Modified Namakwa Sands East OFS Project Residue Disposal Plan

Final Environmental Impact Assessment Report

Report Prepared for

Tronox Mineral Sands (Pty) Ltd

SRK Report Number 548215/7

DMRE Reference Number: WC30/5/1/2/2/113 & 114 MR

DHSWS Reference Number: WU16841

Report Prepared by

February 2021

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SRK Consulting (South Africa) Pty Ltd
The Administrative Building
Albion Spring
183 Main Rd
Rondebosch 7700
Cape Town
South Africa

e-mail: mlaw@srk.co.za
website: www.srk.co.za

Tel: +27 (0) 21 659 3060
Fax: +27 (0) 86 530 7003

SRK Project Number 548215

February 2021

Compiled by:

Matthew Law
Principal Environmental Consultant

Email: mlaw@srk.co.za

Peer Reviewed by:

Chris Dalgliesh
Partner

Authors:

Matthew Law, Sue Reuther

Note:

The EIA Report was updated at the end of the comment period to produce this Final EIA Report for submission to the Department of Minerals and Energy (DMRE).

All changes in the Final EIA Report and Executive Summary vis-a-vis the previously released EIA Report are italicised and underlined for easier reference.

*An **Issues and Responses Summary**, reflecting stakeholder comments received during the stakeholder engagement process and responses is included in Appendix F7.*

Profile and Expertise of EAPs

SRK Consulting (South Africa) Pty Ltd (SRK) has been appointed by Tronox Mineral Sands (Pty) Ltd (Tronox) to undertake the Environmental Impact Assessment (EIA) process required in terms of the National Environmental Management Act 107 of 1998 (NEMA).

SRK Consulting was established in 1974 and comprises over 1 400 professional staff worldwide, offering wide-ranging expertise in the natural resources and environmental sectors. SRK's Cape Town environmental department has a proven track record of managing large, complex environmental and engineering projects in the Western Cape, Africa and internationally. SRK has rigorous quality assurance standards and is ISO 9001 certified.

As required by NEMA, the qualifications and experience of the key independent Environmental Assessment Practitioners (EAPs) undertaking the EIA are detailed below and Curriculum Vitae provided in Appendix A.

Project Director and Reviewer: Christopher Dalgliesh, BBusSc (Hons); MPhil (EnvSci)
RegisteredEAP No. 2019/413
Chris Dalgliesh is an SRK Director and Principal Environmental Consultant with over 33 years' experience, primarily in Southern Africa, West Africa, South America, the Middle East and Asia. Chris has worked on a wide range of projects, notably in the natural resources, Oil & Gas, waste, infrastructure and industrial sectors. He has directed and managed numerous Environmental and Social Impact Assessments (ESIAs), in accordance with international standards (e.g. IFC). He regularly provides high level review of ESIAs, frequently directs Environmental and Social Due Diligence studies and monitors project on behalf of financial institutions, and also has a depth of experience in Strategic Environmental Assessment (SEA) and Resource Economics.

Project Manager: Matthew Law, BSc Hons; MCom (Environmental Economics)
Registered EAP No. 2019/488
Matthew Law has almost 15 years of experience in environmental management throughout Southern Africa, including EIA (for environmental, mining, waste, water and heritage permits), Environmental Management Programmes (EMPrs) and Environmental Auditing. Matthew also undertakes, or contributes to, Socio-Economic Impact Assessments (SIAs). Matthew has managed or participated in more than 100 projects in the mining, infrastructure development, commercial and industrial sectors, providing him with a broad range of experience, detailed legislative knowledge, and understanding of environmental challenges.

Project Consultant: Sue Reuther, BSc Hons (Econ); MPhil (EnvMgmt)
Registered EAP No. 2020/425
Sue Reuther is an Associate Partner and Principal Environmental Consultant with more than 15 years of experience in the environmental assessment sector. She has been involved in a variety of EIAs, SIAs and Visual Impact Assessment, strategic State of Environment Reporting, Environmental Management Frameworks (EMF) and the compilation of EMPr. Sue has experience in mining, infrastructure, marine and energy-related projects in Southern Africa, West Africa, South America and the Middle East.

Statement of SRK Independence

Neither SRK nor any of the authors of this Report have any material present or contingent interest in the outcome of this Report, nor do they have any pecuniary or other interest that could be reasonably regarded as being capable of affecting their independence or that of SRK.

SRK has no beneficial interest in the outcome of the assessment which is capable of affecting its independence.

Disclaimer

The opinions expressed in this report have been based on the information supplied to SRK by Tronox. SRK has exercised all due care in reviewing the supplied information, but conclusions from the review are reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

EAP Affirmation

Section 16 (1) (b) (iv), Appendix 1 Section 3 (1) (r), Appendix 2 Sections 2 (i) and (j) and Appendix 3 Section 3 (s) of the Environmental Impact Assessment (EIA) Regulations, 2014 (promulgated in terms of the National Environmental Management Act 107 of 1998 (NEMA), require an undertaking under oath or affirmation by the Environmental Assessment Practitioner (EAP) in relation to:

- The correctness of the information provided in the report;
- The inclusion of comments and inputs from stakeholders and interested and affected parties;
- Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties; and
- The level of agreement between the EAP and interested and affected parties on the Plan of Study for undertaking the environmental impact assessment.

SRK and the EAPs managing this project hereby affirm that:

- To the best of our knowledge the information provided in the report is correct, and no attempt has been made to manipulate information to achieve a particular outcome. Some information, especially pertaining to the project description, was provided by the applicant and/or their sub-contractors. In this respect, SRK's standard disclaimer (inserted in this report) pertaining to information provided by third parties applies.
- To the best of our knowledge all comments and inputs from stakeholders and interested and affected parties have been captured in the report and no attempt has been made to manipulate such comment or input to achieve a particular outcome. Written submissions are appended to the report while other comments are recorded within the report. For the sake of brevity, not all comments are recorded verbatim and are mostly captured as issues, and in instances where many stakeholders have similar issues, they are grouped together, with a clear listing of who raised which issue(s).
- If applicable, information and responses provided by the EAP to interested and affected parties are clearly presented in the report. Where responses are provided by the applicant (not the EAP), these are clearly indicated.
- With respect to EIA Reports, SRK will take account of interested and affected parties' comments on the Plan of Study and, insofar as comments are relevant and practicable, accommodate these during the Impact Assessment Phase of the EIA process.

Matthew Law

Name

Signature

22 February 2021

Date

Applicant's Details

DMRE Reference No	WC30/5/1/2/2/113 & 114 MR
Name of Applicant	Tronox Mineral Sands (Pty) Ltd
Company Registration	1998/001039/07
Responsible Person	Mr Marius Vlok
Postal Address	PO Box 435 Vredenburg 7380
Physical Address	Namakwa Sands Mine Brand se Baai
Telephone	+27 27 217 3042
Cell	+27 83 709 6556
Facsimile	+ 27 27 217 3100
E- mail	marius.vlok@tronox.com
Application Area	Matzikama Local Municipality in the Western Cape. Co-ordinates: Lat: 31° 14' 09.90" S; Long: 17° 57' 32.00" E Also see Figure 3-5
Holder of Mining Rights	Tronox Mineral Sands (Pty) Ltd
Mining Rights	WC30/5/1/2/2/113 WC30/5/1/2/2/114 WC30/5/1/2/2/100400MR
Type of minerals for which rights are held	Type Codes: HM Type: Heavy Minerals suite Commodities: Ilmenite (no commodity code); Rutile (commodity code Rt); Leucoxene (commodity code Lx); and Zircon (commodity code Zr). And associated minerals including Garnets (commodity code Gn); Kyanite (commodity code Ky); Monazite (commodity code Mz); Silica Sand (commodity code QD); and Cassiterite (no commodity code).

Table of Contents

Appendices

List of Tables

List of Figures

Acronyms and Abbreviations

ADT	Articulated Dump Truck
AEL	Atmospheric Emissions Licence
ART	Anti-Retroviral
BA	Basic Assessment
CBA	Critical Biodiversity Area
CIA	Cumulative Impact Assessment
DCC	Dual Carry Conveyor
DEA&DP	Department of Environmental Affairs and Development Planning
DEA:O&C	Department of Environmental Affairs: Oceans and Coasts
DMRE	Department of Mineral Resources and Energy
DHSWS	Department of Human Settlements, Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
ECA	Environment Conservation Act 73 of 1989
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
EOFS	East Orange Feldspathic Sand
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
FoS	Factor of Safety
FSP	Fine Scale Plan
GA	General Authorisation
GAI	Geochemical Abundance Index
GDP	Gross Domestic Product
GN	Government Notice
GVA-R	Regional Gross Value Added
HDPE	High-Density Polyethylene
HDSA	Historically Disadvantaged South African
HIA	Heritage Impact Assessment
HM	Heavy Minerals
HMC	Heavy Mineral Concentrate
HWC	Heritage Western Cape
HWM	High Water Mark
IAP	Interested and Affected Party
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
LN	Listing Notice
LoM	Life of Mine

MAR	Mean Annual Runoff
MLM	Matzikama Local Municipality
MLRA	Marine Living Resources Act 18 of 1998
MPA	Marine Protected Area
MPRDA	Mineral and Petroleum Resources Development Act 28 of 2002
MSP	Mineral Separation Plant
NDBSP	Namakwa District Biodiversity Sector Plan
NDM	Namakwa District Municipality
NEMA	National Environmental Management Act 107 of 1998 as amended
NEM:AQA	National Environmental Management: Air Quality Act 39 of 2004
NEM:BA	National Environmental Management: Biodiversity Act 10 of 2004
NEM:ICMA	National Environmental Management: Integrated Coastal Management Act 24 of 2008
NEM:WA	National Environmental Management: Waste Act 59 of 1998
NHRA	National Heritage Resources Act 25 of 1999
NID	Notification of Intent to Develop
NS	Namakwa Sands
NWA	National Water Act 36 of 1998
OD	Outside Diameter
OFS	Orange Feldspathic Sand
OFSM	Orange Feldspathic Sand – Mineralised
OFSW	Orange Feldspathic Sand – Waste
p.a.	Per annum
PCP	Primary Concentration Plant
PES	Present Ecological State
RAS	Red Aeolian Sand
REDS	Regional Economic Development Strategy
RoD	Record of Decision
ROM	Run-of-Mine
RSF	Residue Storage Facility
S&EIR	Scoping and Environmental Impact Reporting
SAHRA	South African National Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SCP	Secondary Concentration Plant
SDF	Spatial Development Framework
SDO	Spatial Development Objectives
SLP	Social and Labour Plan
SoW	Scope of Works
SRK	SRK Consulting (South Africa) (Pty) Ltd
StatsSA	Statistics South Africa
STF	Sand Tailings Facility
TDS	Total Dissolved Solids

ToR	Terms of Reference
VEC	Valued Environmental and Social Components
WCD	West Coast District
WCDM	West Coast District Municipality
WEF	Wind Energy Facility
WMA	Water Management Area
WML	Waste Management Licence
WUL	Water Use Licence

Units

°C	Degrees celsius
ha	Hectare
km	Kilometre
km^2	Square kilometre
km/h	Kilometres per hour
l	Litres
l/s	Litres per second
m	Metre
mamsl	Metres above mean sea level
mbgl	Metres below ground level
m^3/h	Cubic metres per hour
Mm^3	Million cubic metres
mm	Millimetre
m/s	Metres per second
mS/m	miliSiemens per metre
Mt	Million Tonnes
Ø	Internal diameter
tph	Tonnes per hour

Chemical Compounds

B	Boron
Cl	Chlorine
$FeTiO_3$	Ilmenite
$FeTiO_3TiO_2$	Leucoxene
N	Nitrogen
NO_2	Nitrogen dioxide
NO_X	Oxides of nitrogen
PM	Particulate matter
SO_2	Sulphur dioxide (also sulfur dioxide)
TiO_2	Titanium dioxide
$ZrSiO_4$	Zircon

Glossary

Attenuation	Processes that naturally transform contaminants to less harmful forms or immobilize contaminants so that they are less of a threat to the environment
Aquifer	An underground body of water.
Baseline	Information gathered at the beginning of a study which describes the environment prior to development of a project and against which predicted changes (impacts) are measured.
Biodiversity	The diversity, or variety, of plants, animals and other living things in a particular area or region. It encompasses habitat diversity, species diversity and genetic diversity
Community	Those people who may be impacted upon by the construction and operation of the project. This includes neighbouring landowners, local communities and other occasional users of the area
Conductivity	A surrogate measure of salinity based on the electrical conductivity produced through the ionic concentration of water.
Construction Phase	The stage of project development comprising site preparation as well as all construction activities associated with the development.
Consultation	A process for the exchange of views, concerns and proposals about a proposed project through meaningful discussions and the open sharing of information.
Co-product	A secondary economic resource contained in the ore body.
Cumulative Impacts	Direct and indirect impacts that act together with current or future potential impacts of other activities or proposed activities in the area/region that affect the same resources and/or receptors.
Ecology	The study of the interrelationships of organisms with and within their environment.
Ecosystem	The interconnected assemblage of all species populations that occupy a given area and the physical environment with which they interact.
Electrical Conductivity (in water)	Reflects the capacity of water to conduct electrical current, and is directly related to the concentration of salts dissolved in water.
Endemic / Endemism	Species unique (native or restricted) to a defined geographic location, i.e. ecological state of a species being unique to a defined geographic location.
Environment	The external circumstances, conditions and objects that affect the existence of an individual, organism or group. These circumstances include biophysical, social, economic, historical and cultural aspects.
Environmental Authorisation	Permission granted by the competent authority for the applicant to undertake listed activities in terms of the NEMA EIA Regulations, 2014.
Environmental Impact Assessment	A process of evaluating the environmental and socio-economic consequences of a proposed course of action or project.
Environmental Impact Assessment Report	The report produced to relay the information gathered and assessments undertaken during the Environmental Impact Assessment.

