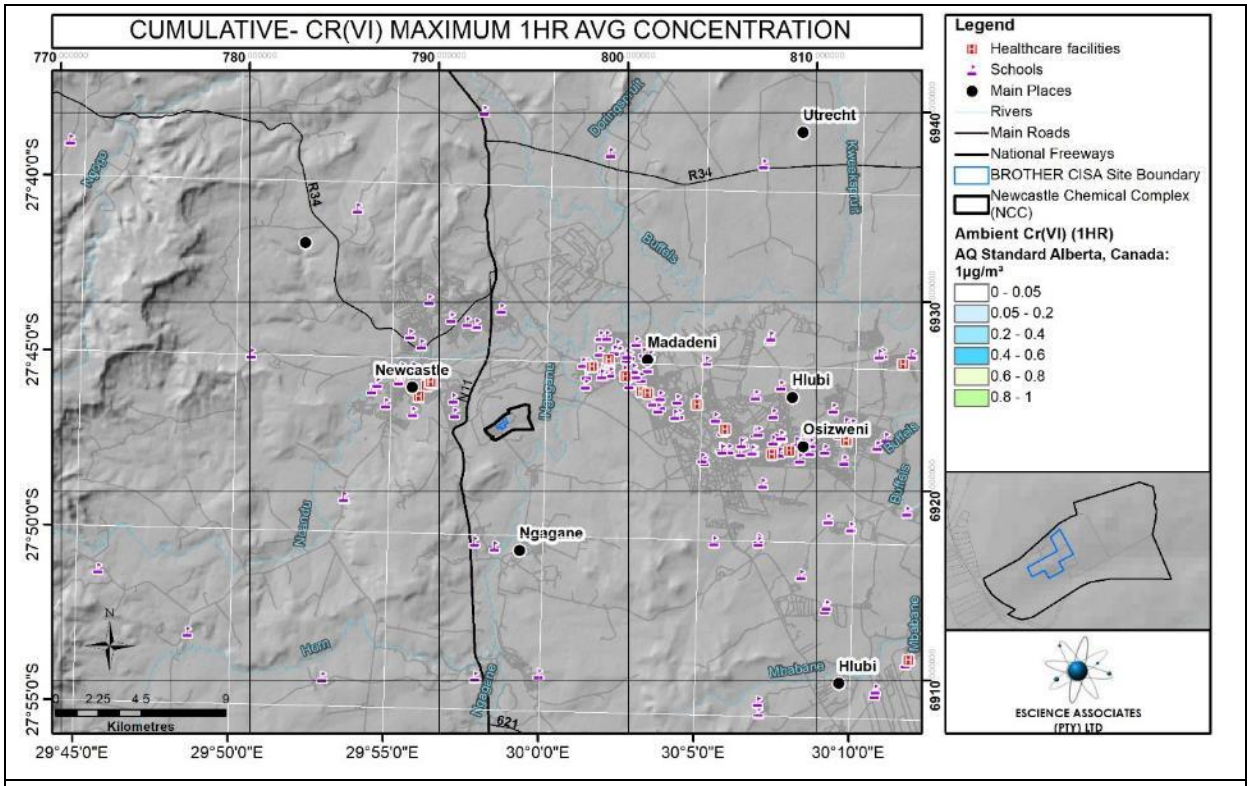


Figure 8-9: Scenario 3 Predicted Cr(VI) 1-Hour maximum modelled ambient concentration.

PREDICTED LIFETIME CARCINOGENIC RISK USING THE WHO IUR

Figure 8-10 shows the predicted excess lifetime carcinogenic risk resulting from the maximum anticipated emissions from the plant, based on the WHO recommendations for linear dose-response relationships between exposure to Cr(VI) compounds and lung cancer. As noted in section 6.4.13.4 of the Air Quality Impact Assessment Report life time exposure risk ratings have been adopted in this study with 1 in 10 000 (i.e. an excess lifetime risk of 0.01%) as the maximum tolerable risk to the public and any lesser risk being deemed within the de minimis range

The predicted excess lifetime carcinogenic risk factor for a small area within the site is 1:36 550 (i.e. an excess lifetime risk of 0.0027%). Immediately outside the boundary, but not covering any receptors is an area exposed to a lifetime carcinogenic risk of 1 in 100 000 (i.e. an excess lifetime risk of 0.001%). The Arbour Park residential area is predicted to be exposed to a lifetime carcinogenic risk in the order of 1 in 500 000 (i.e. an excess lifetime risk of 0.0002%). Further residential areas and part of the Newcastle CBD are exposed to a lifetime carcinogenic risk of 1 in 1000 000.(i.e. an excess lifetime risk of 0.0001%). To put this into context for South Africa, it must be noted that the overall (background) cancer risk for South Africans in 2009 was 1 in 8 (i.e. about 12.5% probability) for men and 1 in 9 (i.e. about 11.1% probability) for women (Herbst, 2015).

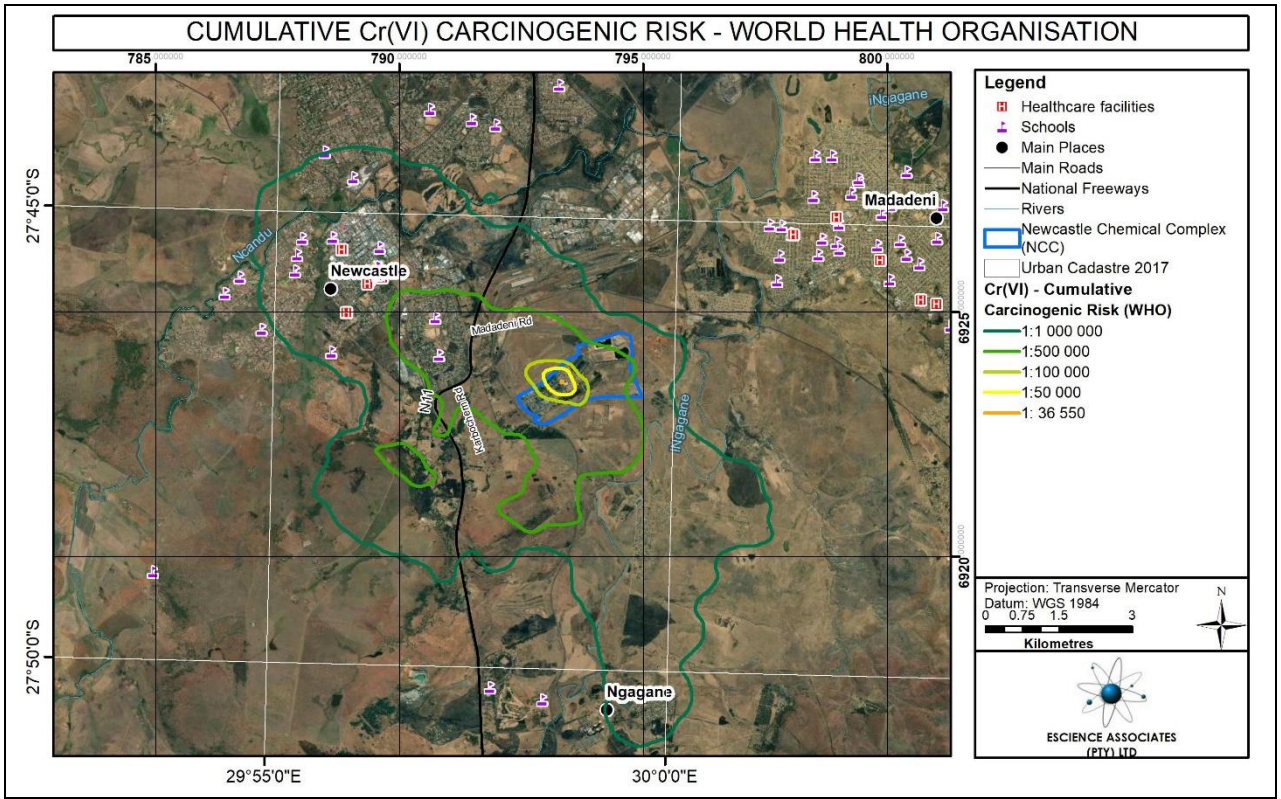


Figure 8-10: Scenario 3 Predicted Cr(VI) lifetime carcinogenic risk with WHO IUR.

PREDICTED LIFETIME CARCINOGENIC RISK USING THE US EPA IUR

Figure 8-11 shows the predicted excess lifetime carcinogenic risk resulting from the maximum anticipated emissions from the plant, based on the US EPA recommendations for linear dose-response relationships between exposure to Cr(VI) compounds and lung cancer. As noted in section 6.4.13.4 of the Air Quality Impact Assessment Report life time exposure risk ratings have been adopted in this study with 1 in 10 000 (i.e. an excess lifetime risk of 0.01%) as the maximum tolerable risk to the public and any lesser risk being deemed within the de minimis range

The predicted excess lifetime carcinogenic risk factor within the proximity of the Newcastle Chemicals Complex and the immediate surrounds of the site is in the order of 1 in 500 000 (i.e. an excess lifetime risk of 0.0002%). No residential areas are predicted to be exposed to a risk greater than 1 in 1000 000 (i.e. an excess lifetime risk of 0.0001%). To put this into context for South Africa, it must be noted that the overall (background) cancer risk for South Africans in 2009 was 1 in 8 (i.e. about 12.5% probability) for men and 1 in 9 (i.e. about 11.1% probability) for women (Herbst, 2015).

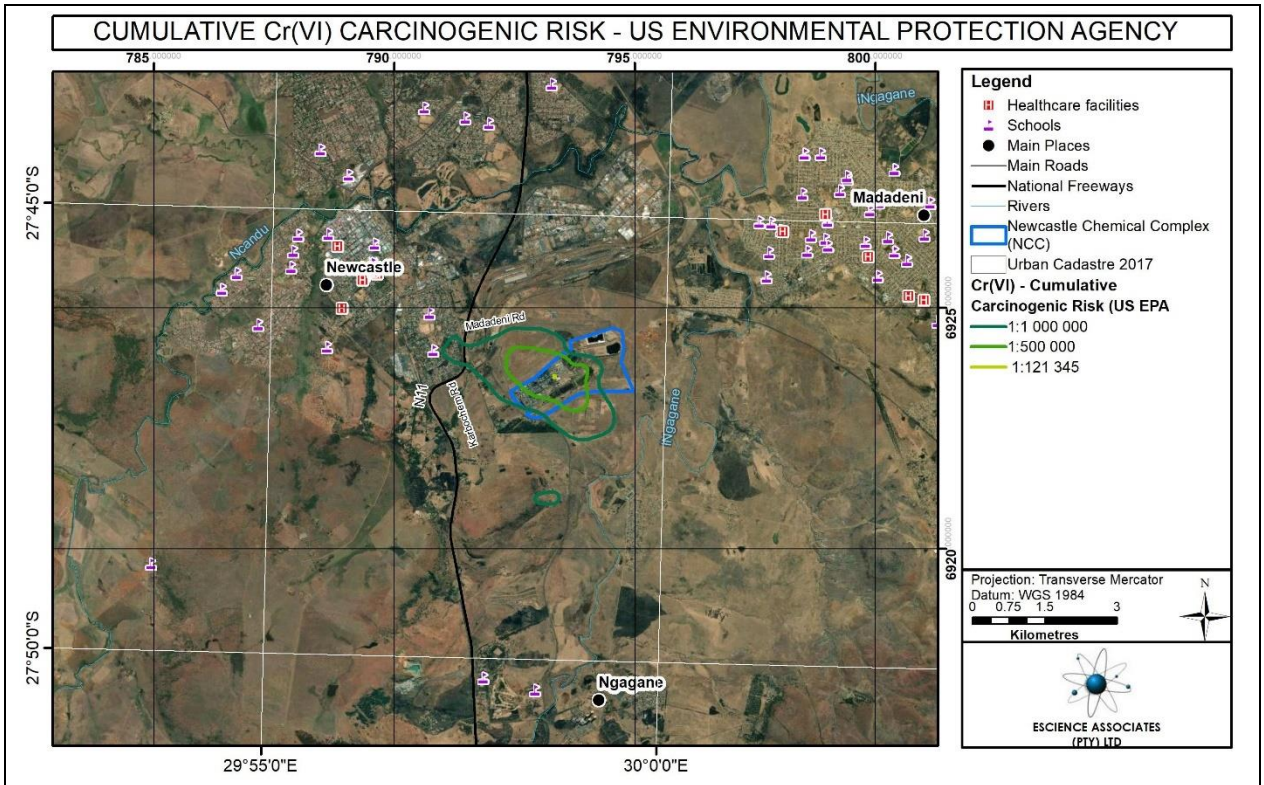


Figure 8-11: Scenario 3 Predicted Cr(VI) lifetime carcinogenic risk with US EPA IUR.

8.1.3.7 PREDICTED CONCENTRATIONS FOR H_2SO_4

PREDICTED 1 HOUR CONCENTRATIONS FOR H_2SO_4

The maximum predicted ambient concentration from the operations is within the Texas and Michigan state limits of 50 µg/m³ and 120 µg/m³ respectively. (Figure 8-12).