Environmental Management Programme	A description of the means (the environmental specification) to achieve environmental objectives and targets during all stages of a specific proposed activity.
Ephemeral	A waterbody that does not flow or contain water year-round, in response to seasonal rainfall and run-off.
Fauna	The collective animals of a given region.
Factor of Safety	Ratio between the forces causing failure (gravity forces of the material weight) and the forces preventing failure (shear strength of the soils)
Feasibility Study	The determination of the technical and financial viability of a proposed project.
Flora	The collective plants of a particular region, habitat or geological period.
Fossil	Rare objects that are preserved due to unusual circumstances.
Freeboard limit	The vertical distance between the crest of a dam (RSF) and the pond surface
Grade	The relative richness of an ore OR slope.
Gangue	The commercially worthless material that surrounds, or is closely mixed with, a wanted mineral in an ore deposit.
Heritage Resources	Refers to something, e.g. a building, an area, a ritual, etc. that forms part of a community's cultural legacy or tradition and is passed down from preceding generations.
Hydraulic	(The study of) water flow.
Hydrology	(The study of) surface water flow.
Impact	A change to the existing environment, either adverse or beneficial, that is directly or indirectly due to the development of the project and its associated activities.
Independent EAP	An independent person with the appropriate qualifications and experience appointed by the Applicant to manage the Environmental Impact Assessment process on behalf of the Applicant.
Integrated Environmental Management	The practice of incorporating environmental management into all stages of a project's life cycle, namely planning, design, implementation, management and review.
Life of Mine	The time in which the ore reserves of a mine will be extracted.
Mineral deposit	A naturally occurring body of minerals which is wholly or partly of economic value. The value lies in the ore minerals and not the body of minerals as a whole.
Mining Right	A right to enter upon and occupy a specific piece of ground (in South Africa) for the purpose of working it for the extraction or collection of minerals.
Mitigation measures	Design or management measures that are intended to avoid and / or minimise or enhance an impact, depending on the desired effect. These measures are ideally incorporated into a design at an early stage.
Non-draining catchment	A catchment that does not drain even in rare rainfall events.
Operational Phase	The stage of the works following the Construction Phase, during which the development will function or be used as anticipated in the Environmental Authorisation.

Palaeochannel	A remnant of an inactive river or stream channel that has been filled or buried by younger sediment.
Particulate matter	Broad term used for fine particles found in the ambient atmosphere, including soil dust, dirt, soot, smoke, pollen, ashes, aerosols and liquid droplets.
Rating	A classification of something based on a comparative assessment of their quality, standard, or suitability.
Ranking	A position in a hierarchy or scale.
Residue	The (fine) material left over after the process of separating the valuable fraction from the uneconomic fraction of an ore.
Residue Facility	A mining and mineral process wastes or by-products storage facility and deposit, as well as associated water containment and diversion structures, including tailings dams, water dams and mineral waste dumps and stockpiles.
Residue Storage Facility	A storage facility for all fine waste products from a processing plant.
Scoping	A procedure to consult with stakeholders to determine issues and concerns and for determining the extent of and approach to an EIA (one of the phases in an EIA). This process results in the development of a scope of work for the EIA and specialist studies.
Slurry	A watery mixture of fine or coarse sands of insoluble matter suspended (not dissolved) in water.
Supernatant Pool	Pool of liquid lying above a solid residue after settlement.
Specialist study	A study into a particular aspect of the environment, undertaken by an expert in that discipline.
Stakeholders	All parties affected by and/or able to influence a project, often those in a position of authority and/or representing others.
Sustainable development	Sustainable development is generally defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. NEMA defines sustainable development as the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations.
Tailings	Tailings are the materials left over after the process of separating the valuable fraction from the uneconomic fraction of an ore. Tailings are distinct from overburden, which is the waste rock or materials overlying an ore or mineral body that are displaced during mining without being processed. Particulate size in tailings at NS are either coarse or fine (fines).
Vadose Zone	The part of earth between the land surface and the groundwater level.
Waterbody	A body of water forming a physiographical feature, for example the sea.
Watercourse	A natural freshwater feature, including pans.

1 Introduction

1.1 Background and Introduction

Tronox Mineral Sands (Pty) (Ltd) (Tronox) operates a heavy minerals mining business which includes the existing Namakwa Sands Mine (Tronox Namakwa Sands – NS) at Brand se Baai and a Mineral Separation Plant (MSP) near Koekenaap on the West Coast of South Africa (see Figure 1-1). At the Namakwa Sands Mine, heavy mineral sands are mined using open-cast strip-mining methods at the East Mine and West Mine, in accordance with approved Environmental Management Programmes (EMPrs) and within an authorised mining area (see Figure 1-2).

Mined material is processed at Primary Concentration Plants (PCP West and PCP East) to produce a heavy mineral concentrate (HMC), which is pumped to the Secondary Concentration Plant (SCP) also located at the Mine (see Figure 1-2). Waste products from primary processing at the PCP East include sand tailings (coarser material) and (finer) residue, called *fines*. Sand tailings are backfilled into the mining void(s), and residue is deposited in Residue Storage Facilities (RSFs).

The East Mine (the site or study area) is currently a shallow mine, where mining of only the top Red Aeolian Sand (RAS) layer occurs. Tronox is authorised to also mine and process the deeper Orange Feldspathic Sand (OFS) resource underlying the RAS material at the East Mine, referred to as the East OFS (or EOFS) Project. For the East OFS Project to proceed, Tronox must modify the Namakwa Sands East OFS Project Residue Disposal Plan (the project), which entails construction of an additional RSF, a change to the approach to tailings backfill (including trucked shallow backfilling areas and conveyed deep backfilling areas, also referred to as Sand Tailings Facilities [STF]) and upgrade of infrastructure.

The National Environmental Management Act 107 of 1998 (NEMA) and the Environmental Impact Assessment (EIA) Regulations, 2014 (promulgated in terms of NEMA) warrant that listed activities require Environmental Authorisation (EA). The National Environmental Management: Waste Act 59 of 2008 (NEM:WA) and the List of Waste Management Activities promulgated in terms of NEM:WA warrant that listed activities require a Waste Management License (WML). The Department of Mineral Resources and Energy (DMRE) is the competent authority for mining-related projects. A Scoping and Environmental Impact Reporting (S&EIR, also referred to as an EIA) process is required to support an application for EA and WML.

Tronox appointed SRK Consulting (South Africa) (Pty) Ltd (SRK) to undertake the S&EIR process required in terms of the NEMA and the EIA Regulations, 2014 for the project.

1.2 Purpose of the Report

Although the East OFS project has already been **granted EA**, in terms of relevant legislation, the modified residue disposal plan (the project) may not commence prior to obtaining a suite of additional authorisations (see Section 2). This report has been compiled in support of these applications.

The EIA Report documents the steps undertaken during the Impact Assessment Phase to assess the significance of potential impacts and determine measures to mitigate the negative impacts and enhance the benefits (or positive impacts) of the proposed project. The report presents the findings of the Impact Assessment Phase and the public participation that forms part of the process.

The EIA Report is accompanied by an Environmental Management Programme (EMPr), which documents the management and monitoring measures that need to be implemented during the design, construction and operational phases of the project to ensure that impacts are appropriately mitigated and benefits enhanced.

More specifically, the objectives of this EIA Report are to:

- Inform the stakeholders about the proposed project and the S&EIR (also referred to as EIA) process followed;
- Obtain contributions from stakeholders (including the applicant, consultants, relevant authorities and the public) and ensure that all issues, concerns and queries raised are fully documented and addressed;
- Assess in detail the potential environmental and socio-economic impacts of the project;
- Identify environmental and social mitigation measures to address the impacts assessed; and
- Produce an EIA Report that will assist DMRE to decide whether (and under what conditions) to authorise the proposed development.

1.3 Scope of Work

Tronox requires that an EIA process be conducted and the associated reports produced and submitted to the competent authority (in this case DMRE), to inform DMRE's decision whether to issue the necessary environmental authorization for the project.

In broad terms the Scope of Work (SoW) includes:

- Conducting an S&EIR process compliant with the EIA Regulations, 2014 for the project;
- Submitting applications through the EIA process for:
    - EA in terms of NEMA;
    - WML in terms of NEM:WA;
    - Amendment of the EMPr in terms of the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA);
    - Amendment of the Water Use Licence (WUL) in terms of the National Water Act 36 of 1998 (NWA); and
    - Heritage approval in terms of the National Heritage Resources Act 25 of 1999 (NHRA);
- Conducting the associated stakeholder engagement (public participation) process, including consultation with relevant authorities, in compliance with the requirements of the EIA Regulations, 2014 and other applicable legislation; and
- Updating the EMPr for the Mine to include site-specific mitigation.

The "battery limits" of the project considered and assessed in the EIA process include:

- A single~400 ha RSF with a storage capacity of up to 66 million m^3 (Mm^3) for residue (fines) disposal (as opposed to three smaller RSFs as contemplated in the DMRE approved EMPr / original application for the East OFS project);
- A modified method for disposal of sand tailings[1] entailing:
    - Single-stack[2] backfilling of sand tailings in the East OFS pit by haul truck; and

[1] Sand tailings are currently trucked to the pit and backfilled at the East Mine, and Tronox raised safety and technical concerns associated with this method if applied to the project.
[2] Only replacing a single layer of tailings to the pit by haul truck.

    - Deeper deposition of sand tailings with conveyors and spreaders at two designated areas, referred to as STFs, in the East Mine pit;

- A 50 ha (RAS tailings) Overburden stockpile with a capacity of 3.15 Mm^3 in an area approved for mining in the East Mine;
- Expansion of the seawater intake by installing a new de-aeration sump;
- Fine residue and return water transfer pipelines;
- An (on site) overhead powerline; and
- Demolition of two abandoned farmhouses and an “outhouse”.

The following aspects are excluded from the SoW:

- Tronox were issued an EA in March 2012 in terms of NEMA for the East OFS project. This EA (also) constitutes NEMA approval for mining in terms of the Transitional Provisions of the EIA Regulations, 2014, since the excavation of the East OFS test pit meets the NEMA requirement for commencement of this activity, and the EA remains valid.
- Tronox has advised that they consider their original approval to mine (and associated EMPr approval by the DMRE) in the East Mine to constitute EA for the clearing of indigenous vegetation including vegetation under rehabilitation in all areas originally approved for mining. Assessment of and application for the clearance of indigenous vegetation is thus excluded from the SoW of this EIA;
- Tronox has advised that they consider their original approval to mine (and associated EMPr approval by the DMRE) in the East Mine to constitute (a) WML for tailings backfill into the East Mine pit. The assessment of impacts in this application therefore focuses on the impacts of the change in deposition strategy as opposed to general return of tailings to the pit.
- Tronox must appoint a competent person to recommend a design for the RSF which prevents contamination of the receiving environment, notably groundwater. Design must be guided by a risk-based analysis, in compliance with the Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits. This aspect is excluded from the SoW of this EIA; and
- Compliance with the Regulations Regarding the Safety of Dams, 2012 must be ensured by Tronox and is excluded from the SoW of this EIA.