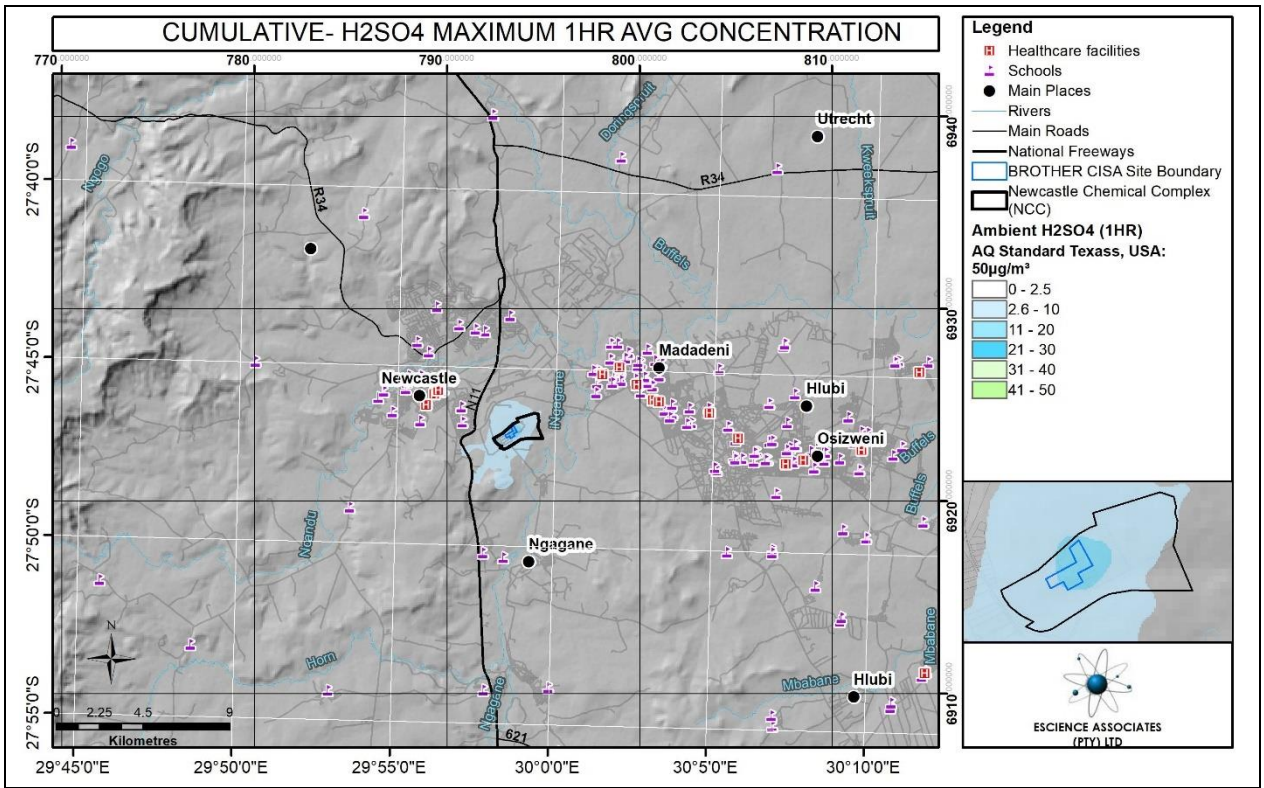


Figure 8-12: Scenario 3 Predicted H_2SO_4 1-Hour maximum modelled ambient concentration.

PREDICTED 24 HOUR CONCENTRATIONS FOR H_2SO_4

The predicted ambient impact from the operations is within the Ontario, Canada Ambient Air Quality limit of 5 µg/m^3, for the 24-hour averaging interval (Figure 8-13).

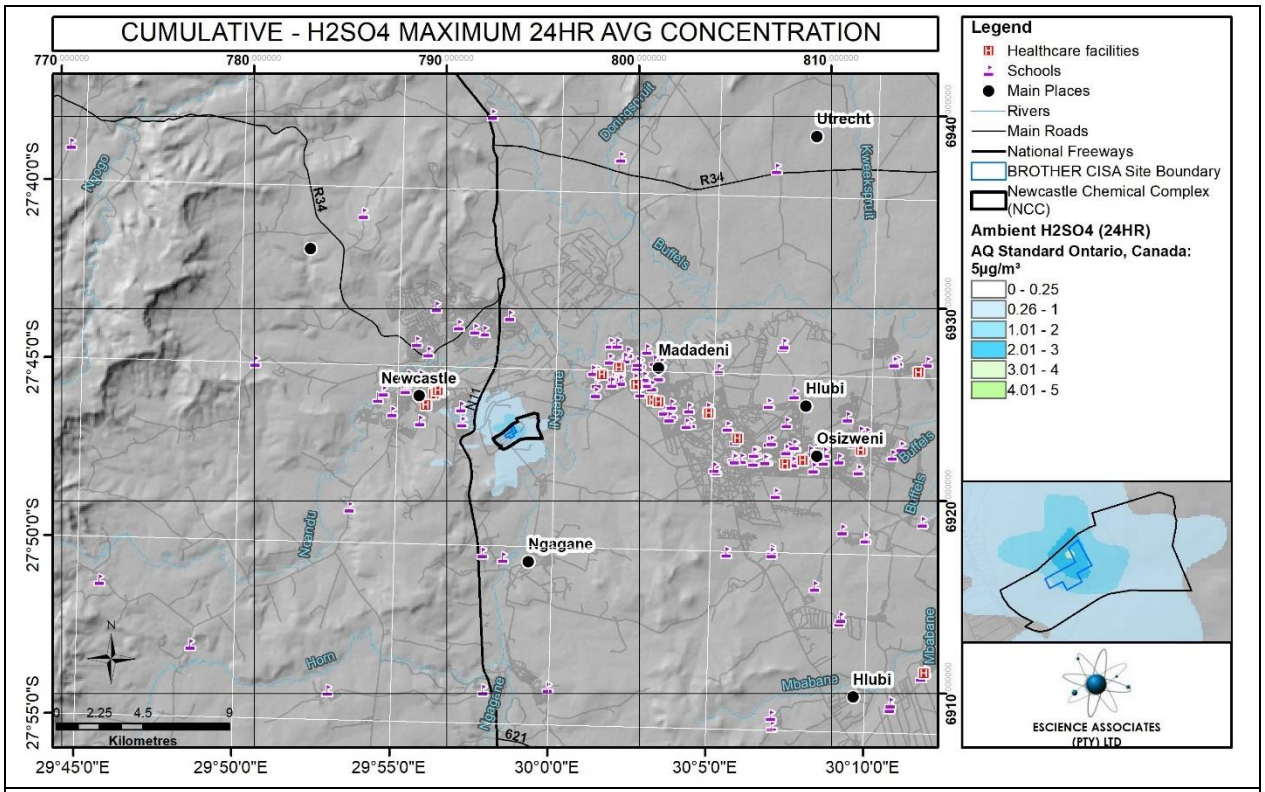


Figure 8-13: Scenario 3 Predicted H_2SO_4 24-Hour maximum modelled ambient concentration.

PREDICTED ANNUAL CONCENTRATIONS FOR H_2SO_4

The predicted ambient impact from the operations is within the Michigan, USA Ambient Air Quality limit of 1 µg/m^3 for the annual averaging interval (Figure 8-14).

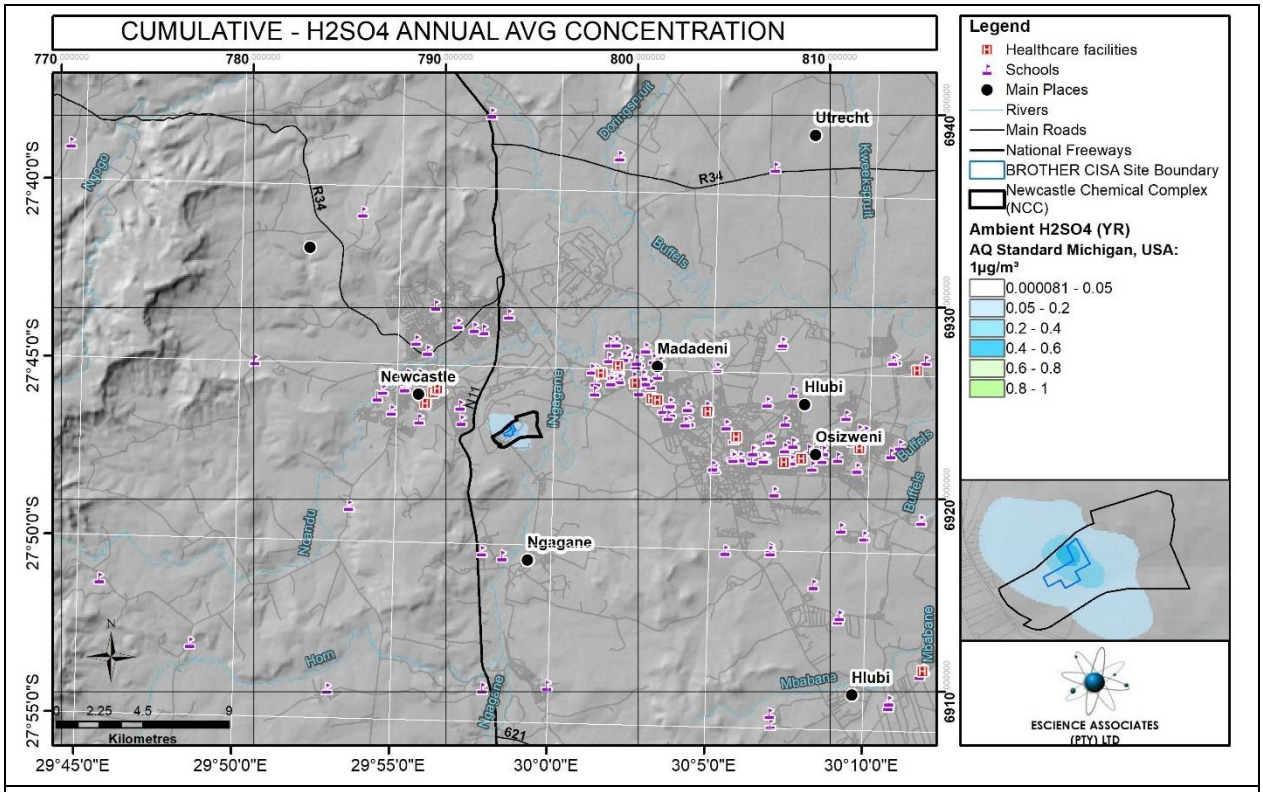


Figure 8-14: Scenario 3 Predicted H_2SO_4 Annual maximum modelled ambient concentration.

8.1.4 RECOMMENDATIONS

In cognisance of the findings of the assessment, and provided that the proposed plant will meet the emissions limits stipulated, it is recommended that the proposed activities be authorised.

Due to the fact that no maximum allowable emission concentration is provided for Cr(VI) in GN 893 of 2015 as amended, It is recommended that Cr(VI) emissions limits as shown in Table 8-5 be applied to stacks where Cr(VI) emissions are anticipated.

Table 8-5: Recommended Cr(VI) emissions limits

Point Source	Proposed Cr(VI) emissions limit (mg/Nm³)
CTS1 - CTS Organic Stack 1	0.035
CTS2 - CTS Organic Stack 2	0.035
CTS13 - CTS Organic Stack 13	0.035
CTS14 - CTS Organic Stack 14	0.035
CTS17 – CTS Inorganic Stack 1	0.01

These recommended limits are based on the following factors:

- These emissions limits result in acceptable Cr(VI) ambient concentrations as shown in sections 8.1.3.6.
- These concentrations are considered achievable through the use of proposed emissions abatement technology;

- The recommended limits are more stringent than the German Technical Instructions on Air Quality Control (TA Luft) limit of 0.05 mg/Nm^3 which may be considered for reference purposes in the absence of a legislated South African emission limit.

It is recommended that the listed point source emissions be monitored in accordance with the stipulations of GN 893 of 2015 as amended, at least once per annum.

8.1.5 PEER REVIEW

A peer review of the Air Quality Impact Assessment was conducted by Riëtha Oosthuizen. The peer review letter can be found as appendix 2 of the Air Quality Impact Assessment.

8.2 ARCHAEOLOGICAL IMPACT ASSESSMENT

A Phase 1 Archaeological Impact Assessment was conducted by Dr Matt Lotter and Dr Tim Forssman. Both are members of the Association of Southern African Professional Archaeologists, with Cultural Resource Management accreditation.

A summary of the assessment is provided herein, the full assessment can be found as Appendix 4.2 hereto.

8.2.1 INTRODUCTION

Drs Matt Lotter and Tim Forssman were then appointed by EScience Associates to perform an Archaeological Impact Assessment of land within which the proposed development will be situated.