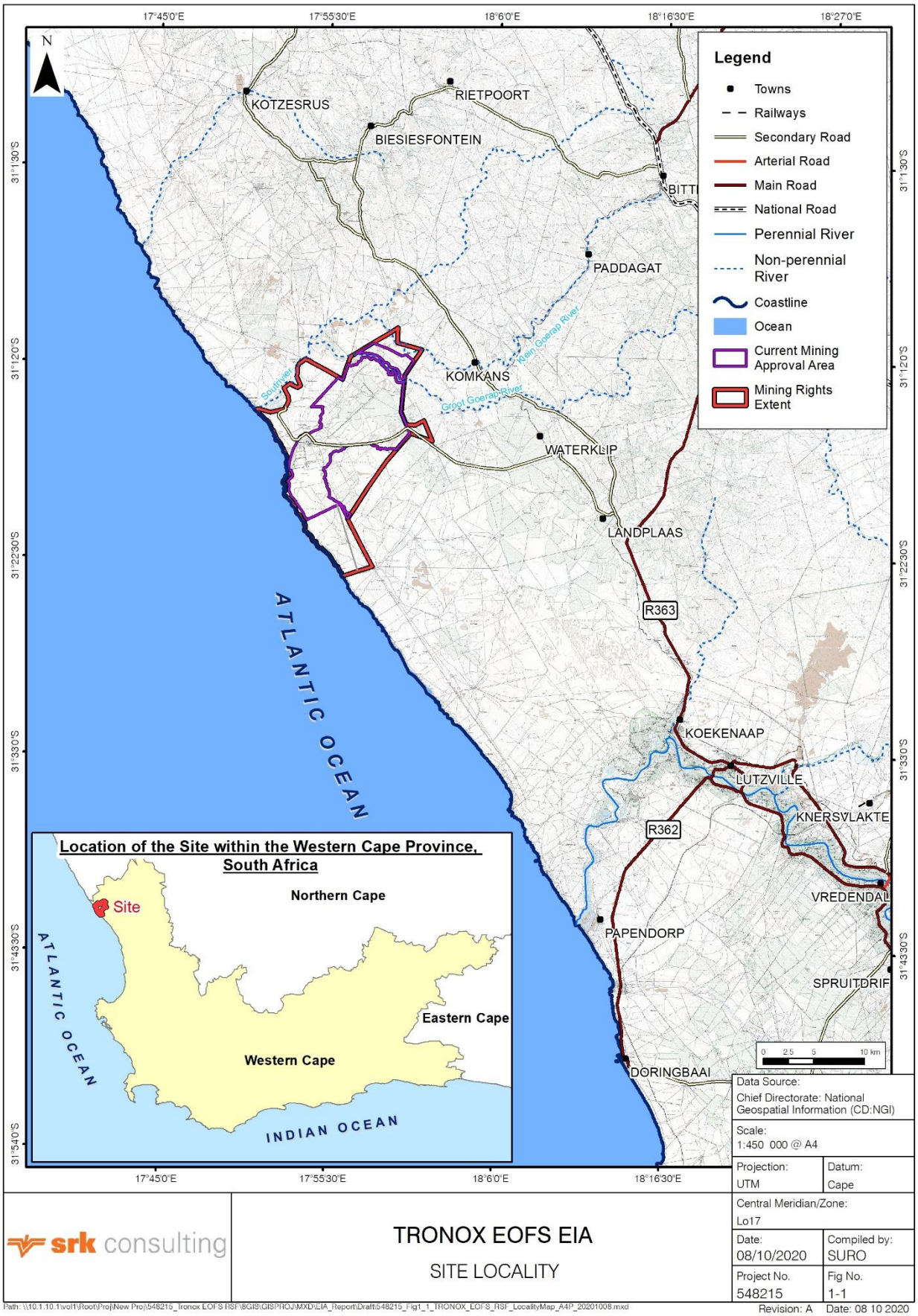

Figure 1-1: Locality map

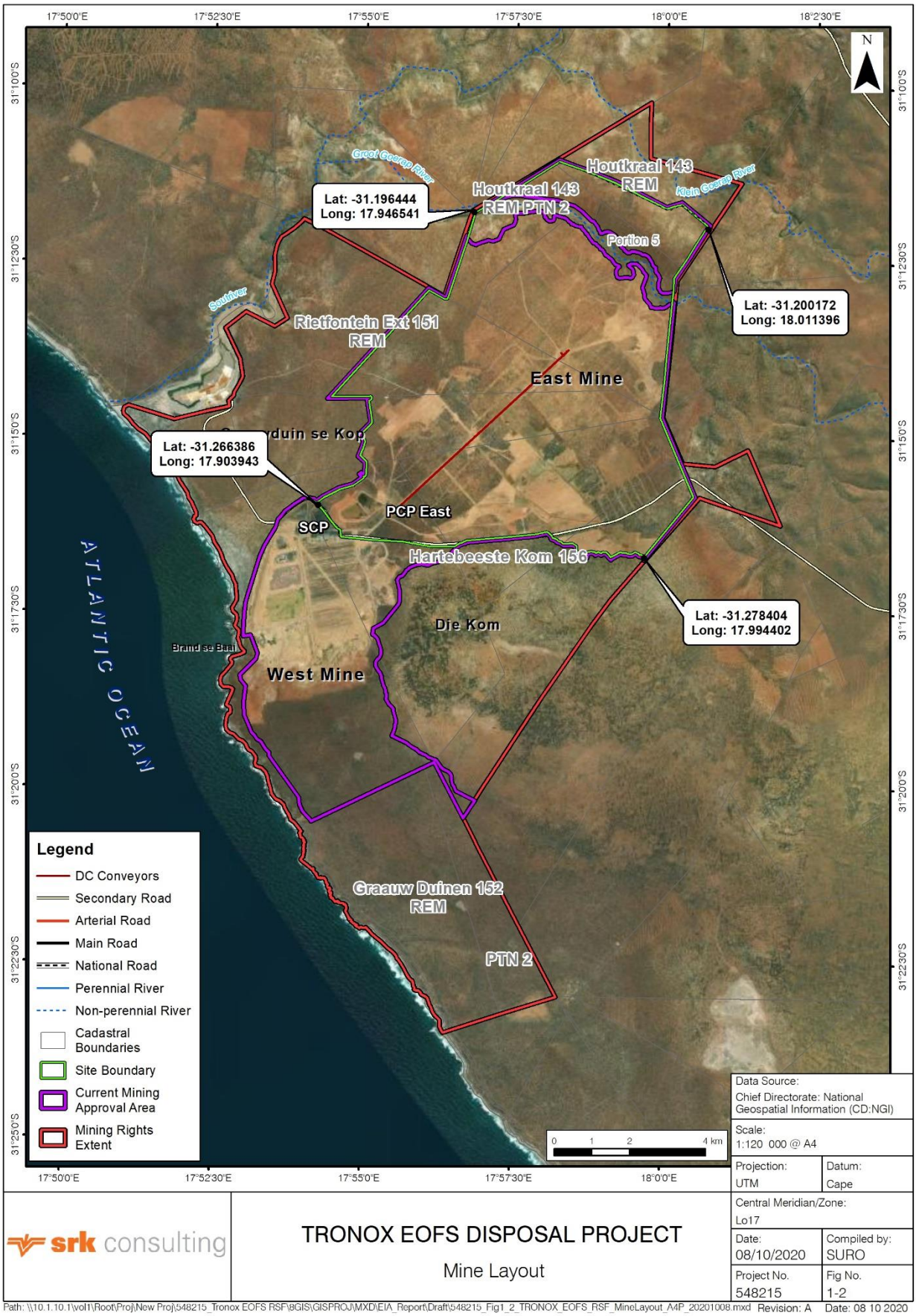

Figure 1-2: Mine layout

1.4 Structure of this Report

This report discusses relevant environmental legislation and its application to this project, outlines the S&EIR process, presents a detailed project description and environmental baseline, details the stakeholder engagement process followed and assesses the potential impacts of the project before concluding the report with a set of pertinent findings and key recommendations. The report consists of the following sections:

Section 1: Introduction

Provides an introduction and background to the proposed project and outlines the purpose of this document and the assumptions and limitation applicable to the study.

Section 2: Governance Framework and Environmental Process

Provides a brief summary and interpretation of the relevant legislation as well as pertinent strategic planning documents and outlines the approach to the environmental process.

Section 3: Project Description

Describes the location and current status of the site and provides a brief summary of the surrounding land uses as well as background to, motivation, and description of, the proposed project.

Section 4: Description of the Affected Environment

Describes the biophysical and socio-economic characteristics of the affected environment against which potential project impacts are assessed.

Section 5: Stakeholder Engagement

Details the stakeholder engagement approach and summarises stakeholder comments that informed the impact assessment.

Section 6: Environmental Impact Assessment

Describes the specialist studies undertaken and assesses the potential impacts of the project utilising SRK's proven impact assessment methodology.

Section 7: Conclusions and Recommendations

Provides an Environmental Impact Statement (EIS), describes the need and desirability of the project, summarises the recommendations of the EIA Report, and outlines further opportunities for stakeholder engagement.

The EIA Report has been prepared in accordance with Section 23 of the EIA Regulations, 2014.

1.5 Content of Report

The EIA Regulations, 2014 (Government Notice (GN) R 982, which came into effect on 8 December 2014, as amended by GN R326 of 2017, Appendix 3, Part 3) prescribe the required content in an EIA Report. These requirements and the sections of this EIA Report in which they are addressed, are summarised in Table 1-1.

Table 1-1: Content of EIA Report as per EIA Regulations, 2014

GN 982, Appendix 3 Ref.:	Item	Section Ref.:
(3) (a)	Details of:	
(3) (a) (i)	The Environmental Assessment Practitioner (EAP) who prepared the report	p. ii
(3) (a) (ii)	The expertise of the EAP, including a Curriculum Vitae	p. ii, App A

GN 982, Appendix 3 Ref.:	Item	Section Ref.:
	Location of the activity, including	
(3) (b) (i)	The 21 digit Surveyor General code of the properties	3.3
(3) (b) (ii)	The physical address and farm name (where available)	p. ii
(3) (b) (iii)	The coordinates of the boundary of the property / properties (where (3) (b) (i) and (3) (b) (ii) are not available)	p. ii Figure 1-2
(3) (c)	A plan indicating the location of the proposed activity / activities and associated infrastructure, or:	Figure 3-5
(3) (c) (i)	For linear activities: a description and coordinates of the corridor in which the proposed activity/ activities is to be undertaken	N/A
(3) (c) (ii)	On land where the property has not been defined, the coordinates within which the activity is to be undertaken	N/A
(3) (d)	A description of the scope of the proposed activities, including:	3
(3) (d) (i)	All listed and specified activities triggered and being applied for	2.3
(3) (d) (ii)	A description of the associated structures and infrastructure related to the development	3.7
(3) (e)	A description of the policy and legislative context and an explanation of how the proposed development complies with and responds to the legislative and policy context	2
(3) (f)	A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location	7.2
(3) (g)	A motivation for the preferred development footprint within the approved site	7.1.1
(3) (h)	A full description of the process followed to reach the proposed development footprint within the approved site, including:	3.8
(3) (h) (i)	Details of the development footprint alternatives considered	3.8.1
(3) (h) (ii)	Details of the public participation process undertaken, including copies of the supporting documents and inputs	5
(3) (h) (iii)	A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them	5
(3) (h) (iv)	The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects	4
(3) (h) (v)	The impacts and risks identified, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts can be reversed, may cause irreplaceable loss of resources, and can be avoided, managed or mitigated	6
(3) (h) (vi)	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks	6.1.4
(3) (h) (vii)	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected, focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects	6.2 - 6.9
(3) (h) (viii)	The possible mitigation measures that could be applied and level of residual risk	6.2 - 6.9
(3) (h) (ix)	If no alternative development locations for the activity were investigated, the motivation for not considering such	3.8.1
(3) (h) (x)	A concluding statement indicating the preferred alternative development location within the approved site	3.8
(3) (i)	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including:	6
(3) (i) (i)	A description of all environmental issues and risks that were identified during the environmental impact assessment process	6.2 - 6.9

GN 982, Appendix 3 Ref.:	Item	Section Ref.:
(3) (i) (ii)	An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures	6.2 - 6.9
(3) (j)	An assessment of each identified potentially significant impact and risk, including:	6.2 - 6.9
(3) (j) (i)	Cumulative impacts	6.10
(3) (j) (ii)	The nature, significance and consequences of the impact and risk	6.2 - 6.9
(3) (j) (iii)	The extent and duration of the impact and risk	6.2 - 6.9
(3) (j) (iv)	The probability of the impact and risk occurring	6.2 - 6.9
(3) (j) (v)	The degree to which the impact and risk can be reversed	6.2 - 6.9
(3) (j) (vi)	The degree to which the impact and risk may cause irreplaceable loss of resources	6.2 - 6.9
(3) (j) (vii)	The degree to which the impact and risk can be mitigated	6.2 - 6.9
(3) (k)	Where applicable, a summary of the findings and recommendations of any specialist report and an indication as to how these findings and recommendations have been included in the final assessment report	6.2 - 6.9
(3) (l)	An EIS which contains:	7.1
(3) (l) (i)	A summary of the key findings of the environmental impact assessment	7.1
(3) (l) (ii)	A map at an appropriate scale which superimposes the proposed activity and its associated structures and the infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers	7.1.2
(3) (l) (iii)	A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives	7.1.1
(3) (m)	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation	6.2 - 6.9, 7.4
(3) (n)	The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment	3.8, 7.4
(3) (o)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation	7.4
(3) (p)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed	1.6
(3) (q)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	7.4
(3) (r)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised	7.4
(3) (s)	An undertaking under oath or affirmation by the EAP in relation to:	p. iii
(3) (s) (i)	The correctness of the information provided in the reports	p. iii
(3) (s) (ii)	The inclusion of comments and inputs from stakeholders and I&APs	p. iii
(3) (s) (iii)	The inclusion of inputs and recommendations from the specialist reports where relevant	p. iii
(3) (s) (iv)	Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties	p. iii

1.6 Assumptions and Limitations

As is standard practice, the report is based on a number of assumptions and is subject to certain limitations. These are as follows:

- It is assumed that information provided by Tronox, their legal advisers and other consultants and specialists is accurate;
- It is assumed that the original authorisations to mine authorise clearing of pristine vegetation or vegetation under rehabilitation in the area originally approved for mining; and
- It is assumed that the person appointed by Tronox to prepare a design concept for the RSF to manage the risk of contamination of the receiving environment (notably groundwater) is competent, and that the design is guided by a risk-based analysis, in compliance with the Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits.

Notwithstanding the above, SRK is confident that these assumptions and limitations do not compromise the overall findings of this report.

2 Governance Framework and Environmental Process

2.1 Legal Requirements

There are a number of regulatory requirements at local, provincial and national level with which the proposed development will have to conform. Key legal requirements include the following:

- NEMA:
    - EIA Regulations, 2014, promulgated in terms of NEMA;
    - Financial Provisioning Regulations 2015, promulgated in terms of NEMA;
- NEM:WA:
    - Regulations regarding the Planning and Management of Residue Stockpiles and Residue Deposits, promulgated in terms of NEM:WA;
    - National Norms and Standards for Disposal of Waste to Landfill;
- MPRDA;
- NWA;
    - Regulations Regarding the Safety of Dams in Terms of Section 123(1) of the NWA, promulgated in terms of the NWA;
- NHRA;
- National Environmental Management: Integrated Coastal Management Act 24 of 2008 (NEM:ICMA);
- National Environmental Management: Air Quality Act 39 of 2004 (NEM:AQA);
- Dust Control Regulations, 2013; and
- Western Cape Noise Control Regulations, 2013.

A brief summary of SRK's understanding of the relevant Acts and Regulations that are applicable to this study is provided below. Note that other legislative requirements may also pertain to the proposed project. As such, the summary provided below is not intended to be definitive or exhaustive, and serves only to highlight key environmental legislation and obligations.

2.2 National Environmental Management Act 107 of 1998

NEMA establishes a set of principles which all authorities have to consider when exercising their powers. These include the following:

- Development must be sustainable;
- Pollution must be avoided or minimised and remedied;
- Waste must be avoided or minimised, reused or recycled;
- Negative impacts must be minimised; and
- Responsibility for the environmental consequences of a policy, project, product or service applies throughout its life cycle.

Section 28(1) states that "*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*". If such degradation/pollution cannot be

prevented, then appropriate measures must be taken to minimise or rectify such pollution. These measures may include:

- Assessing the impact on the environment;
- Informing and educating employees about the environmental risks of their work and ways of minimising these risks;
- Ceasing, modifying or controlling actions which cause pollution/degradation;
- Containing pollutants or preventing movement of pollutants;
- Eliminating the source of pollution; and
- Remedying the effects of the pollution.

Legal requirements for this project:

Tronox has a responsibility to ensure that the proposed activities and the S&EIR process conform to the principles of NEMA. In terms of Section 28 of NEMA, the proponent is obliged to take actions to prevent pollution or degradation of the environment, and to ensure that the environmental impacts associated with the project are considered and mitigated where possible.

2.3 EIA Regulations, 2014

Sections 24 and 44 of NEMA make provision for the promulgation of regulations that identify activities which may not commence without an EA issued by the competent authority (DMRE). In this context, the EIA Regulations, 2014[3], promulgated in terms of NEMA, govern the process, methodologies and requirements for the undertaking of EIAs in support of EA applications. Listing Notices 1-3 in terms of NEMA list activities that require EA ("NEMA listed activities").

The EIA Regulations, 2014 lay out two alternative authorisation processes. Depending on the type of activity that is proposed, either a Basic Assessment (BA) process or a S&EIR process is required to obtain EA. Listing Notice 1[4] lists activities that require a BA process, while Listing Notice 2[5] lists activities that require S&EIR. Listing Notice 3[6] lists activities in certain sensitive geographic areas that require a BA process.

The regulations for both processes – BA and S&EIR – stipulate that:

- Public participation must be undertaken as part of the assessment process;
- The assessment must be conducted by an independent EAP;
- The relevant authorities must respond to applications and submissions within stipulated time frames;
- Decisions taken by the authorities can be appealed by the proponent or any other Interested and Affected Party (IAP); and
- A draft EMPr must be compiled and released for public comment.

GN R982 of 2014 (Appendix 1-5) sets out the procedures to be followed and content of reports compiled during the BA and S&EIR processes.