8.2.2 METHODS

The area was investigated, both on foot and by vehicle, for any surface traces of cultural heritage. Where excavations and terracing had taken place on the property, these and their spoil heaps were also carefully examined to assess the possibility of sub-surface heritage preservation. All finds and/or sites were recorded following standard archaeological procedures. A specially designed site recording form was used to notate any observable traits, including cultural heritage types, deposit information and assemblage or site context, and this was graded following a set rating criteria. All survey routes were GPS recorded and every find was photographed along with the landscape.

8.2.3 CONSTRAINTS AND LIMITATIONS

Ground surface visibility was limited due to the abundance of spoil heap stockpiles for backfilling, specifically in the southern portion of the study area, making the identification of surface archaeology very difficult. It is possible that archaeological find spots or sites were missed as a result; however, in many areas of the property, digging at the surface has exposed the underlying sediments, which illustrate a complete lack of subsurface archaeology. The central and northern part of the property is largely developed so visibility of any archaeological deposits here was severely constrained.

As with all archaeological surveys, the primary goal is to identify cultural material exposed on the surface. From this, one is able to make inferences about what may also lie below the surface. However, without actual test trenches or geotrenches, it is not possible to be certain what is represented underground. Furthermore, underground heritage remains may not be represented on the surface making their identification impossible. This serves as a

considerable limitation. Should any cultural heritage be identified when the development begins, a specialist must be consulted to examine the finds.

8.2.4 RESULTS

No cultural heritage items were found in the development area. Limiting the outcome of this investigation are the excavation spoil heap stockpiles for backfilling, which occur on the site covering parts of the surface, and this is especially relevant in the southern portion of the property. In addition, due to the largely modified nature of the overall landscape, having been terraced several decades prior, this has caused significant modifications to the surrounding landscape and it is highly unlikely that any heritage, if present, would occur within any valuable context. The middle and northern parts of the property have already been extensively developed through the construction of several concrete-floored workshops and site buildings, so in this particular area it is highly unlikely that any unmodified (natural) deposits occur within which archaeological traces could be contained. While there is a remote possibility that these developments may be obscuring cultural heritage, the notable lack of artefacts anywhere in the development area, including within the excavated areas, makes this possibility highly unlikely.

8.2.5 CONCLUSIONS

8.2.5.1 Development impact

The development within the proposed CTS area delineation is not anticipated to have any impact on cultural heritage, based on the absence of heritage finds on the surface or in the excavated areas.

8.2.5.2 Recommendations

No heritage finds of any significance were identified in the impact footprint of the proposed development area. Therefore, regarding visible cultural heritage, there are no recommendations.

Nonetheless, there may still be cultural heritage subsurface that was not observable or inferable from the lack of surface finds, as is always the case. Should any cultural heritage be observed once development commences, a specialist must be consulted to perform an examination of the finds.

8.3 PALAEONTOLOGICAL IMPACT ASSESSMENT

8.3.1 INTRODUCTION

A Phase 1 Palaeontological Impact Assessment (PIA) was conducted by Dr Matthew V. Caruana. He is registered with the Association of Southern African Professional Archaeologists (ASAPA) and has Cultural Resource Management accreditation within ASAPA. He is also a member of the Palaeontological Society of South Africa.

A summary of the assessment is provided herein, the full assessment can be found as Appendix 4.3 hereto.

8.3.2 METHODOLOGY

According to the NHRA (no 25 of 1999) and the National Environmental Management Act (NEMA) (no 107 of 1998). The PIA process consisted of three steps:

- **Step I** – Literature Review: Background information on the study area was based on archival reports available in SAHRIS, as well as available academic literature on relevant fossiliferous formations.
- **Step II** – Physical Survey: The physical survey was conducted on foot and by vehicle according to safety protocols. The survey aimed to identify fossil scatters within the study area, and to inspect any exposed sediment profiles. Any significant finds are recorded through standard palaeo-science procedures including GPS notation, photographic records and descriptions of finds.
- **Step III** – Report: The final step involved the recording and documentation of the survey results, which were analysed and summarized here by Dr Matthew V. Caruana. The purpose of the report is to provide a field rating and significance statement, recommending if any mitigation procedures are necessary before development commences.

The field rating and significance of the survey area was based on four main criteria:

- Site integrity (i.e. primary vs. secondary context);
- Abundance of fossil materials;
- Density of fossils;
    - Low - <10/50m^2
    - Medium - 10-50/50m^2
    - High - >50/50m^2
- Uniqueness; and
- Potential to answer scientific research questions.

8.3.3 STUDY LIMITATIONS

Not detracting in any way from the comprehensiveness of the survey undertaken, it is necessary to realise that the lack of palaeontological resources located during the survey does not reflect an overall lack of fossil-bearing deposits in the area. The presence of the Ecca Group formation indicates possible trace fossils, such as plants and insects preserved in this area.

8.3.4 DESKTOP STUDY FINDINGS

Previous PIA's conducted near to the study area (~8 km), did not report any fossil accumulations. Moreover, one study recommended exemption from further survey or mitigation. PIA studies in Kwa-Zulu Natal focused on the Ecca Group geological formation, which underlies the Brother CISA plant, have concluded that construction and mining activities were unlikely to disturb important palaeontological resources. (Refer to full PIA Report for references).

8.3.5 SURVEY FINDINGS

The survey was conducted on Friday, June 26th 2020, on foot and by vehicle in line with safety protocols. All open spaces were surveyed for cultural and fossil materials. During the survey, significant modification via terracing (landscape flattening activities) was noted, particularly in the southern portion of the property. Spoil heaps were located and surveyed, but no fossil materials were identified (). The majority of the property is occupied by industrial buildings and no fossils or fossiliferous deposits were identified.

Figure 8-15: Example of soil stockpiles on site that were surveyed

8.3.5.1 Field Rating

Field Rating: Low significance and no mitigation required.

- **Site integrity**: highly disturbed
- **Abundance of fossils**: none
- **Density of fossils**: none
- **Uniqueness**: low
- **Potential to answer scientific questions**: none

8.3.6 STATEMENT OF SIGNIFICANCE (HERITAGE VALUE)

Given the previous development and disturbance of the property noted in the survey findings, the proposed upgrade of the Brother CISA property is extremely unlikely to expose or disturb any fossil deposits. As such, it is deemed that the survey area represents a low priority for mitigation, and highly unlikely that any palaeontological resources will be endangered.

8.3.7 RECOMMENDATIONS

According to current development plans, no mitigation measures are required. If construction activities on this property should involve excavation of the property (i.e. earth movement) that exposes any fossil deposits, a professional palaeontologist should be contacted to assess if mitigation actions are necessary. In the latter scenario, it is possible that trace fossils of plants and insects associated with the Vryheid Formation may be exposed, although it is unlikely that they will be of any scientific importance.

8.3.8 CONCLUSIONS

The results of the archival study show that two PIAs have been conducted near the study area, although these concluded that no mitigation was required. Conclusions reached in all PIA's consulted in the archival study suggested that it is highly unlikely that any significant fossils will be exposed and/or disturbed by development activities that did not involve mining. Furthermore, the survey component of this study found no fossils exposed on the property. However, if developments should expose any fossil deposits, SAHRA should be contacted immediately and a professional palaeontologist should be brought in to assess their significance and provide recommendations (e.g. recording, sampling, collection and mitigation).

The absence of fossils on the property, combined with a lack of mitigation of palaeontological resources in the local area, suggests a low negative impact on palaeontological resources. As such, no mitigation is recommended at this time and development of the Brother CISA property should continue.

8.4 MAJOR HAZARD INSTALLATION RISK ASSESSMENT

A Major Hazard Installation Risk Assessment was undertaken by Dr Alfonso Niemand of Nature & Business Alliance Africa (Pty) Ltd, in accordance with SANS1461:2018 (Major Hazard Installation – Risk Assessments).

The OHS Act (85) of 1993 and its Major Hazard Installation (MHI) Regulations (July 2001) requires employers, self-employed persons and users, who have on their premises, either permanently or temporarily, a major hazard installation or a quantity of a substance which may pose a risk that could affect the health and safety of employees and the public, to conduct a risk assessment in accordance with the legislation.

The Occupational Health and Safety Act (Act 85 of 1993) defines a major hazard installation as "*an installation-*

- *where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily; or*
- *where any substance is produced, used, handled or stored in such a form and quantity that it has the potential to cause a major incident*".

The Explanatory Notes on the Major Hazard Installation Regulations issued in April 2005 by the Chief Directorate of Occupational Health and Safety of the Department of Employment and Labour explains the following:

"What is important here is to know that there are two reasons that can determine when an installation is a major hazard installation (MHI). The first reason is when there is more than the prescribed quantity of a substance. The quantities and type of substances are prescribed in the General Machinery Regulation 8 and its Schedule A, on notifiable substances. The second reason is where substances are produced, used, handled or stored in such a form and quantity that it has the potential to cause a major incident. The important issue is the potential of an incident and not whether the incident is a major incident or not. The potential will be determined by the risk assessment.

A major incident means an occurrence of catastrophic proportions, resulting from the use of plant or machinery, or from activities at a workplace.

It is impossible to put a specific value to "catastrophic" because it will always differ from person to person and from place to place. However, when the outcome of a risk assessment

indicates that there is a possibility that the public will be involved in an incident, then the incident can be seen as catastrophic".

The purpose of the study is not to identify all the risks associated with the operations, but to identify those hazards that may result in a major event causing harm to personnel, the public and or the environment.

A summary of the findings of the Major Hazard Installation (MHI) Risk Assessment insofar as it concerns societal risk is given herein. The full assessment is included under Appendix 4.4.

The identification of different hazardous installations within the premises as assessed in the MHI Risk Assessment is given in Table 8-6.

The facility is classified as a major hazard installation because a major incident at the site will have an effect zone such that it will impact members of the public outside the boundaries of the premises. It is essential that risk mitigation measures are applied at the site, as outlined in the MHI report.

Societal risk -
Societal safety risks on this site are acceptably low.

Future land use development around the site

- There are no developing conflicts for this site at the time of the risk assessment.
- To the best knowledge of the risk assessor there are no major hazard installation within the effect zone of a relevant worst-case major incident that can occur at this site.
- If new development around the site is planned, the local authority must take the land-use planning zones in Figure 9.1 into consideration.

Mitigation measures proposed
The MHI Risk assessment proposes safety systems, equipment, and devices to be used for prevention and mitigation of major incidents relating to the liquid sulphur dioxide storage tank, the ammonia engine room and the molten sulphur storage tank. These recommendations are to be implemented.

Table 8-6: List of hazardous installations within the premises

No	Name	CAS No	SANS 10228 Class	Inventory	Release quantity	Associated Hazard
1	Sulphur dioxide liquid	7446-09-5	2.3	60 m^3 (84 000 kg)	84 000 kg	Toxic effect of gas cloud
2	Ammonia liquid	7664-41-7	2.3	850 kg; One compressor; 12 barg	850 kg	Toxic effect of gas cloud
3	Carbon dioxide	124-38-9	2	Two tanks of 25 m^3; 17 barg	25 m^3	Suffocating effect of gas cloud
4	Methane via pipeline (natural gas)	74-82-8	2.1	150-mm pipeline; 6.25 barg to kiln	150-mm hole for 10 minutes	Jet fire Vapour cloud explosion
5	Steam boiler	-	-	25 m3; 21 barg	-	Pressure burst
6	Compressed air vessels	-	-	Three tanks of 5.3 m^3; each 8 barg	-	Pressure burst
7	Liquid sulphur storage tank (molten)	7704-34-9	4.1	80 000 litres	80 000 litres	Pool fire Toxic effect of sulphur dioxide combustion gas cloud
8	Liquid sulphur road tanker (molten)	7704-34-9	4.1	20 000 litres	20 000 litres	
9	Methyl naphthalene storage tank	91-20-3	4.1	200 000 litres	200 000 litres	Toxic effect of gas cloud
10	Methyl naphthalene road tanker	91-20-3	4.1	20 000 litres	20 000 litres	
11	n-Heptane storage tank	142-82-5	3	50 000 litres	50 000 litres	Jet fire Vapour cloud explosion
12	n-Heptane road tanker	142-82-5	3	20 000 litres	20 000 litres	
13	Hydrogen storage tank	1333-74-0		37 m^3 at a pressure of 0.5 barg.	37 m^3	Jet fire Vapour cloud explosion

8.5 AVIATION IMPACT ASSESSMENT

8.5.1 INTRODUCTION

The Department of Environment, Forestry and Fisheries online screening tool identifies the site as having a 'high' aviation sensitivity due to proximity of the Newcastle airport. Accordingly, a specialist assessment and "civil aviation compliance statement" is required.

The report flows from a requirement for the impact of the proposed expansion on the adjoining Newcastle Airport (FANC) to be assessed by way of an Aviation Impact Assessment, and consultation with the Newcastle Municipality as airport owner and the SA Civil Aviation Authority (SACAA) as regulator, who are two key interested and affected parties (I&APs).

A summary of the assessment is provided herein, the full assessment can be found as Appendix 4.5 hereto.