[3] GN R982 of 2014, as amended by GN R326 of 2017
[4] GN R983 of 2014, as amended by GN 327 of 2017
[5] GN R984 of 2014, as amended by GN 325 of 2017
[6] GN R985 of 2014, as amended by GN 324 of 2017

The NEMA National Appeal Regulations[7] make provision for appeal against any decision issued by the relevant authorities. In terms of the Regulations, an appeal must be lodged with the relevant authority in writing within 20 days of the date on which notification of the decision (EA) was sent to the applicant or IAP (as applicable). The applicant, the decision-maker, IAPs and organs of state must submit their responding statement, if any, to the appeal authority and the appellant within 20 days from the date of receipt of the appeal submission.

The proposed project includes activities that are listed in terms of the EIA Regulations, 2014, and require authorisation through this process (see Table 2-1) or are authorised by virtue of Tronox's existing authorisations to mine at the Namakwa Sands East Mine (Table 2-2).

Table 2-1: NEMA listed activities (2014) applicable to the project which require authorisation

No.	Listed activity	
Listing Notice 1 (GN R983)		**Comment**
9	The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water- (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second (l/s) or more.	A ~2 800 m long RSF return water pipeline will be installed directly between the RSF and PCP East in a transformed area / area approved for mining (see Figure 3-19). The pipeline will have an internal diameter (Ø) of 513 mm with a maximum throughput of 2 000 m^3 / hour (i.e. 556 l/s). A ~1 200 m long raw seawater pipeline will be installed between the Buffer Dam to the Seawater Dam, with Ø513 mm and maximum throughput of 1 200 m^3 / hour (i.e. 333 l/s). A ~3 300 m long raw seawater pipeline directly from the new Buffer Dam to the PCP East Raw Seawater Dam north of East Mine RSF4 and RSF5 will be installed with Ø407 mm and maximum throughput of 1 098 m^3 / hour (i.e. 305 l/s).
10	The development and related operation of infrastructure exceeding 1000 m in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes-with an internal diameter of 0,36 metres or more; or with a peak throughput of 120 litres per second or more.	Two ~2 800 m long fines residue pipelines will be installed directly between the RSF and PCP East in a transformed area / area approved for mining (see Figure 3-19). Both of these Ø 513 mm pipelines will have a maximum throughput of 2 000 m^3 / hour (i.e. 556 l/s).
19A	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from: (ii) the littoral active zone, an estuary or a distance of 100 m inland of the high-water mark of the sea or an estuary, whichever distance is the greater.	The seawater intake will be upgraded to include a new de-sanding sump. This upgrade will entail the deposition of material (concrete foundations) within 100 m of the high water mark.
51	The expansion of structures in the coastal public property where the development footprint will be increased by more than 50 square metres, excluding such expansions within existing ports or harbours where there will be no increase in the development footprint of the port or harbour and excluding activities listed in activity 23 in Listing Notice 3 of 2014, in which case that activity applies.	The seawater intake will be upgraded to include a new de-sanding sump. This upgrade will have a total extent of ~50 m^2 within 100 m of the high water mark.

[7] GN R993 of 2014, as amended by GN R205 of 2015.

No.	Listed activity	
54	The expansion of facilities: (v) within a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater; in respect of: (e) infrastructure or structures where the development footprint is expanded by 50 square metres or more	The seawater intake will be upgraded to include a new de-sanding sump. This upgrade will have a total extent of ~50 m^2 within 100 m of the high water mark.

According to Tronox, the NEMA listed activities (2014) listed in Table 2-2 are applicable to the project but are authorised through previous approvals to mine at the East Mine at Namakwa Sands.

Table 2-2: NEMA listed activities (2014) applicable to the project which are authorised

No.	Listed activity	
Listing Notice 2 (GN R984)		**Comment**
15	The clearance of an area of 20 hectares or more of indigenous vegetation	The East OFS project will take place in areas that have either already been mined or are authorised for mining. Vegetation clearance takes place in advance of mining and is ongoing. Mining in the East Mine at Namakwa Sands, and therefore vegetation clearance in this area was authorised through: - The DMRE's approval of the original EMPr for the Namakwa Sands Mine - namely Mining Rights ML4/99 and ML12/2002 converted to WC30/5/1/2/2/113 and WC30/5/1/2/2/114 in 2008; - DEA&DP's approval of the expansion of mining areas at the East Mine in 2012, including the East OFS project itself (DEA&DP Ref. E12/2/4/1-F3/12-3000/10); and - DEA&DP's approval of the further expansion of mining areas at the East Mine in 2017 (DEA&DP Ref. 16/3/1/2/F3/17/3007/13). Therefore, according to Tronox, activities relating to vegetation clearance at the East Mine are ongoing and authorised through existing approvals for mining at Namakwa Sands.
17	Any activity including the operation of that activity which requires a Mining Right	Tronox obtained EA in 2012 for the East OFS project (DEA&DP Ref. E12/2/4/1-F3/12-3000/10) and commenced before the EIA Regulations, 2014, came into effect (through the excavation of an East Mine OFS pit at 31.248732° South, 17.957734° East on 7 May 2012). Therefore listed activities related to the physical act of mining and associated infrastructure are deemed authorised in terms Regulation 54A of the EIA Regulations, 2014: Transitional Provisions.

Activities related to dam construction (Listing Notice 1 Activity 13 and Listing Notice 2 Activity 16) are not considered to be triggered by the project, as the RSF is not a water storage facility. Similarly, no decommissioning of existing facilities, structures or infrastructure is planned.

Legal requirements for this project:

Tronox is obliged to amend their EMPr and apply for EA for the listed activities in Table 2-1. Since a full S&EIR process is required to inform an application for waste management activities (see Section 2.4), Tronox must undertake an S&EIR process in support of the application for EA and EMPr amendment, in accordance with the procedure stipulated in the EIA Regulations, 2014.

2.3.1 Financial Provision Regulations, 2015

Sections 44 (aE), 44 (aF), 44 (aG) and 44 (aH) of NEMA make provision for the promulgation of regulations relating to environmental liability and financial provisions. In this context, the Financial Provisioning Regulations, 2015 (GN R1147 of 2015), promulgated in terms of NEMA, govern the financial provision for the costs associated with undertaking management, rehabilitation and remediation of environmental impacts of prospecting, exploration, mining and production operations through the lifespan of such operations and latent or residual environmental impacts.

The regulations define:

- The method for determining financial provision for annual rehabilitation, final rehabilitation and the remediation of latent environmental impacts;
- Financial vehicles available for financial provision;
- The requirements for the review, assessment and adjustment of financial provision;
- The responsibilities of the holder of a right or a permit;
- Powers of the Minister; and
- Requirements for care and maintenance.

Legal requirements for this project

Tronox must determine the financial provision (see Appendix C4) and provide proof of payment or the arrangements to provide the financial provision prior to commencing the activity. Tronox is obliged to update their financial provision to include aspects of the project within one year of approval, and annually thereafter.

2.4 National Environmental Management: Waste Act 59 of 2008

The NEM:WA aims to (amongst other things) regulate waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development.

The Act makes provision for the listing of waste management activities that have, or are likely to have, a detrimental effect on the environment and may not be undertaken without a WML issued by the competent authority. The competent authority for WML applications for mining operations is the DMRE. NEM:WA must be read in conjunction with NEMA (see Section 2.2). The principles of NEMA and the NEMA EIA Regulations, 2014 are applicable to the application process for WMLs.

Two categories of listed waste management activities were published in terms of NEM:WA in GN R921 of 2013[8]. A person wishing to undertake:

- An activity listed under Category A, must conduct a BA process,
- An activity listed under Category B, must conduct a S&EIR process,

as set out in the NEMA EIA Regulations, 2014, as part of the WML application process.

The Act makes provision for a single environmental assessment process in instances where both EA and WML applications are required. A separate application form must be submitted at the beginning of the EIA process, and additional stakeholder engagement (advertising) applies to an EIA process for a WML application.

[8] As amended by FN 332 of 2014, GN 633 of 2015 and GN 1094 of 2017

The proposed project includes waste management activities that are listed in terms of NEM:WA (see Table 2-3)[9].

Table 2-3: NEM:WA listed waste management activities applicable to the proposed project

Category B: Requiring a S&EIR Process		Comment
Disposal of waste on land		
7	The disposal of any quantity of hazardous waste to land.	Residue stockpiles and deposits are defined as hazardous waste in Schedule 3 of NEM:WA regardless of their chemical composition. The disposal of fines in the RSF will trigger this activity.
Construction of facilities and associated structures and infrastructure		
10	The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).	The construction of the RSF and associated pipelines, return water pipelines and the Overburden stockpile will trigger this activity.
11	The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right.	The construction of the RSF and the Overburden stockpile will trigger this activity.

Legal requirements for this project:

Tronox is obliged to apply for a WML for the listed activities in Table 2-3 and to undertake an S&EIR process in support of the application, in accordance with the procedure stipulated in the EIA Regulations, 2014. Tronox is also obliged to apply for an amendment to the approved EMPr for the East Mine through this EIA process to authorise the change in approach to previously authorised tailings backfill in the East Mine pit.

2.4.1 Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits, 2015

Section 69 (iA) of NEM:WA makes provision for the promulgation of regulations for the management and control of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation. The Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits, promulgated in terms of NEM:WA (GN R632 of 2015), fulfil this purpose.

The amendment of the Regulations through GN 990 of 2018 removed the requirement that barrier systems for all facilities containing contaminated water or material must comply with the National Norms and Standards for the Disposal of Waste to Landfill (GN 636 of 2013). Instead, a competent person must recommend the pollution control measures suitable for a specific residue stockpile or residue deposit on the basis of a risk analysis. The risk analysis must be based on a physical, chemical and mineral content characterisation of the residue

[9] The East OFS project will take place in areas that have either already been mined and backfilled with tailings or are authorised to be mined and backfilled with tailings. Mining and backfilling the mined out pit are ongoing activities at the East Mine. Mining and backfilling the mining pit with tailings in the East Mine at Namakwa Sands was authorised through:

- DMRE's approval of the original EMPr for the Namakwa Sands Mine - namely Mining Rights ML4/99 and ML12/2002 converted to WC30/5/1/2/2/113 and WC30/5/1/2/2/114 in 2008;
- DMRE's approval of the EMPr amendment for the East OFS project and expansion of mining areas at the East Mine in 2012 (dated 28 March 2012); and
- DMRE's approval of the EMPr for further expansion of mining areas at the East Mine in on 30 March 2016 (DMRE Ref. WC 30/5/1/2/2/10040 MR).

Therefore, according to Tronox, listed waste management activities relating to backfilling the East Mine pit with tailings following mining is an ongoing and authorised activity in terms of Section 82 of NEM:WA (transitional provisions) through existing approvals for mining and backfilling at the East Mine at Namakwa Sands. The change in scope of tailings backfill must therefore be approved through an amendment to the EMPr for the mine through this EIA process, as opposed to applying for these activities for tailings backfill.

Legal requirements for this project:

As the RSF and Overburden stockpile are not authorised through previous approvals for mining in the East Mine (as is the case with tailings backfill, according to Tronox), and as these facilities will be developed for the disposal and storage of mining residue respectively, the planning, design, operation and decommissioning of these facilities must comply with the requirements of GN R632 of 2015.

Tronox appointed competent persons to recommend designs for the RSF and Overburden stockpile which manage contamination of the receiving environment, notably groundwater, based on risk-based analyses (see Appendices C1, C2 and D1). These design reports and the Groundwater Impact Assessment have informed the EIA Report.

2.5 Mineral and Petroleum Resources Development Act 28 of 2002

The MPRDA makes provision for equitable access to and sustainable development of South Africa's mineral and petroleum resources and aims to inter alia provide for security of tenure in respect of prospecting, exploration, mining and production operations. In terms of previous mining legislation, mineral rights were held privately by landowners (and in some instances by the State), but the MPRDA vests all mineral rights in the State. The fundamental principles of the MPRDA are:

- Mineral resources are non-renewable;
- Mineral resources belong to the nation and the State is the custodian;
- Protection of the environment for present and future generations to ensure sustainable development of the resources by promoting economic and social development;
- Promotion of local and rural development of communities affected by mining;
- Reformation of the industry to bring about equitable access to the resources and eradicating discriminatory practices; and
- Guaranteed security of tenure.

Section 5A of the MPRDA states that no person may prospect for or remove, mine, conduct technical co-operation operations, reconnaissance operations, explore for and produce any mineral or petroleum or commence with any work incidental thereto on any area without (a) an environmental authorisation, (b) a permission, permit or right and (c) giving the landowner or lawful occupier of the land in question at least 21 days' written notice.

Chapter 4 of the MPRDA deals with Mineral and Environmental Regulation and provisions with regard to application for a Mining Right are set out in Section 22. Section 22 indicates that a Mining Right can only be issued on EA in terms of NEMA, and Section 37 confirms that the principles set out in the NEMA apply to all prospecting and mining operations and that these operations must be carried out in accordance with the generally accepted principles of sustainable development.

Section 102 of the MPRDA indicates that a "… Mining Right, EMPr and EA (issued in terms of NEMA), may not be amended or varied without the written consent of the Minister".

Legal requirements for this project

Tronox holds Mining Rights and EMPrs approved in terms of the MPRDA (and NEMA, depending on the legislative regime at the time of the various applications and approvals for mining at Namakwa Sands) and is thus authorised to mine, process ore and to dispose of mining residue at various approved facilities at Namakwa Sands, including the backfilling of tailings to the East Mine pit.

Tronox must amend their approved EMPrs to authorise the new aspects introduced by this project.

Tronox has applied to amend their approved EMPrs through this EIA process to include new aspects / changes to the approach to the East OFS project, and it is assumed that the DMRE will consider this application when deciding whether or not to issue EA and a WML for the project.

2.6 National Water Act 36 of 1998

Water use in South Africa is controlled by the NWA. The executive authority is the Department of Human Settlements, Water and Sanitation (DHSWS). The NWA recognises that water is a scarce and unevenly distributed national resource in South Africa. Its provisions are aimed at achieving sustainable and equitable use of water to the benefit of all users and to ensure protection of the aquatic ecosystems associated with South Africa's water resources. The provisions of the Act are aimed at discouraging pollution and wastage of water resources.

In terms of the Act, a land user, occupier or owner of land where an activity that causes or has the potential to cause pollution of a water resource has a duty to take measures to prevent pollution from occurring. If these measures are not taken, the responsible authority may do whatever is necessary to prevent the pollution or remedy its effects, and to recover all reasonable costs from the responsible party.