8.5.2 STUDY SCOPE

The study scope is set out below:

1. Submit relevant credentials of 'expert' status, including CV's, letters of reference and project experience.
2. Confirm the South African Civil Aviation Authority (SACAA) licensing and operational status of Newcastle Airport (FANC)
3. Confirm the current Aeronautical Information Publication (AIP) status of FANC
4. Report on the potential International Civil Aviation Organisation(ICAO) Annex 14 or SACAA Civil Aviation Regulations(CARS)/Civil Aviation Technical Standards(CATS) impacts of the proposed Brother CISA project, which would encompass:
    a. Approach surfaces
    b. Take-off climb surfaces
    c. Inner horizontal surface
    d. Inner transitional surface
    e. Conical surface
    f. Radar, communications or navigational systems interference
    g. Any other issues raised by SACAA (as an I&AP)
5. Report on any potential impacts arising from the AIP or any Notices to Airmen(NOTAMs) currently in play, which are likely to be limited to potential dust/smoke plume impacts and any other health and safety issues, which might more detailed assessment of prevailing wind direction and risk of particulates drifting into the path of aircraft (requires client input on air quality issues)
6. Noise impact assessment (of the proposed project on the airport) is not an issue and is excluded.
7. The study is a desk-top study.
8. The study is limited to the impact of the proposed Brother CISA development on Newcastle Aerodrome and does not address possible existing non-compliances of the aerodrome with CAA licence conditions.

8.5.3 LOCATION

The site is in the Newcastle Chemical Park, immediately south of the Newcastle Airport. Figure 8-16 illustrates the location of the proposed development site relative to existing airport infrastructure, GA developments and the FANC terminal, with the following key features noted:

- Runway orientation is essentially east-west (RWY 11/29) with RWY 29 dominant.
- Road access to the airport is from the north, off the Provincial road linking Newcastle to Madadeni
- The apron, passenger terminal and General Aviation (GA) areas are located north of the runway
- The Brother CISA site is 746m south of the runway centreline
- The ground level of the nearest corner of the Brother CISA site is 9 m lower than the runway centreline.
- The gravel crosswind runway is no longer in use.

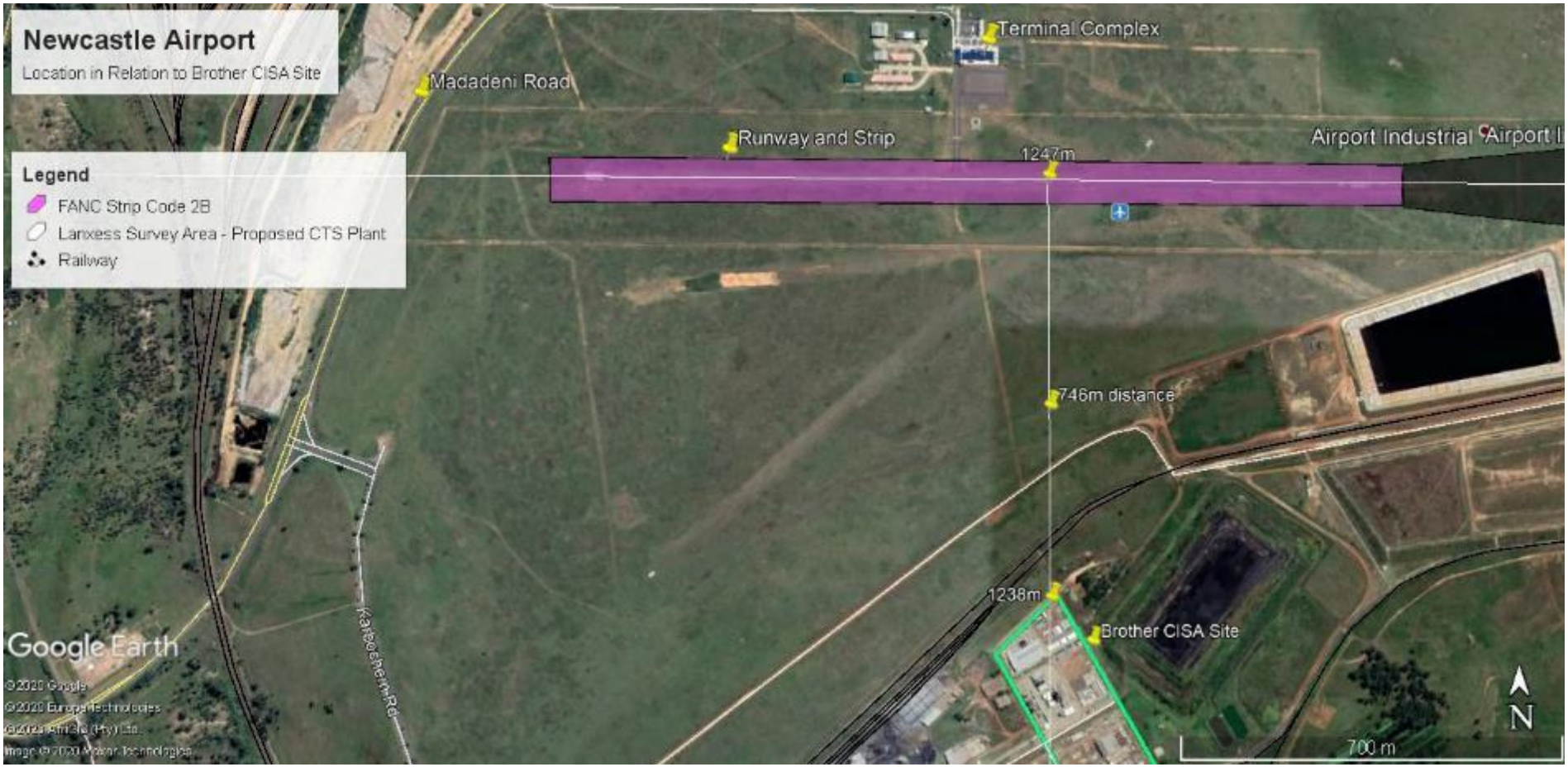


Figure 8-16: Context of Newcastle Airport (FANC) and the Brother CISA Site

8.5.4 IMPACTS OF THE PROPOSED BROTHER CISA FACILITY ON THE NEWCASTLE AIRPORT

After analysis of the layout of the FANC site and assessment of capacity, access and infrastructural constraints, the following summarises the potential impact of the proposed Brother CISA development to the south.

Figure 8-17 shows the key Obstacle Limitation Surfaces as defined in ICAO Annex 14 for the applicable Aerodrome Code (2B) likely to be influenced by the proposed development being:

a. Approach and Take-Off Climb Surfaces

Given the distance of the facility from the runway centreline, the aerodrome approach and take-off climb surfaces are not impacted.

b. Inner horizontal surface

The inner horizontal surface extends over the proposed development site, imposing a height limitation of 45m above the runway reference level of 1 247 m i.e. 1 292 m Above Mean Sea Level. To comply with this restriction, any new structures will need to be restricted to 54m in height.

c. Inner transitional surface

The inner transitional surface does not impact the proposed development site.

d. Conical surface

The conical surface is superseded by the Inner Horizontal surface.

e. Radar, communications or navigational systems interference

The aerodrome is equipped with radio communications equipment located in the terminal building, which is used to communicate with aircraft and to enable remote operation of runway edge lights for night-time emergency operations. In addition, a non-directional beacon is positioned north of the terminal complex. The infrastructure is a minimum of 1 000m from the proposed development site, which imposes a low risk of interference. In any event, standard operating procedures would require pilots to abort any movements in the event of communications failures and to divert, if necessary, to nearby airports such as Ladysmith.

f. Wind and Air Quality

In the absence of detailed wind data from the aerodrome itself, the potential of impacts on aircraft operations arising from dust or smoke plumes was referenced to anecdotal wind data sourced from the DAEA Ambient Air Quality Monitoring Network Report (2012) (Appendix C), subject to updated data being source by the Environmental Consultants.

The wind rose data for Newcastle confirms anecdotal data provided by the runway users, that predominant winds are westerly and south westerly, with a calm frequency of 1,0 – 2,0m/s, and wind speed in excess of 6 m/s only moderately likely. In terms of impact on the aerodrome, the positioning of the proposed development is such that any new plumes will have low impact on the airfield within the landing zone. It is also likely that, because of the distance from the facility and height differential, any potential impact of visibility on approaches to RWY 29 will have dispersed, and not materially affect runway usability.

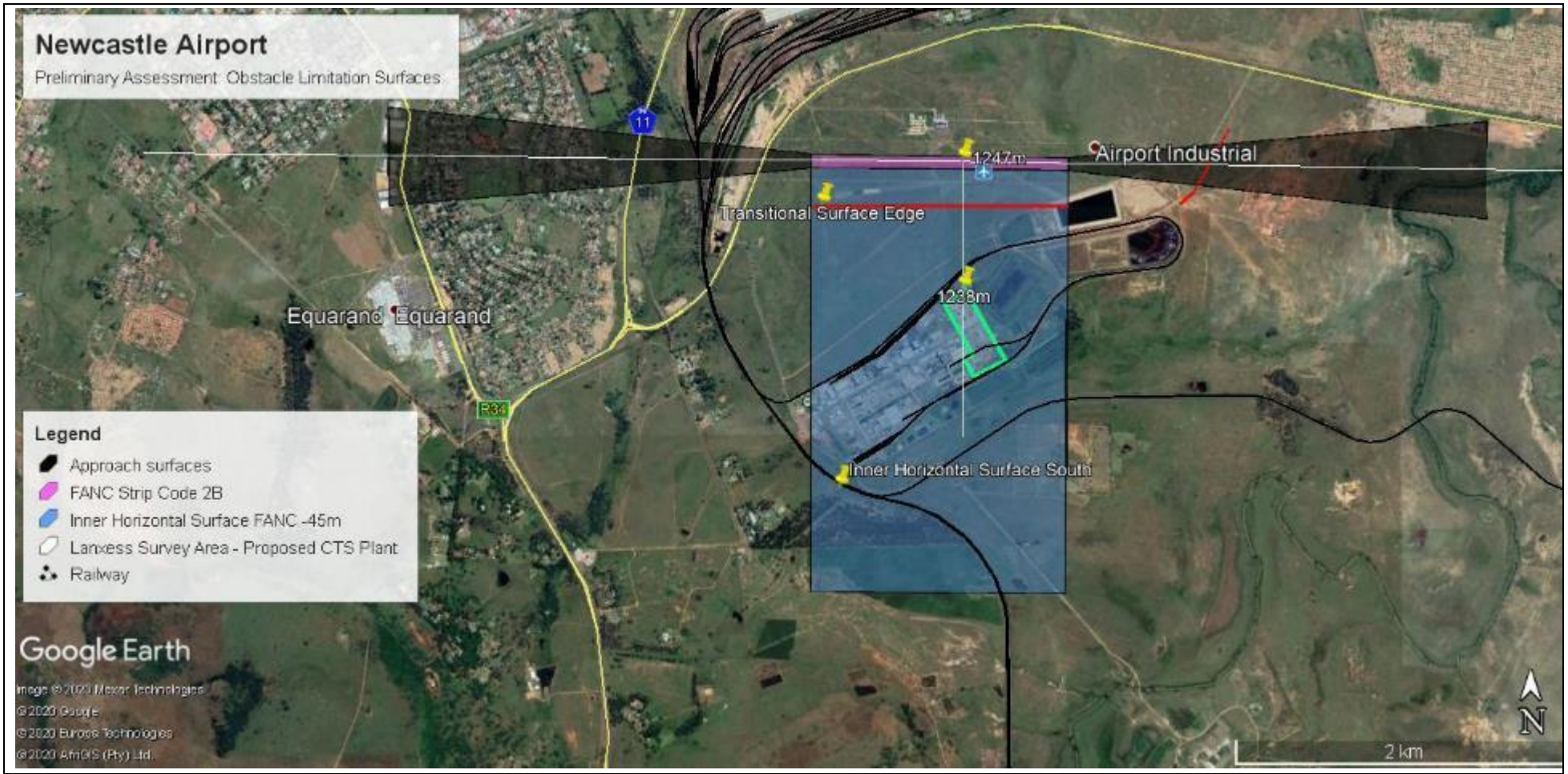


Figure 8-17: Development Site Locality in relation to Aerodrome OLS

8.5.5 CONCLUSIONS AND COMPLIANCE STATEMENT

The analysis in accordance with ICAO Annex 14 and relevant SACAA standards indicates a low likelihood of any material impacts of the proposed development on operations at Newcastle Aerodrome, and the sensitivity of the site is thus low.

It is recommended therefore that the development be supported, subject to a height restriction of 54m above natural ground level within the development site.

9 METHODOLOGY USED TO DETERMINE IMPACTS

The following criteria and methodology is proposed to determine the significance of environmental impacts that may result from the facility.

9.1 TYPE/NATURE OF IMPACTS

Potential environmental impacts may either have a positive or negative effect on the environment, and can in general be categorised as follows:

a. Direct/Primary Impacts

Primary impacts are caused directly due to the activity and generally occur at the same time and at the place of the activity.

b. Indirect/Secondary Impacts

Secondary impacts induce changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken.

c. Cumulative Impacts

Cumulative impacts are those that result from the incremental impact of the activity on common resources when added to the impacts of the other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

9.2 DETERMINING SIGNIFICANCE

The following criteria were used to determine the significance of an impact. The scores associated with each of the levels within each criterion are indicated in brackets after each description [like this].

9.2.1 NATURE

Nature (N) considers whether the impact is:

- Positive [- ¼]
- Negative [+1].

9.2.2 EXTENT

Extent (E) considers whether the impact will occur:

- on site [1]
- locally: within the vicinity of the site [2]
- regionally: within the local municipality [3]
- provincially: across the province [4]
- nationally or internationally [5].

9.2.3 DURATION

Duration (D) considers whether the impact will be:

- very short term: a matter of days or less [1]
- short term: a matter of weeks to months [2]
- medium term: up to a year or two [3]
- long term: up to 10 years [4]
- very long term: 10 years or longer [5].

9.2.4 INTENSITY

Intensity (I) considers whether the impact will be:

- negligible: there is an impact on the environment, but it is negligible, having no discernible effect [1]
- minor: the impact alters the environment in such a way that the natural processes or functions are hardly affected; the system does however, become more sensitive to other impacts [2]
- moderate: the environment is altered, but function and process continue, albeit in a modified way; the system is stressed but manages to continue, although not with the same strength as before [3]
- major: the disturbance to the environment is enough to disrupt functions or processes, resulting in reduced diversity; the system has been damaged and is no longer what it used to be, but there are still remaining functions; the system will probably decline further without positive intervention [4]
- severe: the disturbance to the environment destroys certain aspects and damages all others; the system is totally out of balance and will collapse without major intervention or rehabilitation [5].

9.2.5 PROBABILITY

Probability (P) considers whether the impact will be:

- unlikely: the possibility of the impact occurring is very low, due either to the circumstances, design or experience [1]
- likely: there is a possibility that the impact will occur, to the extent that provisions must be made for it [2]
- very likely: the impact will probably occur, but it is not certain [3]
- definite: the impact will occur regardless of any prevention plans, and only mitigation can be used to manage the impact [4].

9.2.6 MITIGATION OR ENHANCEMENT

Mitigation (M) is about eliminating, minimising or compensating for negative impacts, whereas enhancement (H) magnifies project benefits. This factor considers whether –

- A negative impact can be mitigated:
- unmitigated: no mitigation is possible or planned [1]
- slightly mitigated: a small reduction in the impact is likely [2]
- moderately mitigated: the impact can be substantially mitigated, but the residual impact is still noticeable or significant (relative to the original impact) [3]
- well mitigated: the impact can be mostly mitigated, and the residual impact is negligible or minor [4]

A positive impact can be enhanced:

- unenhanced: no enhancement is possible or planned [1]
- slightly enhanced: a small enhancement in the benefit is possible [2]
- moderately enhanced: a noticeable enhancement is possible, which will increase the quantity or quality of the benefit in a significant way [3]
- well enhanced: the benefit can be substantially enhanced to reach a far greater number of receptors or recipients and/or be of a much higher quality than the original benefit [4].

9.3 CALCULATING IMPACT SIGNIFICANCE

The table below summarises the scoring for all the criteria.

Table 9-1: Scoring for Significance Criteria

CRITERION	SCORES					
	- ¼	**1**	**2**	**3**	**4**	**5**
N-nature	positive	negative	-	-	-	-
E-extent	-	site	local	municipal	provincial	national
D-duration	-	very short	short	moderate	long	very long
I-intensity	-	negligible	minor	moderate	major	severe
P-probability	-	unlikely	likely	Very likely	definite	-
M-mitigation	-	none	slight	moderate	good	-
H-enhancement	-	none	slight	moderate	good	-
R-reversibility	-	none	slight	moderate	good	-

Impact significance is a net result of all the above criteria. The formula proposed to calculate impact significance (S) is:

- For a negative impact: S = N x (E+D) x I x P ÷ ½(M+R); and
- For a positive impact: S = N x (E+D) x I x P x (H).

Negative impacts score from 2 to 200. Positive impacts score from – ½ to -200.

9.4 UNDERSTANDING IMPACT SIGNIFICANCE

The following is a guide to interpreting the final scores of an impact (for negative impacts):

Table 9-2: Final Significance Scoring

Final score (S)	Impact significance	
0 – 10	Negligible	The impact should result in no appreciable damage to the environment, except where it has the opportunity to contribute to cumulative impacts
10 – 20	Low	The impact will be noticeable but should be localized or occur over a limited time period and not cause permanent or unacceptable changes; it should be addressed in an EMP and managed appropriately.
20 – 50	Moderate	The impact is significant and will affect the integrity of the environment; effort must be made to mitigate and reverse this impact; in addition, the project benefits must be shown to outweigh the impact.
50 – 100	High	The impact will affect the environment to such an extent that permanent damage is likely, and recovery will be slow and difficult; the impact is unacceptable without real mitigation or reversal plans; project benefits must be proven to be very substantial; the approval of the project will be in jeopardy if this impact cannot be addressed.

Table 9-2: Final Significance Scoring		
Final score (S)	Impact significance	
100 – 200	severe	The impact will result in large, permanent and severe impacts, such as, sterilising of essential environmental resources, local species extinctions, eco-system collapse; project alternatives that are substantially different should be considered, otherwise the project should not be approved.

10 IMPACT SIGNIFICANCE ASSESSMENT/ANALYSIS

It is important to note that the proposed activities will take place within the existing disturbed footprint of the site, and that the alternatives considered are all within this footprint. This means that the impact assessment for the various alternatives is largely the same. Therefore, a single impact assessment has been presented herein to avoid unnecessary duplication.

10.1 CONSTRUCTION PHASE

10.1.1 INTRODUCTION

This phase of the project involves all those activities related to preparation of the site and subsequent construction/establishment of the various project structures and associated surface infrastructure thereon, once prepared.

It is envisaged that the construction period will last for approximately 24 months, until such time as operational activities commence.

10.1.2 CONSTRUCTION AND INSTALLATION WASTE GENERATION, HANDLING AND DISPOSAL

10.1.2.1 Introduction

Nominal volumes of construction and installation waste will be generated during the establishment of the proposed activity and associated infrastructure. The waste would predominantly comprise of building rubble, packaging and fabrication waste/s. Steel and electric cabling waste is also expected from installation. It is likely that most, if not all, of the waste generated would be non-hazardous/general waste. The generation of such waste could indirectly impact on the operational lifespan of a waste disposal facility, through the permanent occupation of remaining available airspace at this facility.

Note: Impacts of onsite waste storage on soil and ground water quality are assessed under 'soil and ground water quality.

10.1.2.2 Impact Discussion & Significance Assessment

Waste which is disposed of will have impact at a municipal extent. The intensity of the impact will, however, be low relative to cumulative local and regional waste generation volumes.

Table 10-1: Impacts of Construction Waste Generation (Construction)		
Nature (N)	Indirect negative impact on landfill airspace availability.	1
Extent (E)	Regional Use of airspace that would otherwise be available to other users in the municipality	3
Duration (D)	Very long term – Waste will be permanently placed in landfill	5
Intensity (I)	Negligible: The anticipated impact will be negligible, with a very little effect on relative airspace availability.	1
Probability (P)	Definite: The generation of waste during the construction phase is largely unavoidable (the amount generated can, however, be managed)	4
Mitigation (M)	Well mitigated: A small reduction in the volumes of waste generated can likely be effected during	4

Table 10-1: Impacts of Construction Waste Generation (Construction)			
	construction. However, a significant portion of this waste can be re-used and/or recycled.		
Enhancement (H)	N/A		-
Reversibility (R)	Moderately reversible through reuse, recovery and/or recycling initiatives: Where the impact relates to contribution to landfill, any measure implemented to reuse, recover, or recycle such waste would constitute the reversal of the impact		3
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	16
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	9
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

10.1.2.3 Mitigation/Management

The contractor/s will be required to provide a method statement specific to waste minimisation, reuse, recovery and recycling, as well as temporary storage and disposal; where such plans would need to be signed off by competent site environmental personnel / environmental control officer (ECO), prior to the start of construction activities.

Construction waste which can be practically recycled will be sorted and stored for that purpose. In general, the National Norms and Standards for Storage of Waste will provide a guideline for waste storage. All construction and installation waste must be stored temporarily in a manner that protects groundwater and soil, and appropriately disposed of at a suitable, permitted/licensed, disposal site (i.e. where the waste in question is classified as general waste), or stored temporarily prior to collection by a suitably licensed waste disposal contractor in the event that hazardous waste is generated. Temporary waste storage areas must be sited under the guidance of site environmental personnel prior to the start of construction activities. Construction personnel should be trained in their correct use and the site should be regularly inspected to ensure that they are being appropriately managed.

10.1.3 SOIL, SURFACE WATER, AND GROUNDWATER QUALITY

10.1.3.1 Introduction

The inappropriate storage, management and handling of waste, fuel or lubricants during the construction period could result in potentially negative impacts on soil, surface water and groundwater quality; where contaminants from spillages or inadequate storage of such could enter the soil, surface water, and groundwater environment, through the infiltration of contaminated surface run-off. Poorly managed construction vehicle maintenance procedures and wash bays too may impact negatively on groundwater quality. Contamination of this nature, associated with the construction phase of a project of this magnitude, would typically be hydrocarbon based (i.e. petrol, diesel and oil leaks and spillages to bare soil surfaces). Small hydrocarbon spills are expected to be adsorbed to clays and organic material in the soil and thus are not expected to migrate significantly and can thus easily be cleaned up by removal of the affected soil. Temporary concrete

batching plants can also impact negatively on groundwater resource quality if inadequately managed.

During the construction phase, stormwater will be diverted to the existing stormwater management system in place.

Groundwater contamination is likely to be restricted to the confines of the site. Mitigation by ensuring that adequate bunded facilities are in place for storage of waste, fuels, lubricants and vehicle maintenance will largely eliminate the potential for soil, surface water and groundwater contamination.

10.1.3.2 Impact Discussion & Significance Assessment - Groundwater

Table 10-2: Impacts on groundwater quality (Construction)			
Nature (N)	Negative impact on water resource quality		1
Extent (E)	Locally: Localised to the site and immediate surrounds		2
Duration (D)	Long term: Only if a plume enters groundwater will it be a long process to remediate contaminated groundwater.		4
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected. Contaminants that have a possibility of entering groundwater are small		2
Probability (P)	Unlikely: The probability of a significant spill taking place during construction is low. The probability of significant contamination from waste materials is also low as the majority of wastes are not hazardous. Hazardous waste such used oil and lubricants will in any case be stored in sealed drums/containers.		1
Mitigation (M)	Well mitigated: Providing adequate bunded facilities, for storage will largely reduce the potential for soil and groundwater contamination.		4
Enhancement (H)	N/A		-
Reversibility (R)	Slightly reversible: Groundwater remediation is possible but is a lengthy and costly process.		2
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(R)	**Negligible**	8
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	4
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

10.1.3.3 Impact Discussion & Significance Assessment - Surface Water

Table 10-3: Impacts on surface water quality (Construction)		
Nature (N)	Negative impact on water resource quality	1

Table 10-3: Impacts on surface water quality (Construction)			
Extent (E)	Regional: A severe spill that impacts the Karbochem spruit would affect water quality downstream		3
Duration (D)	Short term: Due to constant flow and dilution a spill that impacts on surface water quality would be quickly diluted. Potential spills, such as hydrocarbons, during construction are not expected to be large and would mostly be absorbed by soils before reaching the Karbochem spruit.		2
Intensity (I)	Moderate: The environment would be altered, but function and process continue, albeit in a modified way; the system is stressed but manages to continue, although not with the same strength as before		3
Probability (P)	Unlikely: The probability of a significant spill taking place during construction is low. The probability of significant contamination from waste materials is also low as the majority of wastes are not hazardous. Hazardous waste such used oil and lubricants will in any case be stored in sealed drums/containers.		1
Mitigation (M)	Well mitigated: Providing adequate bunded facilities, for storage will largely reduce the potential for surface water contamination.		4
Enhancement (H)	N/A		-
Reversibility (R)	None		1
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(R)	**Low**	15
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	6
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

10.1.3.4 Impact Discussion & Significance Assessment - Soil

Table 10-4: Impacts on soil (Construction)		
Nature (N)	Direct Negative impact on the site	1
Extent (E)	On site	1
Duration (D)	Short term: Potential impact addressed immediately	2
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected	2
Probability (P)	Unlikely: The probability of a significant spill taking place during construction is low. The probability of significant contamination from waste materials is also low as the majority of wastes are not hazardous. Hazardous waste such used oil and lubricants will in any case be stored in sealed drums/containers.	1

Table 10-4: Impacts on soil (Construction)			
Mitigation (M)	Well mitigated: Providing adequate bunded facilities, for storage will largely reduce the potential for soil and groundwater contamination.		4
Enhancement (H)	N/A		-
Reversibility (R)	Slightly reversible: the impact requires that effort is taken immediately after the impact		2
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(R)	**Negligible**	4
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	2
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

10.1.3.5 Mitigation/Management

The remediation of significantly contaminated groundwater can be a long, arduous and costly process. Any such remediation efforts may also be likely to leave significant residual contamination, despite any such remediation attempts (dependant on the nature and extent of the contamination itself). As such, the proponent's management actions should focus on the prevention of any such potential hydrocarbon contamination, rather than post impact remediation thereof. A comprehensive range of effective, proven, mitigation measures will be implemented in this regard, which are in principle as follows:

- Contractors to provide a method statement in respect of how they propose to manage storage of fuel and lubricants, waste storage, concrete batching, and vehicle maintenance areas to minimise the potential for groundwater pollution. Such method statements would need to be signed off by competent site environmental personnel / environmental control officer (ECO), prior to the start of construction activities;
- All hazardous substances to be stored within appropriately sized, impermeable, bund walls;
- Storm water control measures to be implemented that prevent the free movement of 'clean' storm water run-off through the aforementioned storage areas, as well as any vehicle maintenance areas.
- Hazardous substances spill kits to be readily available at all points where hazardous substances will be stored and/or transferred (e.g. refuelling points);
- Vehicle and plant servicing to only take place in dedicated service yards on impermeable surfaces coupled with appropriate 'dirty' water containment systems/sumps and oil/water separators; and
- Drip trays to be appropriately placed under vehicles and plant that over-night on bare soil surfaces.
- Where hydrocarbon spills occur, the soil is to be removed for treatment or disposal as soon as practical.