Section 21 of the NWA specifies a number of water uses, including:

(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; and

(k) using water for recreational purposes.

These water uses require authorisation in terms of Section 22 (1) of the Act, unless they are listed in Schedule 1 of the NWA, are an existing lawful use, fall under a General Authorisation issued in terms of Section 39 or if the responsible authority waives the need for a licence.

Legal requirements for this project:

The disposal of residue at the RSF is classified as water uses in terms of section 21 (g) of the NWA. An amendment to Tronox's Water Use Licence (WUL) will be required from the competent authority, in this case DHSWS. An online application on the electronic Water Use Licences Application and Authorisation System was lodged on 3 July 2020 (reference WU16841).

2.6.1 Regulations Regarding the Safety of Dams, 2012

Section 123 (1) of the NWA makes provision for the promulgation of regulations relating to the safety of dams. In this context, the Regulations Regarding the Safety of Dams, 2012 (GN R139 of 2012), promulgated in terms of the NWA, govern the requirements for dams with a safety risk.

The regulations define the following:

- Methods to determine whether a dam is classified as having a safety risk;
- Requirements for the classification of dams (with a safety risk);
- Requirements for licencing to construct, enlarge, alter or repair a dam with a safety risk;
- Dam design requirements;
- Licencing requirements to impound water in a dam with a safety risk;
- Operation and maintenance requirements;
- Emergency preparedness;
- Record keeping; and
- Safety evaluation.

Legal requirements for this project:

Although Tronox advises that the design aims to ensure that the RSF is not classified as "a dam with a safety risk" (i.e. that the facility will not store more than 50 000 m^3 of free standing water under normal operating conditions), the proponent must verify this during operations. If the RSF is found to contain more than 50 000 m^3 of free standing water under normal operating conditions then Tronox will be required to classify the facility, comply with design requirements based on this classification and apply for the facility to be licensed as a dam with a safety risk.

2.7 National Heritage Resources Act 25 of 1999

The protection and management of South Africa's heritage resources are controlled by the NHRA. The enforcing authority for this act is the South African National Heritage Resources Agency (SAHRA). In the Western Cape, SAHRA has delegated this authority to Heritage Western Cape (HWC). In terms of the Act, historically important features such as graves, trees, archaeological artefacts/sites and fossil beds are protected. Similarly, culturally significant symbols, spaces and landscapes are also afforded protection.

Section 38 of the NHRA requires that any person who intends to undertake certain categories of development must notify HWC at the very earliest stage of initiating such a development and must furnish details of the location, nature and extent of the proposed development. A Notice of Intent to Develop (NID), which provides details regarding the location, nature and extent of the proposed development. After review of the NID, HWC decides whether a HIA will be required.

Section 38 also makes provision for the assessment of heritage impacts as part of an EIA process and indicates that, if such an assessment is deemed adequate, a separate HIA is not required. There is however the requirement in terms of Section 38 (8) for the consenting authority (in this case the DMR) to ensure that the evaluation of impacts on the heritage resources fulfils the requirements of the relevant heritage resources authority (HWC), and that the comments and recommendations of the heritage resources authority are taken into account prior to the granting of the consent.

Section 38(1) of the NHRA specifies activities that trigger the need for the proponent to notify HWC of the proposed development, in order for HWC to determine the need for further Heritage Assessment.

Legal requirements for this project:

The project and associated infrastructure trigger the following category in Section 38(1) of the NHRA:

(c) Any development or activity that will change the character of a site (i) exceeding 5 000 m^2 in extent, (ii) involving three or more existing erven or subdivisions thereof.

In addition, three structures older than 60 years will be demolished. Tronox submitted a Notice of Intent to Develop (NID) to HWC for the project on 15 June 2020. HWC responded to the NID on 1 July 2020 (see Appendix B). HWC stated that there was no reason to believe that the project will impact on heritage resources, and no further action (specialist assessment) of heritage impacts would be required in terms of the NHRA.

2.8 National Environmental Management: Integrated Coastal Management Act 24 of 2008

NEM: ICMA provides for the integrated management of the coastal zone, including the promotion of social equity and best economic use, while protecting the coastal environment.

Chapter 7 of the Act establishes integrated permitting procedures and other measures to ensure the protection and sustainable use of the coastal zone and its resources. This includes the requirement that adequate consideration be given to the objectives of this Act when considering applications for EA (and planning authorisation) for any development within the coastal zone, and the consideration of impacts on coastal public property, the coastal protection zone and coastal access land.

Chapter 8 of the Act establishes an integrated system for regulating the disposal of effluent and waste into the sea. In terms of Section 69, a coastal waters discharge permit (CWDP) is required from the DEA for the discharge of effluent into coastal waters.

Legal requirements for this project:

Although Tronox do not propose any discharge into the marine environment, the project requires the development of infrastructure in the coastal protection zone (broadly defined as within 1 km of the high water mark of the sea in rural areas). Impacts on the coastal environment are therefore assessed in this EIA and found to be of very low significance.

2.9 National Environmental Management: Air Quality Act 39 of 2004

The NEM:AQA lists activities that generate atmospheric emissions that have or may have a significant detrimental effect on the environment and require licensing in terms of NEM:AQA. An Atmospheric Emission Licence (AEL) from the competent authority is required for these activities, which are listed in GN 893 of 2013. All applications must conform to the requirements of NEMA and the application must be accompanied by “such documentation and information as may be required by the licensing authority”.

Legal requirements for this project:

The proposed project does not include activities listed in terms of NEM:AQA. An AEL is therefore not required.

2.10 Dust Control Regulations, 2013

Section 32 of NEM:AQA makes provision for the promulgation of regulations for any matter necessary for the implementation or application of NEM:AQA. In this context, the Dust Control Regulations, promulgated in terms of NEM:AQA (GN R827 of 2013) prescribe general measures for the control of dust in all areas.

GN R827 of 2013 specifies the following:

- Dustfall standards;
- Dustfall and air quality monitoring;
- Dust management; and
- Offences and penalties.

Legal requirements for this project:

In terms of GN R632 of 2015 (see Section 2.4.1) Tronox must comply with this regulation. Dust management for the proposed project will be incorporated into Tronox existing dust management, monitoring and reporting programme.

2.11 Western Cape Noise Control Regulations, 2013

Section 25 of the (mostly repealed) Environment Conservation Act 73 of 1989 (ECA) provides for regulations for the control of noise, vibration and shock. The Western Cape Noise Control Regulations were published in terms of Section 25 of the ECA in Provincial Notice 200 of 2013 (the Noise Control Regulations).

The Noise Control Regulations regulate disturbing and nuisance causing noise, particularly in urban areas.

Legal requirements for this project:

In terms of the Noise Control Regulations, Tronox may not cause a disturbing or nuisance causing noise. Noting the rural nature of the area, remote location of the Mine and absence of sensitive (or any urban) receptors, the Noise Control Regulations have an extremely limited applicability to operations at the Mine.

2.12 Planning Policy Framework

This section discusses a number of key formal planning policies relevant to the project. As Tronox operations are of regional socio-economic significance, provincial plans are considered in this section, in addition to regional and local policies. The policies and plans briefly discussed below include regional and local development and spatial plans, such as the:

- Integrated Development Plans (IDPs) for district and local municipalities, which identify the specific needs in, and formulate desirable developments for, municipalities;
- Spatial Development Frameworks (SDFs) for the province, district and local municipalities, which translate the aims of the IDP into a spatial dimension and, together with the IDP, aim to give effect to the national imperative to increase economic growth and promote social inclusion whilst ensuring that such growth is environmentally sustainable;
- The West Coast District Regional Economic Development Strategy (REDS); and
- The systematic plan for a protected area system in the Knersvlakte region of Namaqualand.

2.12.1 The Western Cape Spatial Development Framework (2014)

The Western Cape Provincial SDF is a spatial planning document that guides district and local spatial initiatives such as IDPs and SDFs. The Western Cape Provincial SDF sets out to put in place a coherent framework for the Province's urban and rural areas that:

- Gives spatial expression to the national and provincial development agendas;

- Serves as basis for coordinating, integrating and aligning 'on the ground' delivery of national and provincial departmental programmes;
- Supports municipalities in fulfilling their municipal planning mandate in line with the national and provincial agendas; and
- Communicates government's spatial development intentions to the private sector and civil society.

The Provincial SDF identifies a number of policy objectives. Of most relevance to the project, Policy R3 ("*Safeguard the Western Cape's agricultural and mineral resources, and manage their sustainable use*") states the following:

- The location of mineral deposits and known reserves of construction materials in municipal SDFs must be recorded;
- Land use policies that reserve mineral deposits for possible use must be introduced and applied (subject to environmental authorisation);
- Ecosystem requirements must be reconciled with conflicting land development pressures through proactive spatial planning, and application of a land use management system that safeguards biodiversity, protects resources and opens up opportunities for improved livelihoods and jobs; and
- New mine ventures should first take place in transformed areas.

2.12.2 West Coast District Municipality Integrated Development Plan (2017 - 2022)

The West Coast District Municipality (WCDM) IDP recognises mining in the West Coast District (WCD) as a contributing factor towards South Africa's mining industry with the major ore terminal at the Port of Saldanha. However, the most recent draft of the IDP indicates mining and quarrying to be of the smallest regional economic sectors (approximately 1%).

Furthermore, the IDP also notes a high level of poverty in the WCDM and a need to enhance job creation projects that alleviate poverty.

The strategic objectives of the WCDM's IDP include:

0. Ensuring environmental integrity for the West Coast;
1. Pursuing economic growth and facilitation of job opportunities by inter alia:
2. Promoting social well-being of the community;
3. Promoting bulk infrastructure development services; and
4. Ensuring good governance and financial viability.

Regarding the Matzikama Local Municipality (MLM), the IDP emphasises that "upliftment of the community through sustainable economic development", the "promot(ion of) local economic development (to) make Matzikama an attractive investment destination", and a "reduc(tion of) poverty through (the) promotion of job creation", as well as the "promot(ion of) a clean and healthy environment" are key development priorities.

The WCDM IDP also lists various environmental sector plans have that been developed to ensure environmental integrity for the West Coast. Among a few are Estuary Management Plans for the Bergriver, Olifantsriver and Verlorensvlei, an Integrated Coastal Management Programme incorporating all five local municipalities and various initiatives to eradicate alien vegetation while contributing towards economic upliftment.

2.12.3 West Coast District Municipality Spatial Development Framework (2020)

The purpose of the WCDM's SDF (2020) is to provide a tool that guides spatial development at District level. The SDF contextualises the Spatial Development Objectives (SDOs) presented in the Framework by describing spatial development challenges in the following three themes:

1. The built environment;
2. The socio-economic environment; and
3. The biophysical environment.

The SDF recognises that development is critical, especially in the north of the District and in other rural areas, but that sensitive cultural and biophysical resources need to be protected, and that tourism has significant growth potential as an industry in the long term.

The Spatial Development Objectives (SDOs) focus on economic development and tourism, housing, the provision of infrastructure and the promotion of renewable energy projects, sustainable water management and the protection and conservation of environmental resources.

The four main SDO's are categorised into two main spatial goals for the WCD, namely:

- *Goal 1: Growth and development opportunities in key sectors/locations:*
  - SDO 1: Align the future settlement patterns of the WCDM with areas of real/proven economic potential without compromising conservation objectives and biodiversity.
  - SDO 2: Promote integrated human settlement planning to enhance spatial transformation, social wellness and community safety; and
  - SDO 3: Align future development along transport routes and economic infrastructure.
- *Goal 2: Areas that need to be protected:*
  - SDO 4: Promote sustainable utilisation of the District's natural resource base to extract economic development opportunities.

These SDOs are encapsulated spatially in the SDF Plan – see Figure 2-1.

Regarding mining specifically, the SDF:

1. Indicates that certain mineral deposits in the region are not being exploited, and that the sector has the potential to make a more significant contribution to the WCDM economy; and
2. Recognises that mining plays an important role in producing constriction materials used in the region; but
3. Acknowledges that the impact of mining on road infrastructure and the environment need to be carefully considered.

2.12.4 West Coast District Municipality Second Generation Coastal Management Programme (2019 – 2024)

The Vision of the WCDM Second Generation Coastal Management Programme (2019) is:

"*We, the people of the West Coast District, celebrate the diversity, richness and uniqueness of our coast and its communities. The coastal environment will be effectively managed to ensure a balance between ecological integrity, sustainable livelihoods and cultural values. The coast will be a safe, clean and healthy asset with equitable access and opportunities for all communities, now and in the future."*

Relevant coastal management priorities were determined to guide coastal zone management in the WCDM. The priorities are based on a situational analysis, including challenges to coastal protection in the WCDM. The priorities are to:

- Improve cooperative governance and clarify institutional arrangements;
- Facilitate coastal access;
- Ensure that coastal planning and development is conducted in a manner that ensures the protection and rehabilitation of the coastal zone;
- Enhance compliance monitoring and enforcement efforts in the District;
- Ensure effective management of estuarine resources in the WCDM;
- Protect, manage and sustain use of natural resources;
- Manage heritage resources within the District;
- Effectively manage and control pollution in the coastal zone;
- Ensure the socio-economic development of coastal communities; and
- Develop and facilitate awareness, education, training, capacity building and information gathering in the District.

The WCDM Coastal Management Plan (2019) notes that the mining has the potential to enhance the economic status of the WCDM and to create significant jobs in the area. However, it also acknowledges that this activity has the potential to significantly impact on the biodiversity and negatively affect the regional eco-tourism industry.