10.1.4 AIR QUALITY – DUST GENERATION

10.1.4.1 Introduction

During construction, the undertaking of ground preparation and civil works may lead to the generation of vehicle and wind entrained dust. Although the impact is likely to be localised to the site due the size of the area to be worked, dust suppression techniques such as wetting roads, or application of dust palliatives, may be required. Other emissions during construction, such as construction vehicle and machinery exhausts are not anticipated to be significant.

10.1.4.2 Impact Discussion & Significance Assessment

The impact will be of a low intensity and isolated to the site and its immediate surrounds. Effective mitigation, in the form of accepted dust suppression techniques, can be applied, but will not likely mitigate the potential occurrence of the impact in its entirety.

Table 10-5: Impacts on Air Quality (Construction)			
Nature (N)	Negative impact on ambient air quality.		1
Extent (E)	Locally: Localised to the site and immediate surrounds		2
Duration (D)	Medium term: Construction phase (conservatively anticipated for up to 24 months)		3
Intensity (I)	Minor: Natural processes or functions will hardly be affected		2
Probability (P)	Likely: there is a possibility that the impact will occur, to the extent that provisions must be made for it.		2
Mitigation (M)	Well mitigated: Effective dust suppression methods readily available		4
Enhancement (H)	N/A		-
Reversibility (R)	Irreversible: Not practical to reverse the impact once it has occurred		1
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	20
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	8
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

10.1.4.3 Mitigation/Management

The Proponent to institute effective dust suppression measures on all un-surfaced access roads for the duration of the construction phase.

10.1.5 NOISE

The following activities will generate noise during the construction phase of the proposed plant and roads:

- Removal and transportation of top soil from the footprint area;

- Earthmoving equipment at the foot print area;
- Hauling of material to and from the specific area;
- Building activities during construction of the proposed storage areas

10.1.5.1 Impact Discussion & Significance Assessment

Noise during installation and assembly of proposed infrastructure and equipment is expected to have no significant impact outside of the site provided that the recommended mitigatory measures are implemented.

In the context of existing site and surrounds (neighbouring industrial activities) noise from construction is not expected to have a significant impact. It must be noted that sound pressure level decreases rapidly with distance from the source.

Table 10-6: Noise impacts (Construction)			
Nature (N)	Negative impact on site		1
Extent (E)	On site: Localised to the site		1
Duration (D)	Medium term: Construction phase (conservatively anticipated for up to 24 months)		3
Intensity (I)	Negligible: The facility is within an industrial area and there are no nearby noise receptors outside of the facility.		1
Probability (P)	Definite: It is likely that noise will be generated to an extent that mitigation measures should be considered		4
Mitigation (M)	Well mitigated: To be limited to normal working hours, in accordance with locally applicable by-laws.		4
Enhancement (H)	N/A		-
Reversibility (R)	Irreversible: The status quo will return to the previous status quo upon completion of construction.		1
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	16
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	6.4
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

10.1.5.2 Mitigation/Management

- Construction related activities should be limited to hours as agreed upon by the other industries within the Newcastle Chemicals Complex.

- A complaints register should be implemented such that neighbouring industries can notify the proponent if noise becomes a nuisance.

10.1.6 SOCIO-ECONOMICS – JOB PROVISION

10.1.6.1 Introduction

The employment opportunities expected to be created by the project during the construction phase are as follows -

- Approximately 30 new skilled employment opportunities will be created in the construction phase of the project
- Approximately 160 new un-skilled employment opportunities will be created in the construction phase of the project

There will however be socio economic benefits related to the supply of materials and support necessary for the construction process.

10.1.6.2 Impact Discussion & Significance Assessment

The impact will be of a minor intensity and is expected to have a municipal extent. Effective enhancement, in the form of the proponent making a concerted effort to employ workers from the surrounding areas, can be applied where it is practical.

Table 10-7: Impacts on Socio-economics (Construction)			
Nature (N)	Positive impact on job creation		-0.25
Extent (E)	Regional: Expected to have an impact within the municipality.		3
Duration (D)	Medium term: Construction phase (conservatively anticipated for up to 24 months)		3
Intensity (I)	Minor: The number of jobs created will not be large and these jobs will be temporary.		2
Probability (P)	Definite: Impact will occur		4
Mitigation (M)	N/A		-
Enhancement (H)	Moderate enhancement, in the form of the proponent making a concerted effort to employ workers from the surrounding areas, can be applied		3
Reversibility (R)	N/A		N/A
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).	**Moderate (Positive)**	-36

10.1.6.3 Enhancement

Effective enhancement, in the form of the proponent making a concerted effort to employ workers from the surrounding areas, can be applied where practical.

10.1.7 ARCHAEOLOGICAL IMPACT

An Archaeological Impact Assessment was conducted. A summary of the assessment is provided in section 8.2 the full assessment can be found as Appendix 4.2 hereto.

10.1.7.1 Impact Discussion & Significance Assessment

The specialist concluded that the development is not anticipated to have any impact on cultural heritage, based on the absence of heritage finds on the surface or in the excavated areas.

10.1.7.2 Mitigation/Management

No heritage finds of any significance were identified in the impact footprint of the proposed development area. Therefore, regarding visible cultural heritage, there are no recommendations.

Should any cultural heritage be observed once development commences, a specialist must be consulted to perform an examination of the finds.

10.1.8 PALAEONTOLOGICAL IMPACT

A Palaeontological Impact Assessment was conducted. A summary of the assessment is provided in section 8.3 the full assessment can be found as Appendix 4.3 hereto.

10.1.8.1 Impact Discussion & Significance Assessment

Given the previous development and disturbance of the property noted in the survey findings, the proposed upgrade of the Brother CISA property is extremely unlikely to expose or disturb any fossil deposits. As such, it is deemed that the survey area represents a low priority for mitigation, and highly unlikely that any palaeontological resources will be endangered.

10.1.8.2 Mitigation/Management

According to current development plans, no mitigation measures are required.

If construction activities on this property should involve excavation of the property (i.e. earth movement) that exposes any fossil deposits, SAHRA should be contacted immediately and a professional palaeontologist should be brought in to assess their significance and provide recommendations (e.g. recording, sampling, collection and mitigation).

10.2 OPERATIONAL PHASE IMPACTS

10.2.1 AIR QUALITY IMPACTS

A specialist air quality impact assessment was undertaken. The full Air Quality Impact Assessment can be found as Appendix 4.1 hereto.

A detailed summary of the Air Quality Impact Assessment outcomes is given in section 8.1. The conclusions are provided below.

10.2.1.1 Impact Discussion & Significance Assessment

Three scenarios were modelled as described in section 8.1.3

Only the results for the cumulative scenario (Scenario 3) are presented herein. The results for scenarios 1 and 2 on their own can be found in the full report as Appendix 4.1

PARTICULATE MATTER

PM_{10} - 24 HOUR

Predicted maximum ambient concentrations of PM_{10} from the operations are well within the 24-hour limit, 75 µg/m³.

PM_{10} - ANNUAL

Predicted maximum ambient concentrations of PM_{10} from the operations are well within the annual ambient air quality limit, 40 µg/m³.

$PM_{2.5}$ - 24 HOUR

Predicted maximum ambient concentrations of $PM_{2.5}$ from the operations are well within the 24-hour limit, 40 µg/m³.

$PM_{2.5}$ - ANNUAL

Predicted maximum ambient concentrations of $PM_{2.5}$ from the operations are well within the annual ambient air quality limit, 20 µg/m³.

SULPHUR DIOXIDE

1-HOUR

Predicted maximum ambient concentrations of SO_2 from the operations exceed the 1-hour limit, 350 µg/m³, however the predicted exceedances are all within the industrial boundary. The frequency of exceedance is well within the maximum allowable number of exceedances per year.

24-HOUR

Predicted maximum ambient concentrations of SO_2 from the operations are within the 24-hour limit, 125 µg/m³.

ANNUAL

Predicted maximum ambient concentrations of SO_2 from the operations are within the annual limit, 50 µg/m³.

NITROGEN DIOXIDE

1-HOUR

Predicted maximum ambient concentrations of NO_2 are within the 1-hour limit of 200 µg/m³.

ANNUAL

Predicted maximum ambient concentrations of NO_2 from the operations are within the annual limit, 40 µg/m³.

HEXAVALENT CHROMIUM

1-HOUR

The maximum predicted ambient concentration from the operations is within the Alberta state and Manitoba state 1-hour limits of 1 µg/m^3 and 4.5 µg/m^3, respectively.

PREDICTED LIFETIME CARCINOGENIC RISK USING THE WHO IUR

The predicted lifetime carcinogenic risk resulting from the maximum anticipated emissions from the plant is detailed in section 8.1.3.6. Considering that no receptors beyond the boundaries of the Newcastle Chemicals Complex are predicted to experience lifetime carcinogenic risk greater than 1 in 500 000, the risk is considered acceptable.

PREDICTED LIFETIME CARCINOGENIC RISK USING THE US EPA IUR

The predicted lifetime carcinogenic risk resulting from the maximum anticipated emissions from the plant is detailed in section 8.1.3.6. Considering that no receptors beyond the boundaries of the Newcastle Chemicals Complex are predicted to experience lifetime carcinogenic risk greater than 1 in 500 000, the risk is considered acceptable.

SULPHURIC ACID

1-HOUR

The maximum predicted ambient concentration from the operations is within the Texas and Michigan state limits of 50 µg/m³ and 120 µg/m³ respectively.

24-HOUR

Predicted maximum 24-h ambient concentrations from the operations are within the Ontario state limit of 5 µg/m³.

ANNUAL

Predicted maximum ambient concentrations of H_2SO_4 from the operations are within the Michigan state limit of 1 µg/m^3 and the Massachusetts state limit of 2.72 µg/m^3.

10.2.1.2 RECOMMENDATIONS

In cognisance of the findings of the assessment, and provided that the proposed plant will meet the emissions limits stipulated, it is recommended that the proposed activities be authorised.

Due to the fact that no maximum allowable emission concentration is provided for Cr(VI) in GN 893 of 2015 as amended, It is recommended that Cr(VI) emissions limits as shown in Table 10-8 be applied to stacks where Cr(VI) emissions are anticipated.

Table 10-8: Recommended Cr(VI) emissions limits

Point Source	Proposed Cr(VI) emissions limit (mg/Nm³)
CTS1 - CTS Organic Stack 1	0.035
CTS2 - CTS Organic Stack 2	0.035
CTS13 - CTS Organic Stack 13	0.035
CTS14 - CTS Organic Stack 14	0.035
CTS17 – CTS Inorganic Stack 1	0.01

These recommended limits are based on the following factors:

- These emissions limits result in acceptable Cr(VI) ambient concentrations as shown in sections 8.1.3.6
- These concentrations are considered achievable through the use of proposed emissions abatement technology;
- The recommended limits are more stringent than the German Technical Instructions on Air Quality Control (TA Luft) limit of 0.05 mg/Nm^3 which may be considered for reference purposes in the absence of a legislated South African emission limit.

It is recommended that the listed point source emissions be monitored in accordance with the stipulations of GN 893 of 2015 as amended, at least once per annum.

10.2.2 TRAFFIC

10.2.2.1 Introduction

During operations, the facility will receive deliveries of raw materials and products will be collected.