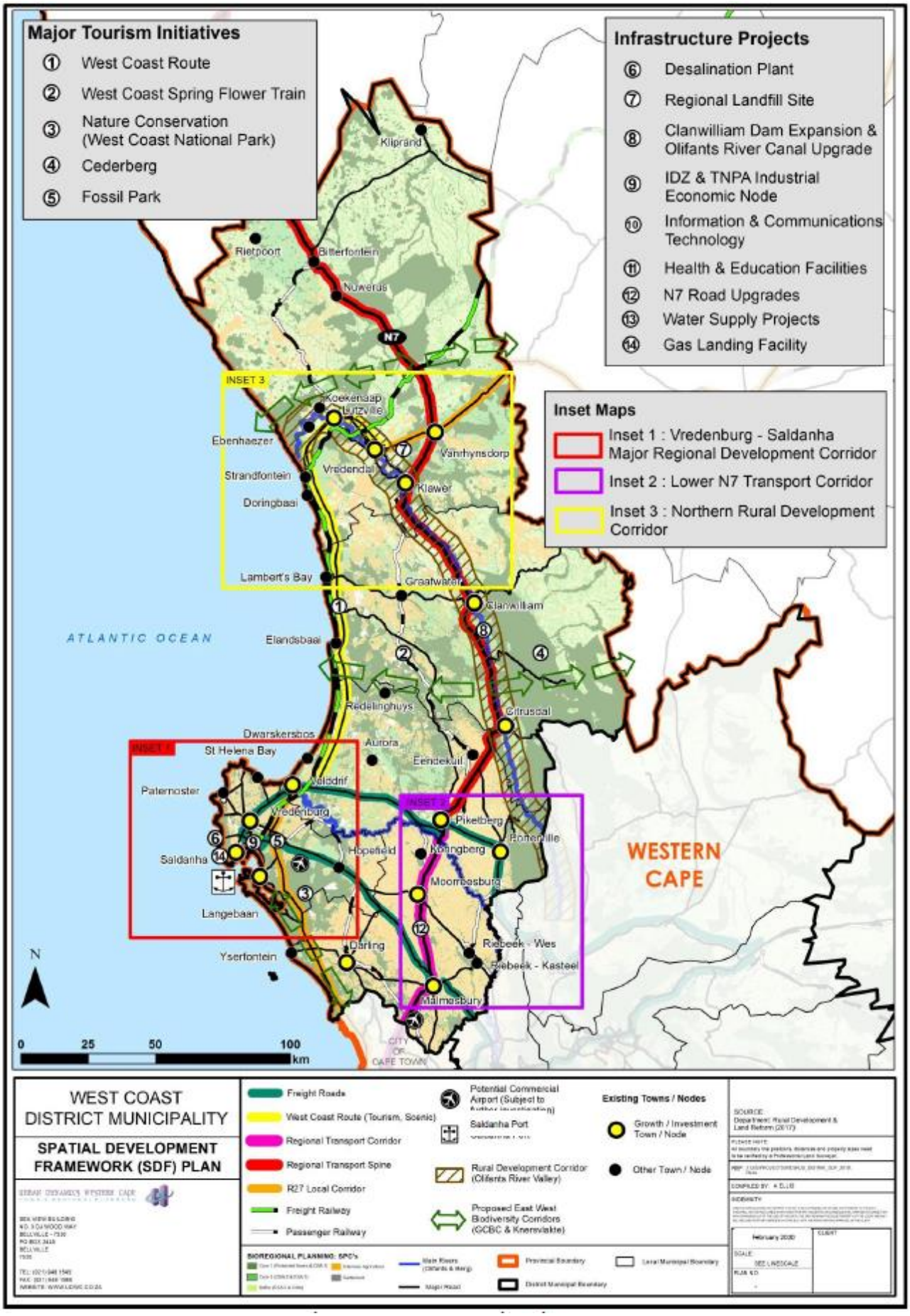

Figure 2-1: West Coast District SDF Plan

2.12.5 Matzikama Local Municipality Integrated Development Plan (2017 – 2022)

The Matzikama Local Municipality (MLM) IDP (2017 – 2022) Third Review (2020) is the over-arching municipal strategic plan with the main purpose of articulating the vision of MLM and how it should be accomplished.

The IDP identifies the following key challenges, or focus areas, to development in the region:

- Poverty and unemployment;
- Inadequate access to housing;
- Health and education;
- Waste management; and
- Infrastructure development.

Strategic goals of the IDP to address these challenges are to:

- Provide municipal basic services to meet demands of growing population and development challenges;
- Maintain sufficient revenue sources to enable the municipality to meet its constitutional obligations;
- Coordinate, facilitate and stimulate sustainable economic development through strategy, policy and programme development;
- Reduce poverty levels;
- Maintain sufficient organizational resources, enhance the involvement of the public in the development and decision making processes and provide ethical and professional services to support the needs of the communities;
- Provide opportunities to officials and councillors for the development of professional and leadership skills and enhance employment equity in the organization; and
- Develop and sustain the spatial, natural and built environment.

The IDP also refers to the disproportionate contribution that the mining sector makes to social development initiatives (relative to their contribution to Regional Gross Value Added [GVA-R]) through mining companies' implementation of their Social and Labour Plans (SLPs), and highlights that there is economic potential from the exploitation of additional mineral resource deposits in the region.

With regard to Ward 8 specifically (in which the Mine and MSP are located), the IDP identifies housing shortages and unemployment as key development challenges here.

2.12.6 Matzikama Local Municipality Spatial Development Framework (2019)

The MLM SDF is intended to be read with the IDP (2017 – 2022) for the region, and therefore does not provide any detail regarding regional development priorities. The plan rather seeks to implement the plans and policies presented in the IDP by specifying spatial priorities for specific *urban settlements* in the District Municipality, and therefore has limited relevance to the Mine or project.

2.12.7 Sout River Estuarine Management Plan (2019)

The Sout River Estuarine Management Plan (2019) provides the vision of the future desired state of the Sout River estuary and guide the management of human activities in and around the system by setting out strategic objectives, management priorities and detailed management strategies with actions/activities.

The strategic objectives of the plan are as follows:

- Improve and maintain the ecological health and functioning of the Sout River estuary;
- Conserve the biodiversity of the Sout River estuary;
- Minimise impacts associated with developments and proposed changes in land use, including infrastructure and agriculture;
- Manage the Sout River estuary well through effective co-operative governance;
- Regulate socio-economic benefits, and improve resilience in the face of climate change, to ensure the sustainable use of the Sout River estuary and its resources; and
- Understand and communicate the scientific aspects, importance and value of the Sout River estuary.

2.12.8 Systematic Plan for a Protected Area System in the Knersvlakte region of Namaqualand (1999)

This systematic conservation plan identifies a system of areas to conserve the unique plant patterns and processes in the Knersvlakte region of the Succulent Karoo, and identifies immediate priorities, in terms of land parcels, for acquisition for conservation of this region.

The Mine falls outside of the area identified for the conservation of the Knersvlakte, and therefore this conservation plan has no impact on the project, and the project will not affect the implementation of this plan.

2.12.9 Mining and Biodiversity Guideline, 2013

The DMRE's Mining and Biodiversity Guideline, 2013 was drafted to inform decisions between economic growth (in this case, mining) and environmental protection, and to minimise the impact of mining on the country's biodiversity and ecosystem services through a practical, user-friendly approach for integrating biodiversity considerations into the planning processes for mines, and managing biodiversity during operations.

The Guideline provides explicit direction in terms of where mining-related impacts are legally prohibited, where biodiversity priority areas may present high risks for mining projects, and where biodiversity may limit the potential for mining. The Guideline distinguishes between four categories of biodiversity priority areas in relation to their importance from a biodiversity and ecosystem service point of view as well as the implications for mining in these areas:

1. Legally protected areas, where mining is prohibited;
2. Ares of highest biodiversity importance, which pose the highest risk to mining, including:
    a. Critically Endangered and Threatened ecosystems;
    b. Critical Biodiversity Areas (CBAs);
    c. River and wetland Freshwater Ecosystem Priority Areas (FEPA), including a 1 km buffer; and
    d. RAMSAR sites;
3. Areas of high biodiversity importance, which pose a high risk to mining, including:
    a. Protected areas buffers;
    b. Transfrontier Conservation Areas;
    c. Other identified priorities from provincial spatial biodiversity plans;

d. High water yield areas;

e. Coastal Protection Zones; and

f. Esturine function zones; and

4. Areas of moderate biodiversity importance, which pose a moderate risk to mining, including:

a. Ecological Support Areas (ESAs);

b. Vulnerable ecosystems; and

c. Focus areas for land based protected area expansion and focus areas for offshore protection.

The Guideline dictates that the site is of low risk to mining as:

- The proposed project area is located in an area either already mined, or approved for mining;
- Mining is set-back from the Groot-Georaap River (a FEPA) by at least 100m;
- The area is not a high water yield area; and
- Only benign impacts on the Coastal Protection Zone are anticipated from the expansion of infrastructure here.

2.12.10 Tronox Namakwa Sands Corporate Environmental Policy

Tronox Namakwa Sands Corporate Environmental Policy is as follows:

Tronox Namakwa Sands is a Heavy Mineral Sand Producer on the West Coast of South Africa and is committed to conserving environmental resources, preventing adverse impacts to the environment and fostering sustainable development.

The following principles are embodied in the Tronox Namakwa Sands Environmental Management System:

- *Compliance with all applicable laws and regulations;*
- *Identification and assessment of environmental aspects;*
- *Setting and reviewing environmental objectives and targets;*
- *Prevention of pollution; and*
- *Striving for continual improvement.*

To achieve these principles, Tronox Namakwa Sands will:

- *Allocate adequate financial and human resources;*
- *Implement environmental awareness and environmental training;*
- *Evaluate the effectiveness of environmental performance;*
- *Engage stakeholders in matters of common concern;*
- *Operate an ISO14001 compliant Environmental Management System;*
- *Demonstrate active stewardship of biodiversity; and*
- *Promote good relationships with and enhance the capacities of local communities.*

2.13 Environmental Process

The general approach to this study is guided by the principles contained in Section 2 of NEMA and those of Integrated Environmental Management (IEM).

NEMA lists a number of principles that apply to the actions of organs of state and that also serve as reference for the interpretation of environmental legislation and administration of environmental processes. The principles most relevant to environmental assessment processes and projects for which authorisation is required are summarised below.

Principles relevant to the EIA process:

- Adopt a risk-averse and cautious approach;
- Anticipate and prevent or minimise negative impacts;
- Pursue integrated environmental management;
- Involve stakeholders in the process; and
- Consider the social, economic and environmental impacts of activities.

Principles relevant to the project:

- Place people and their needs at the forefront of concern and serve their needs equitably;
- Ensure development is sustainable, minimises disturbance of ecosystems and landscapes, pollution and waste, achieves responsible use of non-renewable resources and sustainable exploitation of renewable resources;
- Assume responsibility for project impacts throughout its life cycle; and
- Polluter bears remediation costs.

This S&EIR process complies with these principles through its adherence to the EIA Regulations, 2014 and associated guidelines, which set out clear requirements for, *inter alia,* impact assessment and stakeholder involvement (see below), and through the assessment of impacts and identification of mitigation measures during the Impact Assessment Phase. An initial analysis of the project's compliance with the aims of sustainable development is provided in the impact assessment.

In accordance with the IEM Information Series (DEAT, 2004), an open, transparent approach, which encourages accountable decision-making, has been adopted.

The underpinning principles of IEM require:

- Informed decision making;
- Accountability for information on which decisions are made;
- A broad interpretation of the term “environment”;
- An open participatory approach in the planning of proposals;
- Consultation with interested and affected parties;
- Due consideration of alternatives;
- An attempt to mitigate negative impacts and enhance positive impacts of proposals;
- An attempt to ensure that the social costs of development proposals are outweighed by the social benefits;
- Democratic regard for individual rights and obligations;
- Compliance with these principles during all stages of the planning, implementation and decommissioning of proposals; and
- The opportunity for public and specialist input in the decision-making process.

Although various environmental authorisations, permits or licences are required before the proposed project may proceed, the regulatory authorities are committed to the principle of cooperative governance and in order to give effect to this principle, a single S&EIR process is required to inform all applications. To this end, a single EIA Report will be compiled and will be submitted to the DMRE in support of the application for an EA of NEMA listed activities, for a WML for NEM:WA listed activities and in order to inform an application to amend the EMPr for the Mine.

Supplementary applications have been made for the WUL amendment and HWC comment.

The study will also be guided by the requirements of the EIA Regulations, 2014 (see Section 2.3), which are more specific in their focus and define the detailed approach to the S&EIR process, as well as relevant guidelines published by the DEA and DEA&DP[10], including:

- DEA&DP’s EIA Guideline and Information Document Series (DEA&DP, 2013), which includes guidelines on Generic Terms of Reference (ToR) for EAPs and Project Schedules, Public Participation, Alternatives, Need and Desirability and Exemption Applications and Appeals;
- DEA’s Public Participation Guideline in terms of NEMA EIA Regulations (DEA, 2017); and
- DEA’s Guideline on Need and Desirability (DEA, 2017a).

The competent authority for this project is the DMRE.

2.13.1 Submission of Applications

Various environmental authorisations, permits and licences are required before the proposed project may proceed. Application forms must generally be submitted at the outset of the S&EIR process. The required authorisations and their status are listed in Table 2-4.

[10] As no specific guidelines are available from DMRE, reference is made to DEA and DEA&DP guidelines.

Table 2-4: Environmental Authorisations, permits and licences required for the Project

Application	Authority	Status
EA	DMRE	An integrated application for EA and WML was submitted to DMRE by 18 June 2020 in compliance with Section 16 of the EIA Regulations, 2014.
WML	DMRE	
Heritage Application	HWC	A NID was submitted to HWC by 18 June 2020.
WUL	DWS	An online application on the electronic Water Use Licences Application and Authorisation System was lodged on 3 July 2020 (reference WU16841)

2.13.2 S&EIR Process and Phasing

The S&EIR process consists of three phases, namely the Pre-Application and Scoping Phases (which have been completed) and an Impact Assessment Phase (the current phase) (see Figure 2-2 below).

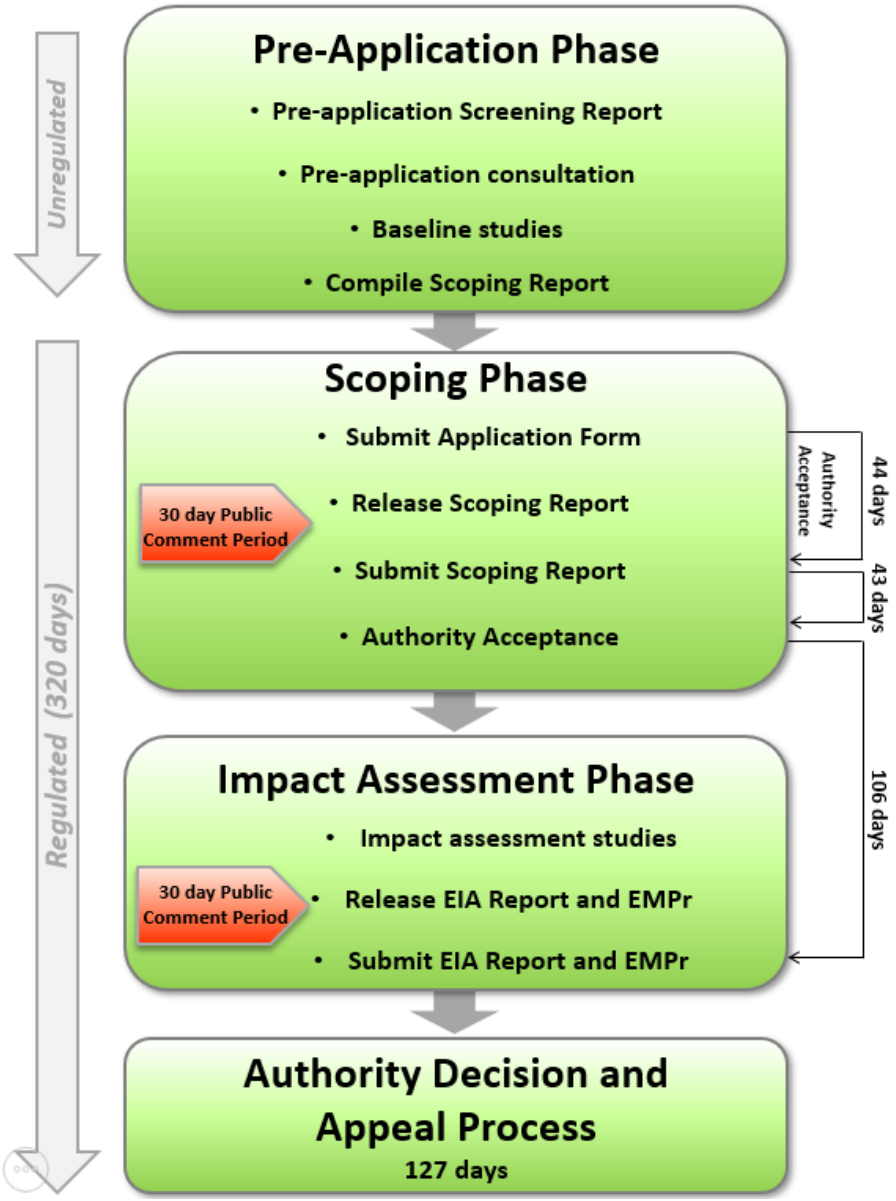

Figure 2-2: S&EIR process

The objectives of the Pre-Application Phase are to:

- Identify appropriate specialist studies using the national screening tool prescribed by Regulation 16(1)(b)(v) of the NEMA EIA Regulation, 2014;
- Identify stakeholders, including neighbouring landowners/ residents and authorities;
- Compile draft Scoping Report describing the affected environment and present an analysis of the potential environmental issues and benefits arising from the proposed project that may require further investigation in the Impact Assessment Phase;
- Develop ToR for specialist studies to be undertaken in the Impact Assessment Phase;

The objectives of the Scoping Phase are to:

- Inform stakeholders of the proposed activity, feasible alternatives and the S&EIR process;
- Provide stakeholders with the opportunity to participate effectively in the process and identify any issues and concerns associated with the proposed activity, review specialist study ToR and the Plan of Study for EIA; and
- Submit a Scoping Report to the relevant authorities (in this case DMRE).

The objectives of the Impact Assessment Phase are to:

- Inform and obtain contributions from stakeholders, including relevant authorities, the public and local communities and address their relevant issues and concerns;
- Build capacity amongst stakeholders during the S&EIR process so that they may actively and meaningfully participate;
- Document and contextualise the biophysical baseline conditions of the study area and the socio-economic conditions of affected communities;
- Assess in detail the potential environmental and socio-economic impacts of the project;
- Identify environmental and social mitigation measures to avoid and/or address the impacts assessed; and
- Develop and/or amend environmental and social management plans based on the mitigation measures developed in the EIA Report and EMPr.

Further detail about activities undertaken or planned during the S&EIR process is presented in Section 5.

3 Project Description

The project design information in this chapter reflects the information available at the time of the compilation of the EIA Report. However, since the design and EIA are being undertaken concurrently, the project description will evolve and be refined during detailed design.

3.1 Introduction

This project is associated with operations that take place within Tronox's East Mine only (see Figure 1-2) and does not relate to operations in the West Mine. This project description therefore focuses on the East Mine at Namakwa Sands as it relates to the project. Details of surface infrastructure at the East Mine site are described in more detail in Section 3.9 below.

Note that descriptions of operations at the Namakwa Sands Mine are drawn from EMPrs for the existing Mine area and are at times reproduced *verbatim*. These source documents include:

- EIA for Namakwa Sands West Mine Residue Storage Facility 6 (SRK, 2017);
- Expansion into Satellite Deposits EMPr (SRK, 2017);
- The Namakwa Sands Consolidated EMPr (Golder, 2008); and
- The EMPr Addendum: Namakwa Sands Proposed Mine plan expansion and Resource Definition Drilling Programme (Golder, 2011).

3.2 Resource / Reserve Estimate

A **Mineral Resource** is defined as 'concentration or occurrence of material of intrinsic economic interest in or on the earth's crust in such form, quality and quantity that there are reasonable prospects for eventual economic extraction' (JORC, 2004). An **Ore Reserve** is the economically mineable part of a measured and/or indicated Mineral Resource, including diluting materials[11], allowances for losses that may occur when the material is mined, and the consideration of modifying factors[12].

Tronox has undertaken prospecting in the East Mine OFS resource to declare an ore (or mineral) reserve of ~164 Mt at a 0.4% cut-off grade. Tronox anticipate mining ~8.6 Mt ROM from the East OFS project per annum (Mtpa) over a 31 year period (i.e. until 2055) at the 0.4% cut-off grade. Depending on the economic climate during mining, Tronox may elect to only mine certain areas with a higher cut-off grade which will reduce the life of the East OFS operation (e.g. to 20 years at a 0.56% cut-off grade).

3.3 Description of the East OFS Project Area

The Mine is located at Brand se Baai which lies in the magisterial district of Vanrhynsdorp, in the MLM and WCDM of South Africa. The Mine is ~63 km north west of Lutzville by road on the R363 (see Figure 1-1).

The Mine is located within the Namaqualand Coastal Sub-region of the Cape Floristic Region, and the surrounding areas are underlain by unconsolidated and semi consolidated sediments of Quaternary age (the economic resource). The study area and its surrounds experience an arid climate with hot dry summers with very low rainfall during winter.

[11] Diluting materials are non-ore materials that are mined together with the ore as ore and surrounding materials cannot be cleanly separated during ore lifting.

[12] Modifying factors include realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental considerations.

Tronox existing mining operations are covered by two converted Mining Rights, namely WC30/5/1/2/2/113 and WC30/5/1/2/2/114 and a third new Mining Right, namely WC30/5/1/2/2/100400MR issued by DMRE in terms of the MPRDA on 18 August 2008 and 30 March 2016 respectively – see area demarcated with red on Figure 1-2. This area consists of the 13 properties listed in Table 3-1. Tronox is authorised in terms of the MPRDA to operate (prospect and mine) within this Mining Right Area in terms of a number of existing approved EMPrs.

The Mining Rights cover 19 144 ha of land of which ~14 000 ha has been authorised for mining (see purple boundary on Figure 1-2), and has either already been transformed, or is scheduled for mining in the future.

Tronox extracts HM using open-cast strip-mining methods from the East Mine and the West Mine – see Figure 1-2 and Table 3-1 – properties to which this application relates are indicated in **bold**), and the Mine precinct comprises long-term surface infrastructure to support mining, including administration and workshop buildings, two large PCPs and a SCP, a seawater pumpstation (intake) near Brand-se-Baai, fresh water and seawater storage dams and eleven RSFs (fines dams) with a total surface area of ~600 ha (see Figure 3-2 and Figure 3-4), tailings and rejects stockpiles, a wide network of haul roads and conveyors (see Figure 3-3) and earthmoving machinery and equipment.

Table 3-1: Existing Namakwa Sands Mine properties

Farm Name	Area (ha)	Surface Owner	SG Code
West Mine			
Hartebeeste Kom 156, Portion 1	**2096**	**Tronox Mineral Sands (Pty) Ltd**	**C07800000000015600001**
Rietfontein Extension 151, Portion 2	475	Tronox Mineral Sands (Pty) Ltd	C07800000000015100002
Graauwduinen 152, Remainder of Portion 1	**2837**	**Tronox Mineral Sands (Pty) Ltd**	**C07800000000015200001**
Graauwduinen 152, Remaining Extent	1736	Tronox Mineral Sands (Pty) Ltd	C07800000000015200000
Graauwduinen 152, Portion 2 (Afgunst)	599	Tronox Mineral Sands (Pty) Ltd	C07800000000015200002
East Mine			
Goeraap 140 Portion 17	244	Tronox Mineral Sands (Pty) Ltd	C07800000000014000017
Rietfontein Extension, 151, Remaining Extent	**2231**	**Tronox Mineral Sands (Pty) Ltd**	**C07800000000015100000**
Houtkraal 143, Remainder of Portion 2	645	Tronox Mineral Sands (Pty) Ltd	C07800000000014300002
Houtkraal 143, Portion 5	**1780**	**Tronox Mineral Sands (Pty) Ltd**	**C07800000000014300005**
Houtkraal 143, Remaining Extent	870	Tronox Mineral Sands (Pty) Ltd	C07800000000014300000
Rietfontein Extension, 151, Portion 1	**1621**	**Tronox Mineral Sands (Pty) Ltd**	**C07800000000015100001**
Hartebeeste Kom 156, Portion 2	**1723**	**Tronox Mineral Sands (Pty) Ltd**	**C07800000000015600002**
Hartebeeste Kom 156, Portion 3	1777	Tronox Mineral Sands (Pty) Ltd	C07800000000015600003

The Mine area has been transformed through surface mining activities which have caused scarring (due to stripping of vegetation) and large man-made landforms (e.g. RSFs, stockpiles and voids - see Figure 3-1), and linear infrastructure such as the Dual Carry Conveyor (DCC), pipelines and haul

roads. The topographical landscape in the authorised mining area has been significantly modified by mining activities, although an extensive rehabilitation programme is underway:

- Approximately 6 200 ha have been cleared for mining on the East and West Mines (out of an area of ~14 000 ha which has been approved for mining); and
- Of the area cleared for mining, ~2 300 ha (37%) are in advanced stage of rehabilitation, and ~2 400 ha being actively rehabilitated (39%);

This project is associated with operations that take place within Tronox's East Mine only (referred to as the study area), and all activities and infrastructure is proposed in areas that are previously disturbed, have been mined previously or are approved for mining.

srk consulting	TRONOX EOFS DISPOSAL PROJECT View of the PCP East from the haul road at the DCC	Project No. 548215

Figure 3-1: View of the PCP East from the haul road at the DCC

srk consulting	TRONOX EOFS DISPOSAL PROJECT RSF 5 in the East Mine	Project No. 548215

Figure 3-2: Residue Storage Facility (RSF) 5 in the East Mine

srk consulting	TRONOX EOFS DISPOSAL PROJECT Dual Carriage Conveyor servicing the East Mine	Project No. 548215

Figure 3-3: Dual Carriage Conveyor servicing the East Mine

Source: Google Earth, 2020

3.4 Surrounding Land Use

The ephemeral Groot Goeraap and Sout Rivers are the main regional surface drainage features. The Sout River lies north of the existing mining areas and flows in a westerly direction. The Groot Goeraap River drains in a westerly direction from the (East Mine) mining area into the Sout River (see Figure 1-2).

Land use in the vicinity of the Mine is strongly informed by the regional climate, particularly the limited rainfall and poor quality groundwater. The wider area is largely agricultural, mostly given over to low intensity sheep farming, although tourism is of increasing significance in the region.

Isolated farmsteads and labourers' cottages are sparsely scattered throughout the region, typically located around the few reliable water sources. An extensive network of sandy/gravel farm roads connects the various farms. On some of the farms, tracts of land have been cleared of natural vegetation and planted with crops. Borrow pits, exploration trenches and diggings are scattered throughout the landscape, but many are no longer used or have been abandoned. These borrow pits/diggings and the fallow croplands present as scars in the landscape accentuated by exposed bright red soils.

The coastal strip is considered to be a largely uninhabited, distinguishable topographical unit within the regional landscape. In this unit, rocky outcrops and wave-cut platforms, are separated by isolated beaches in small bays, and a primary dune belt. Brand se Baai is one of the many small bays along the coast. The coastal strip is a popular recreational area for farmers and residents of nearby towns with numerous informal camping sites located along the coast – one such camp site is located at Brand se Baai.

A commercial saltworks (Cawood Saltworks) on the Sout River is more than 2.5 km to the north of the East Mine boundary, and has altered this estuary, with large evaporation dams located in and along its southern boundary (see Figure 3-4).

A small privately-owned Bed and Breakfast, Joetsies Guesthouse, is located on Mine owned property ~8 km south east of the active East Mine area on the R363.

3.5 East OFS Project Background

Currently only the surface RAS is mined in the East Mine to a maximum depth of about 6m, using a conventional open pit panel mining method (excavation).

Prior to mining, vegetation is cleared, and topsoil is harvested to a depth of 5 cm for use in concurrent rehabilitation. Following site preparation, front end loaders excavate the ore (RAS) and deposit it into haul trucks, which transport the ore to the nearest moveable grizzly feeder at a branch conveyor. Branch conveyors then transport the ore to the DCC which conveys the ore to the East Mine PCP ROM stockpile.

Tailings are returned from the PCP East by the DCC to branch conveyors and grizzly feeders from where trucks haul and tip the material to the (relatively shallow) pit for backfilling (i.e. the material is *single stacked* with haul trucks and not mechanically spread).

Fine residue from the PCP East is pumped to the active East Mine RSF (currently East Mine RSF 5).

Once the pit of each mining block is backfilled it is profiled / shaped, and windbreaks are installed. Harvested topsoil is then spread in rehabilitated areas during growing seasons to enhance rehabilitation success. Rehabilitated areas are monitored to determine rehabilitation success.

The East Mine RAS LoM extends until 2024.