- 22 trucks per day are anticipated for delivery of raw materials
- 20 trucks per day are anticipated for collection of product

Due to a number of business having closed at the Newcastle Chemicals Complex, the traffic has reduced significantly from its peak and thus the expected total trips to and from the facility is still expected to be lower than the number of trips when all businesses were operational in the past. It is therefore expected that there will not be a net increase in the amount of transport historically associated with the site.

10.2.2.2 Impact Discussion & Significance Assessment

The site is appropriately zoned and is adjacent to a significant road artery network (R544 and N12). The impact of traffic related to the site is thus largely within the local roads joining onto the arterial roads.

Table 10-9: Impacts on traffic (operation)			
Nature (N)	Negative		1
Extent I	Local: The impact of traffic is expected to be on the access road to the site, the impact on roads further afield will become negligible.		2
Duration (D)	Very Long term: for the duration of the sites' operation.		5
Intensity (I)	Minor: It is expected that there will not be a net increase in the amount of transport historically associated with the site.		2
Probability (P)	Definite: During operations, the facility will receive deliveries of raw materials and products will be collected		4
Mitigation (M)	Moderately mitigated: deliveries and collections may be scheduled at specific times to avoid peak traffic entering and exiting the complex		3
Reversibility I	Mostly reversible: impact will cease upon closure of operation		4
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Moderate**	22
Significance Rating with Mitigation -Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Low**	16

10.2.2.3 Mitigation/Management

Where practical, Brother CISA should schedule deliveries and collections outside of peak traffic entering and exiting the complex.

10.2.3 EMERGENCY INCIDENT - MAJOR HAZARD INSTALLATION

The identification of different hazardous installations within the premises as assessed in the MHI Risk Assessment is given in Table 8-6.

The facility is classified as a major hazard installation because a major incident at the site will have an effect zone such that it will impact members of the public outside the boundaries of the premises. It is essential that risk mitigation measures are applied at the site, as outlined in the MHI report.

Societal risk -
Societal safety risks on this site are acceptably low.

Future land use development around the site

- There are no developing conflicts for this site at the time of the risk assessment.
- To the best knowledge of the risk assessor there are no major hazard installation within the effect zone of a relevant worst-case major incident that can occur at this site.
- If new development around the site is planned, the local authority must take the land-use planning zones in Figure 9.1 into consideration.

The MHI Risk assessment proposes safety systems, equipment and devices to be used for prevention and mitigation of major incidents relating to the liquid sulphur dioxide storage tank, the ammonia engine room and the molten sulphur storage tank. These recommendations are to be implemented.

10.2.4 SOIL, SURFACE WATER, AND GROUNDWATER QUALITY

10.2.4.1 Introduction

The inappropriate storage, management and handling of hazardous raw materials or products during operations could result in potentially negative impacts on soil, surface water and groundwater quality; where contaminants from spillages or inadequate storage of such could enter the soil, surface water, and groundwater environment, through the infiltration of contaminated surface run-off.

A new stormwater pond and stormwater management infrastructure will be constructed during the plant construction period and this stormwater management system will serve the facility during the operational phase, thus capturing any potentially contaminated run-off will report to the stormwater management system. Captured water would be recirculated into the process for use as process water. There will be no discharge of contaminated stormwater.

Groundwater contamination, if it were to occur, is likely to be restricted to the confines of the site. Mitigation by ensuring that adequate bunded facilities are in place for storage of hazardous will largely eliminate the potential for soil, surface water and groundwater contamination.

10.2.4.2 Impact Discussion & Significance Assessment - Groundwater

Table 10-10: Impacts on groundwater quality (Operation)		
Nature (N)	Negative impact on water resource quality	1
Extent (E)	Locally: Localised to the site and immediate surrounds	2
Duration (D)	Long term: Only if a plume enters groundwater will it be a long process to remediate contaminated groundwater.	4

Table 10-10: Impacts on groundwater quality (Operation)			
Intensity (I)	Major: A significant spill or leak could result in groundwater contamination that would disrupt normal functions or processes and would require intervention to reverse or reduce impact.		4
Probability (P)	Unlikely: The probability of a significant spill taking place is low. Hazardous substances will be stored in bunded facilities within the sites stormwater management area.		1
Mitigation (M)	Well mitigated: Providing adequate bunded facilities, for storage will largely reduce the potential for soil and groundwater contamination.		4
Enhancement (H)	N/A		-
Reversibility (R)	Slightly reversible: Groundwater remediation is possible but is a lengthy and costly process.		2
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(R)	**Low**	16
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	8
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

10.2.4.3 Impact Discussion & Significance Assessment - Surface Water

Table 10-11: Impacts on surface water quality (Operation)		
Nature (N)	Negative impact on water resource quality	1
Extent (E)	Regional: A severe spill that impacts the Karbochem spruit would affect water quality downstream	3
Duration (D)	Short term: Due to constant flow and dilution a spill that impacts on surface water quality would be quickly diluted.	2
Intensity (I)	Major: A severe spill reaching the Karbochem spruit would disrupt functions or processes, resulting in reduced diversity. The system would require positive intervention to fully restore systems and functions	4
Probability (P)	Unlikely: Given that the site has established procedures and training in place to prevent spills of hazardous chemicals the probability of a significant spill taking place during operations is low. These materials will in any case be stored in bunded facilities. The probability of significant contamination from waste materials is also low as the majority of wastes are not hazardous. Hazardous waste such used oil and lubricants will in any case be stored in sealed drums/containers.	1
Mitigation (M)	Well mitigated: Providing adequate bunded facilities, for storage will largely reduce the potential for surface water contamination.	4
Enhancement (H)	N/A	-

Table 10-11: Impacts on surface water quality (Operation)			
Reversibility (R)	Slight – although an arduous task. adequate clean up and rehabilitation after a sever spill would return the surface water resource to its prior state		2
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(R)	**Low**	13
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	7
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

10.2.4.4 Impact Discussion & Significance Assessment - Soil

Table 10-12: Impacts on soil (Operation)			
Nature (N)	Direct Negative impact on the site		1
Extent (E)	On site		1
Duration (D)	Short term: Potential impact can be addressed immediately through removal and remediation of contaminated soil		2
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected		2
Probability (P)	Unlikely: The probability of a significant spill taking place and contaminating soil is low due to the fact that hazardous substances will be stored within bunded facilities.		1
Mitigation (M)	Well mitigated: Providing adequate bunded facilities, for storage will largely reduce the potential for soil and groundwater contamination.		4
Enhancement (H)	N/A		-
Reversibility (R)	Slightly reversible: the impact requires that effort is taken immediately after the impact		2
Significance Rating without Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(R)	**Negligible**	4
Significance Rating with Mitigation - Negative Impact (S)	N x (E+D) x I x P ÷ ½(M+R)	**Negligible**	2
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).		-

10.2.4.5 Mitigation/Management

The remediation of significantly contaminated groundwater can be a long, arduous and costly process. Any such remediation efforts may also be likely leave significant residual

contamination, despite any such remediation attempts (dependant on the nature and extent of the contamination itself). As such, the proponent's management actions should focus on the prevention of any such potential hydrocarbon contamination, rather than post impact remediation thereof. A comprehensive range of effective, proven, mitigation measures will be implemented in this regard, which are in principle as follows:

- All hazardous substances to be stored within appropriately sized, impermeable, bund walls;
- Storm water control measures to be implemented that prevent the free movement of 'clean' storm water run-off through the hazardous substance storage areas and process areas.
- Hazardous substances spill kits to be readily available at all points where hazardous substances will be stored and/or transferred;

10.2.5 SOCIO-ECONOMICS

Introduction

The employment opportunities expected to be created by the project during the operational phase are as follows -

- Approximately 10 new skilled employment opportunities will be created in the operational phase of the project
- Approximately 90 new un-skilled employment opportunities will be created in the operational phase of the project

Impact Discussion & Significance Assessment – Direct Impact

The direct impact will be of a negligible intensity and will likely have a municipal extent. Effective enhancement, in the form of the proponent making a concerted effort to employ workers from the surrounding areas, can be applied.

Table 10-13: Impacts on Socio-economics (Operation)			
Nature (N)	Positive impact on job creation		-0.25
Extent (E)	Municipal: Expected to have an impact beyond the vicinity of the site		3
Duration (D)	Very long term: Operations are expected to last longer than 10 years		5
Intensity (I)	Minor: The number of jobs to be created is not insignificant, however the employment profile of the municipality will not be significantly altered.		2
Probability (P)	Definite: Impact will occur		4
Mitigation (M)	N/A		-
Enhancement (H)	Moderate enhancement, in the form of the proponent making a concerted effort to employ workers from the surrounding areas, can be applied		3
Reversibility (R)	N/A		N/A
Significance Rating -Positive Impact (S)	N x (E+D) x I x P x (H).	**Moderate (Positive)**	-48

Enhancement

Effective enhancement, in the form of the proponent making a concerted effort to employ workers from the surrounding areas, can be applied.

10.2.6 AVIATION IMPACT

An Aviation Impact Assessment was conducted. A summary of the assessment is provided in section8.5, the full assessment can be found as Appendix 4.5 hereto.

10.2.6.1 Impact Discussion & Significance Assessment

The specialist assessment indicates a low likelihood of any material impacts of the proposed development on operations at Newcastle Aerodrome, and the sensitivity of the site is thus low.

10.2.6.2 Mitigation/Management

The specialist recommends that the development be supported, subject to a height restriction of 54m above natural ground level within the development site.

The highest proposed structures are 25m above the ground level, thus well below the height restriction of 54m.

10.3 DECOMMISSIONING PHASE

Due to the plant being located in an industrial complex it is not anticipated that the site will require rehabilitation in order to restore an undisturbed state. The decommissioning of the plant is expected to entail the dismantling and / or demolishing of the plant infrastructure, the potential impacts of which are assessed below.

If decommissioning were to take place it would entail dismantling of the infrastructure for sale and / or recycling as well as the potential demolition of the existing buildings. The potential impacts of these activities are therefore considered to be similar to that of the construction phase.

10.4 SUMMARY OF ENVIRONMENTAL IMPACTS

A summary of the impact assessment is presented in Table 10-14. It is clear that the impacts of the proposed upgrades, with mitigation are all anticipated to be low, negligible or positive.

Table 10-14: Summary of Environmental Impacts

Construction phase:	**Impact**	**Impact significance with mitigation**
Potential general waste generation during construction phase	-	Negligible
Potential impacts on groundwater resources through accidental leaks and spillages of hazardous materials (particularly hydrocarbons, e.g. diesel, oil) during construction activities	-	Negligible
Potential impacts on surface water resources through accidental leaks and spillages of hazardous materials (particularly hydrocarbons, e.g. diesel, oil) during construction activities	-	Negligible
Potential impacts on soil through accidental leaks and spillages of hazardous materials (particularly hydrocarbons, e.g. diesel, oil) during construction activities	-	Negligible
Potential Air Quality Impacts through dust generation	-	Negligible
Potential noise generation during construction phase	-	Negligible
Socio-economic Impact through creation of temporary / short-term employment opportunities during the construction phase	+	Moderate (Positive)
Archaeological		Negligible (Refer to section 0)
Palaeontological		Negligible (Refer to section 8.3)
Operational phase:	**Impact**	**Impact significance with mitigation**
Air quality	-	Acceptably Low (Refer to section 8.1)
Traffic	-	Low

Table 10-14: Summary of Environmental Impacts		
Emergency Incident	-	Societal Risk Acceptably Low (Refer to section 8.4)
Potential impacts on groundwater resources through accidental leaks and spillages of hazardous materials during operations	-	Negligible
Potential impacts on surface water resources through accidental leaks and spillages of hazardous materials during operations	-	Negligible
Potential impacts on soil through accidental leaks and spillages of hazardous materials during operations	-	Negligible
Socio-economic Impact through creation of employment opportunities during operations	+	Moderate (Positive)
Aviation	-	Negligible (Refer to section 8.5)
Decommissioning phase:	**Impact**	**Impact significance with mitigation**
Potential general waste generation during decommissioning phase	-	Negligible
Potential impacts on groundwater resources through accidental leaks and spillages of hazardous materials (particularly hydrocarbons, e.g. diesel, oil) during decommissioning activities	-	Negligible
Potential impacts on surface water resources through accidental leaks and spillages of hazardous materials (particularly hydrocarbons, e.g. diesel, oil) during decommissioning activities	-	Negligible
Potential impacts on soil through accidental leaks and spillages of hazardous materials (particularly hydrocarbons, e.g. diesel, oil) during decommissioning activities	-	Negligible
Potential Air Quality Impacts through dust generation	-	Negligible
Potential noise generation during decommissioning phase	-	Negligible
Socio-economic Impact through creation of temporary / short-term employment opportunities during the decommissioning phase	+	Moderate (Positive)

10.5 SELECTION AND MOTIVATION FOR THE PREFERRED ALTERNATIVE

10.5.1 LOCATION AND LAYOUT ALTERNATIVES

Given that this is a proposed expansion of existing activities, macro-scale site alternatives are of limited relevance as these proposed activities will be additions to an existing plant, with established supporting facilities and infrastructure, which make the proposed expansion feasible. It is both desirable and necessary for the preferred location to be within the current plant boundary, for the following reasons:

- The Brother CISA facility is existing and operational with services and utilities infrastructure in place.
- The area to be used is part of the disturbed footprint of the facility within the well-established industrial chemicals park
- The facility currently manufactures sodium dichromate which is the most significant raw material for the proposed CTS and Vitamin K production processes. The proposed processes will therefore be directly integrated with the existing chrome chemical production facilities.

Although macro-scale site alternatives are not feasible, alternatives within the current extent of the facility have been considered. Refer to Figure 2-8 for the locations within the site that have been considered.

A site selection matrix has been developed to inform the preferred location selection process (Table 2-3). Selection of the preferred site was undertaken using a first principles approach, based on:

1. Potential environmental impacts;
2. Socio-economic impacts and constraints;
3. Design and operating constraints;
4. Capital and running cost considerations.

The northern area (Alternative Location 2) is largely occupied by existing utilities infrastructure. This leaves the southern portion (Alternative location 1) for other proposed infrastructure such as the final product storage warehouse and storm water and fire water dams. Refer to Figure 2-7 for the proposed layout.

10.5.2 ACTIVITY ALTERNATIVES

The proposed type of activity is inherently related to the existing activities and products at the site. Different means of meeting the general purpose and requirements of the proposed activity are inherent in the process and technology alternatives considered in section 10.5.3 below.

10.5.3 TECHNOLOGY/PROCESS ALTERNATIVES

10.5.3.1 Vitamin K production

Vitamin K production worldwide is predominantly undertaken through liquid phase oxidation. This process is divided into 3 types below depending on the oxidising agent:

- Hydrogen Peroxide Oxidation Process
- Cerium Salt Oxidation Process
- Chromic Salts Oxidation Process and Chrome Tanning Salts Co-production

10.5.3.2 Inorganic CTS Production

The manufacture of inorganic CTS involves the reaction of sodium dichromate (SDC) and sulphur dioxide gas (SO_2). The SO_2 gas is generated by oxidising sulphur in a furnace. The SO_2 gas from the burner is fed into a set of absorption columns where it reacts with, and reduces the SDC, to form CTS. This produces a CTS liquor which is then dried to form a powder. The powder along with various additives, is then stored as product and may be bagged or supplied to clients in bulk. Heat generated from oxidising the sulphur is used generate steam which is subsequently used to dry the products into a powder format. The process is thus both energy efficient and economical as the primary raw material (SDC) is produced on the site.

10.5.3.3 Preferred Alternatives

CISA proposes to produce CTS using both the inorganic and organic process, and vitamin K compounds integrated with organic CTS process. This combination of processes provides and optimal product mix with optimal energy consumption and economic production attached to the existing SDC plant. It is notable that these processes have the following advantages over the other technology alternatives:

1. The fact that no wastewater is produced. Water is recirculated back through the process as it contains valuable precursors for use in the SDC plant.

2. Lower energy consumption. In particular the benefit of heat recovery from sulphur oxidation provides high thermal efficiency for the inorganic process.

3. Lower dependence of electricity as electrolysis is not required.

4. Direct supply of the primary raw material (SDC) and exploitation of an existing resource rather than developing processes which require alternative raw materials to be brought to the site.

5. Local value addition to the existing chrome chemical facility by transforming SDC produced on the site further up the economic value chain to produce CTS and vitamin K compounds.

6. Lower costs and mutual benefits to both the Chrome Tanning salts and the Vitamin K production processes, and the obvious advantage of not having to import and transport alternative raw materials.

10.5.4 NO-GO ALTERNATIVE VERSUS THE PROPOSED ACTIVITIES

The no-go option refers to the alternative of the proposed development not going ahead at all. The baseline status quo is maintained in this case.

The no-go alternative will result in the elimination of the following desirable facets of the proposed activities, namely:

- The facility will not seize the opportunity to manufacture products that are further up the value chain.
- The macro-economic advantages of producing higher value export products would be lost.

- The facility is expected to provide skilled and unskilled employment opportunities during the construction and operational phases;
- The proposed CTS and Vitamin K Production facility is expected to stimulate economic development on both local scale (namely local job creation, and local economic stimulus) and on a national scale (namely beneficiation of chrome ore to produce high value processed products for export).
- The facility will utilise sodium dichromate which is currently produced on site and transported off site as a liquid, the use of this liquid on site will reduce the transport of a hazardous liquid by road to ports for export. This would be offset by the transport of the proposed products which are less hazardous.

It is notable that the potential negative environmental impacts as detailed further in this report would also be avoided.

The negative impacts that would be avoided by the no-go option are anticipated to be within acceptable levels provided the management measures put forward in the EMPr are implemented, and therefore do not outweigh the desirable facets listed above.

The no-go option is therefore not a desirable alternative.

10.6 IMPACT MANAGEMENT MEASURES FROM SPECIALIST STUDIES

10.6.1 AIR QUALITY IMPACT ASSESSMENT

No maximum allowable emission concentration is provided for Cr(VI) in GN 893 of 2015 as amended, It is recommended that Cr(VI) emissions limits as shown in Table 10-15 be applied to stacks where Cr(VI) emissions are anticipated.

Table 10-15: Recommended Cr(VI) emissions limits

Point Source	Proposed Cr(VI) emissions limit (mg/Nm^3)
CTS1 - CTS Organic Stack 1	0.035
CTS2 - CTS Organic Stack 2	0.035
CTS13 - CTS Organic Stack 13	0.035
CTS14 - CTS Organic Stack 14	0.035
CTS17 – CTS Inorganic Stack 1	0.01

These recommended limits are based on the following factors:

- These emissions limits result in acceptable Cr(VI) ambient concentrations as shown in sections 8.1.3.6
- These concentrations are considered achievable through the use of proposed emissions abatement technology;
- The recommended limits are more stringent than the German Technical Instructions on Air Quality Control (TA Luft) limit of 0.05 mg/Nm^3 which may be considered for reference purposes in the absence of a legislated South African emission limit.

It is recommended that the listed point source emissions be monitored in accordance with the stipulations of GN 893 of 2015 as amended, at least once per annum.

The Proponent should implement sufficient abatement measures to ensure that the emissions limits listed in Table 4-4 and Table 4-5 are met.

10.6.2 ARCHAEOLOGICAL IMPACT ASSESSMENT

No heritage finds of any significance were identified in the impact footprint of the proposed development area. Therefore, regarding visible cultural heritage, there are no recommendations. Should any cultural heritage be observed once development commences, a specialist must be consulted to perform an examination of the finds.

10.6.3 PALAEONTOLOGICAL IMPACT ASSESSMENT

According to current development plans, no mitigation measures are required. If construction activities on this property should involve excavation of the property (i.e. earth movement) that exposes any fossil deposits, SAHRA should be contacted immediately and a professional palaeontologist should be brought in to assess their significance and provide recommendations (e.g. recording, sampling, collection and mitigation).

10.6.4 MHI RISK ASSESSMENT

The MHI Risk assessment proposes safety systems, equipment and devices to be used for prevention and mitigation of major incidents relating to the liquid sulphur dioxide storage tank, the ammonia engine room and the molten sulphur storage tank. These recommendations are to be implemented.

10.6.5 AVIATION IMPACT ASSESSMENT

The specialist recommends that the development be supported, subject to a height restriction of 54m above natural ground level within the development site.

10.7 CONDITIONAL FINDINGS TO BE INCLUDED AS CONDITIONS OF AUTHORISATION

It is recommended that the proposed activities be undertaken in accordance with the EMPr as appended hereto.

In terms of section 22 of the National Environmental Management: Air Quality Act (Act 39 of 2004), and Atmospheric Emissions Licence is required to conduct an activity listed in section 21 of the same Act. It is therefore required that an Atmospheric Emissions Licence be obtained prior to conducting the listed activities.

10.8 DESCRIPTION OF ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

10.8.1 ASSUMPTIONS AND LIMITATIONS – AIR QUALITY IMPACT ASSESSMENT

The following significant assumptions have been undertaken:

1. A tier 2 approach was undertaken for atmospheric conversion of NOx emissions to NO_2.

2. Chemical transformation of gaseous pollutants (NOx and SO_2) has otherwise not been accounted for. This is due to:

a. Limitations in the availability of data on chemical and other parameters contributing to chemical transformation (e.g. ambient concentrations of ozone, reactive organic compounds etc.)
b. The limitations of the modelling software. Although the CALPUFF suite is a tier 3 system, and one of the best in its class, the ability of such dispersion models in general to accurately account for chemical transformation is relatively limited.

The predicted ambient concentrations of the gaseous pollutants are therefore typically expected to be over-estimations. This is in fitting with the precautionary principle.

3. All PM emitted from point source was assumed to be PM_{10}. This is potentially an over-estimation of actual PM_{10} emissions.

4. It has been assumed that all proposed stacks which may emit Cr(VI) are doing so at the emissions limits shown in Table 8-5, continuously for every hour of the full 3 years modelled. This is a significant exaggeration versus actual emissions. Notably:
    a. Measured data stack emissions tests show that the stacks are generally well within the permitted maximum concentrations at the time of measuring.
    b. Actual emissions vary in reality, and there are periods of no emissions due to planned and unplanned maintenance, as well as planned and unplanned production stoppages.

5. It has been assumed that all Cr(VI) remains in oxidised form and that there is no significant reduction in the atmosphere. Notably the presence of acidic gases such as SO_2 and NO_2 from industrial activities, motor vehicle emissions, and domestic fuel burning has not been taken into account. These may facilitate the atmospheric reduction of Cr(VI). It is notable from ambient measurements (refer to section 7 of the Air Quality Impact Assessment Report) that actual ambient concentrations of Cr(VI) are below detectable levels and as such this is very conservative assumption.

6. Removal of potentially significant pollutants identified from ambient air through wet deposition has not been modelled and thus the modelled results are thus expected to be an over-estimation in this regard.

In general the predicted ambient concentrations are expected to be over-estimated. This is in fitting with the precautionary principle.

10.8.2 LIMITATIONS - ARCHAEOLOGICAL IMPACT ASSESSMENT

Ground surface visibility was limited due to the abundance of spoil heap stockpiles for backfilling, specifically in the southern portion of the study area, making the identification of surface archaeology very difficult. It is possible that archaeological find spots or sites were missed as a result; however, in many areas of the property, digging at the surface has exposed the underlying sediments, which illustrate a complete lack of subsurface archaeology. The central and northern part of the property is largely developed so visibility of any archaeological deposits here was severely constrained.

As with all archaeological surveys, the primary goal is to identify cultural material exposed on the surface. From this, one is able to make inferences about what may also lie below the surface. However, without actual test trenches or geotrenches, it is not possible to be certain what is represented underground. Furthermore, underground heritage remains may not be represented on the surface making their identification impossible. This serves as a

considerable limitation. Should any cultural heritage be identified when the development begins, a specialist must be consulted to examine the finds.

10.8.3 LIMITATIONS - PALAEONTOLOGICAL IMPACT ASSESSMENT

Not detracting in any way from the comprehensiveness of the survey undertaken, it is necessary to realise that the lack of palaeontological resources located during the survey does not reflect an overall lack of fossil-bearing deposits in the area. The presence of the Ecca Group formation indicates possible trace fossils, such as plants and insects preserved in this area.

11 CONCLUSION

The main objective of this report was to identify and discuss issues of potential environmental significance, and where possible, indicate the significance of those impacts. The identification and assessment of environmental impacts, for each project phase, shows that these impacts can be effectively managed with the proposed mitigation measures in place.

It is the professional opinion of the EAP that the EIA process undertaken for the project to date has been procedurally correct, in terms of, *inter alia,* the requirements outlined in Government Notice No. 982 of 4 December 2014, as amended. The EAP, furthermore, believes that the significant issues that may potentially be realised through the possible authorisation of the project by the Competent Authority have indeed been identified to the best practical extent. The EAP also believes that the information provided in this EIA Report is sufficient /substantive for IAPs to contribute meaningfully to the EIA process thus far (as required by Government Notice 982) and for the competent authority (CA) to make an informed decision as to whether, or not activity should be authorised. It is, therefore, the EAPs recommendation that the CA approve this activity based on the substantive content provided in the report itself.

In cognisance of the low significance of potential impacts, and the long-term environmental benefits of the proposed activities, it is the recommendation of the EAP that the proposed activities be authorised.

The potential negative impacts of the proposed activities are all deemed to be low or negligible, as shown in Table 10-14, and adequate practical mitigation measures are stipulated in the Environmental Management Programme.

12 AFFIRMATION BY EAP

EScience Associates (Pty) Ltd, as the Environmental Assessment Practitioner, led by Sam Leyde and Abdul Ebrahim hereby affirms that:

- The information herein is true and correct to the best of our knowledge;
- The EAP has kept a register of all interested and affected parties that participated in a public participation process;
- The EAP has ensured that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties has been facilitated in such a manner that all interested and affected parties have been provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- The EAP has included all comments and inputs made by stakeholders and interested and affected parties as well as the competent authority. Responses to comments are appended to this Environmental Impact Report.

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