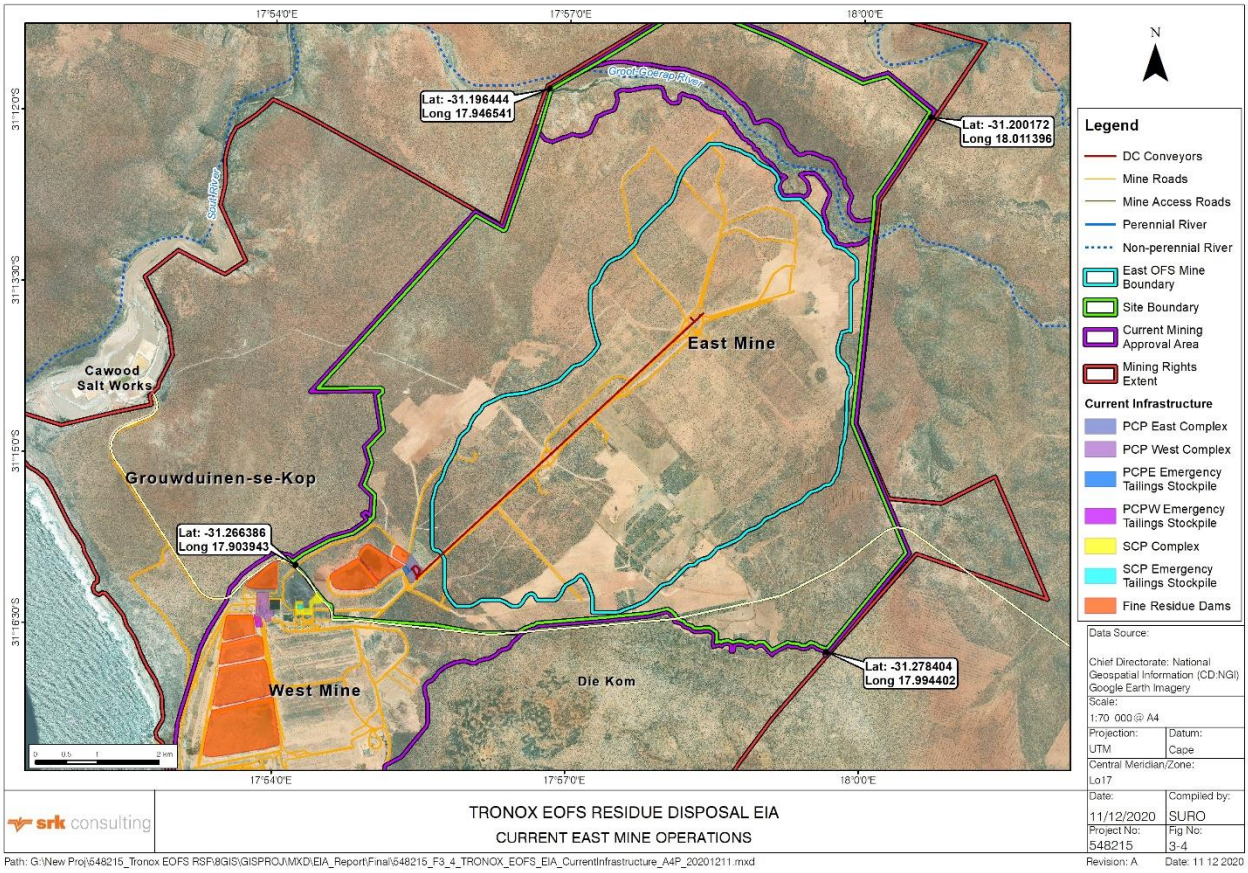

Figure 3-4: East Mine Operations

In order to continue operations at the East Mine beyond 2024, Tronox is authorised to Mine the deeper OFS resource to a depth of ~35 m throughout the East OFS Mine boundary (see , and to upgrade the PCP East in order to process East OFS ore.

Mining of OFS in the East Mine (the East OFS project) will involve the following activities:

1. Site preparation:
    a. Physically marking out area to be mined;
    b. Clearing of previously rehabilitated areas and topsoil harvesting to a minimum depth of 5 cm; and
    c. Removal of previously backfilled 1 m – 3 m deep RAS tailings horizon ("RAS tailings overburden" or "Overburden").
2. Ore extraction and transport:
    a. Excavation of OFS ore (no drilling or blasting is required) to an average depth of 7 m; and
    b. Transport ore by front end loaders or haul trucks to the DCC and conveyed to the PCP East.
3. Processing:
    a. Primary Concentration at the upgraded PCP East; and
    b. Secondary Concentration.
4. Overburden, tailings and residue management.
    a. Tailings placement
        i. Single stacking sand tailings in the approved East OFS pit by haul truck (shallow backfilling to a depth of at least 1m); and
        ii. Deeper stacking of sand tailing by means of conveyor systems at two discrete areas, referred to as STFs.
    b. Residue disposal in a new RSF;
    c. RAS tailings overburden stockpiling (during initial phases) in an interim stockpile (Overburden Stockpile) and subsequent replacement into the East OFS pit (see Section 3.10.1); and
    d. Profiling the RAS tailings overburden stockpiling, STFs, RSF side slopes and shallow backfilled East OFS pit.
5. Rehabilitation of backfilled areas:
    a. Topsoil placement and levelling;
    b. Wind break establishment;
    c. Revegetation;
    d. Monitoring (success of) rehabilitation; and
    e. Maintenance and aftercare activities.

As is the case currently, seawater will be used to process East OFS ore, and the beneficiation process will not require chemical processes or treatment (besides separation of material using a flocculant).

Although Tronox has been granted EA for the East OFS project, detailed planning has demonstrated that a number of changes to the approved approach to sand tailings and residue management, as well as additional infrastructure, are required. These changes and additional infrastructure are the subject of this EIA process (and referred to as "the project"). The project description chapter therefore focusses predominantly on these changes only.

3.6 Project Motivation

Tronox employs more than 1 200 people at the Mine, MSP and smelter directly (including 174 people with dedicated employment at the East Mine). These facilities also sustain many more indirect employment opportunities in the region. A number of companies and enterprises in surrounding towns, and in the district, rely on the Mine to operate. According to the previous Matzikama SDF (2010), the Namakwa Sands mine was estimated to employ, directly or indirectly, up to 60% of employed people in the local municipality (Headland, 2014).

The Mine also procures approximately R900 million of goods and services annually from operations at the Mine and MSP in the local economy and contributes approximately R100 million annually in royalties to the government, and a far larger sum in company taxes.

Namakwa Sands therefore plays a very important function as a local and regional economic driver.

The current approved LoM is until 2043, and there are sufficient resources in the West Mine to continue mining until this date. The RAS resource in the East Mine will be exhausted in 2024, and operations at the East Mine would cease at this date should the East OFS project not proceed, and Namakwa Sands' revenue would drop significantly, and ~25% of the Mine staff complement would be retrenched.

Tronox benefits from economies of scale by processing mineral sands at the SCP and MSP – i.e. hard costs are relatively fixed at these facilities up to their maximum production capacity. Tronox advises that without the concentrate feed from the East Mine PCP (and the revenue that this feed generates), the Mine could operate at a loss and become sub-economic (and close).

Furthermore, once the RAS resource in the East Mine is exhausted (in 2024), ilmenite, zircon and rutile outputs are expected to decrease by ~50%. This reduction would be offset by minerals extracted from East OFS ore once the East OFS project is operational. Once East Mine OFS production comes on stream, the West Mine will also be able to increase production since Tronox expects blending of East and West OFS ore to increase overall recovery from the West Mine. Without the East OFS project, the ilmenite feed at Tronox's smelter in Saldanha Bay would need to be supplemented by external sources by 2033 (i.e. imported), significantly affecting the profitability of this beneficiation facility.

The approved sand tailings disposal strategy to the mining void is flawed in the sense that multiple stacking layers would be required (see Box 1 below). The sand tails inherently contain nearly no clay material, and Tronox would end up stacking in a very loose, sandy beach type configuration. In the past when Tronox has attempted this, it has resulted in haul truck roll-overs and multiple vehicle failures. Tronox therefore deem this option as a significant threat to Safe Operations, which is Tronox's primary Corporate Value, and therefore not feasible – and the specific motivation for this application.

The only feasible (safe) alternative would be to use multiple mechanical tailings stackers to distribute the sand tailings material evenly over the mining void. This would come at significant additional Capex and Opex to Tronox, which would place the financial feasibility of the project at risk.

3.7 Modified Project and Infrastructure Requirements

The following changes to the authorised East OFS project and additional infrastructure are proposed and require authorisation through this process:

- The current EMP requires backfill to be returned to natural topography; however, the proposed methodology and depth of mining does not allow for this to be achieved safely (Box 1) and therefore the approach to backfilling will be amended as follows:
    - Returning RAS tailings overburden to the on average 8 m deep pit by haul truck, to a minimum depth of 1 m in portions of the 8 m deep mining pit (see Section 3.10.5);
    - Tipping (single stacking[13] – see Box 1) sand tailings by haul truck to a minimum depth of 1 m in portions of the 8 m deep mining pit (see Section 3.10.5); and
    - Deeper backfilling of sand tailings with conveyor and stacker systems at two discrete areas referred to as STFs[14] in the East Mine pit to accommodate the surplus sand tailings from the void in the remainder of the pit (STF 1 and STF 2 in Figure 3-21 – see Section 3.10.5).

      This change in approach to sand tailings backfilling would result in a profiled and rehabilitated void which is an average of 7 m deep across most of the East Mine, as well as two areas of deeper backfill (the STFs) that would protrude on average 14 m above the mined out pit.

Box 1: Sand Tailings backfill

Currently in the *shallow* East Mine, RAS tailings are used to backfill the pit by haul truck almost to pre-mining ground level which mimics the pre-mining landform. This is technically feasible because RAS mining is a shallow operation, and in most cases tailings replacement only requires "single stacking" of tailings – only a single layer of tailings is replaced to the pit by haul truck.

This approach to tailings backfill, if to be done safely, becomes more time consuming and costly when successive "layers" (or multiple stacks) of tailings must be hauled and placed one on top of the other (as vehicles are slower and break down) – as would be the case for the deeper East OFS project where on average 7 m (or three to five successive layers) of tailings would need to be placed to completely fill the void created by the project. An alternative approach to sand tailings management is therefore proposed in this application.

- Establishing a ~400 ha, ~66 Mm^3 (volumetric capacity) RSF (RSF 6) for the controlled disposal of fine residue generated by the East OFS project (as opposed to three separate, smaller fine residue facilities which were approved in the original application) and associated residue and return water pipelines and pumps (see Section 3.9.1, especially 3.9.1.5);
- Establishing a 50 ha Overburden stockpile with a capacity of 3.15 Mm^3 in an area approved for mining east of the proposed RSF (see Figure 3-21 and Section 3.9.2);
- Upgrading the seawater intake (see Section 3.9.3); and
- Demolishing three structures within the East OFS pit, each more than 60 years old (see Section 3.9.7).

In addition to the above infrastructure, Tronox seek to amend their EMPr in order to:

- Install a 22 kV overhead powerline (see Section 3.9.6);

[13] This differs from the currently approved method of hauling and backfilling **all** sand tailings into the East OFS pit and therefore mimicking the pre-mining topography (elevation).

[14] Two STFs are optimal from an OpEx and safety perspective and are required to allow for blending of ore of different grades from different mine locations, and to provide independent and continuous disposal capacity if one STF is not operational (e.g. during stacker relocation).

- Define the PCP East Boundary within which various processing infrastructure required for processing East OFS ore can be installed (see Section 3.9.5);
- Amend the layout of process water lines between the approved Buffer Dam, PCP West Raw Seawater Dam and the PCP West Raw Seawater Dam (see Section 3.9.4); and
- Confirm the final location of the approved 40 000 m^3 seawater Buffer Dam (see Figure 3-19).

3.8 Project Alternatives

Appendix 2 Section 2 (h)(i) of the EIA Regulations, 2014[15], requires that all S&EIR processes must identify and describe alternatives to the proposed activity that are 'feasible and reasonable'. Different types or categories of alternatives can be identified, e.g. location alternatives, type of activity, design or layout alternatives, technology alternatives and operational alternatives. The 'No-Go' or 'No Project' alternative must also be considered.

Not all categories of alternatives are applicable to all projects. However, the consideration of alternatives is inherent in the design process and the identification of mitigation measures, and therefore, alternatives have been and will be taken into account in the design and S&EIR processes.

A number of environmental, technical and financial risks and constraints associated with the East OFS project (particularly pertaining to the STFs and RSF) have been identified by Tronox and their consultants. Alternatives have been considered to address these risks and constraints, which include:

- Contamination;
- Increase in groundwater quantity / groundwater mounding (and groundwater intrusions into terrestrial and aquatic environments);
- Loss of sense of place (to recreational users of the coastline, local residents and at closure);
- The cost of construction (CapEx) of the RSF and operational costs (OpEx) (to backfill sand tailings); and
- Safety of operations for the backfilling of tailings.

3.8.1 Location / Site Alternatives

The primary subject of this application is a change in the approach to the approved residue management method for the East OFS project, in order to reduce CapEx and OpEx (and enhance the economic feasibility of the project), improve the safety of operations and to ensure the technical feasibility of the project. Since subject of the application is a modified approach, the location of the project is fixed. Furthermore, the location of the heavy mineral deposit is fixed, and has dictated the existing Mine / process plant locations.

It is not economically viable to transport overburden material, sand tailings or fine residue for storage or disposal to a remote location, and there are few disturbed areas outside the mining area that would be suitable for storage or disposal of overburden material. Alternative sites for the Overburden stockpile, STFs and RSF (other than within the East Mine) have thus not been considered.

With regard to the Overburden stockpile, as process (sea) water has already leached from this material (and therefore groundwater impacts were considered to be benign) its proposed location was dictated by:

[15] The Regulations Regarding the Planning and Management of Residue deposits and Stockpiles also require the consideration of site alternatives.

- Proximity to the start-up pit (and therefore lower cost of transportation);
- Its location within a mined out area, but outside of the authorised East OFS project footprint (i.e. in an area that will not entail vegetation clearance while also not sterilising the East OFS resource here);
- Its location in a low-lying area (which reduces the visibility); and
- Proximity to the RSF for use of the overburden material for capping of this facility at closure.

Therefore, the proposed site for the overburden facility is appropriate, and no other reasonable and feasible alternative sites for the overburden facility were considered in the EIA process.

In order to assess the financial, sense of place, environmental and safety risks and suitability of the STFs and RSF, alternative (feasible) locations for the RSF were considered in the East Mine, and a Screening Study was conducted to identify envelopes which are suitable for construction of the STFs. The outcomes of these studies are described below.

Tronox have also considered the technical implications of the layout of approved process water pipelines between an approved seawater Buffer Dam and the PCP East and PCP West Raw Seawater dams, and these alternatives are also presented and discussed here.

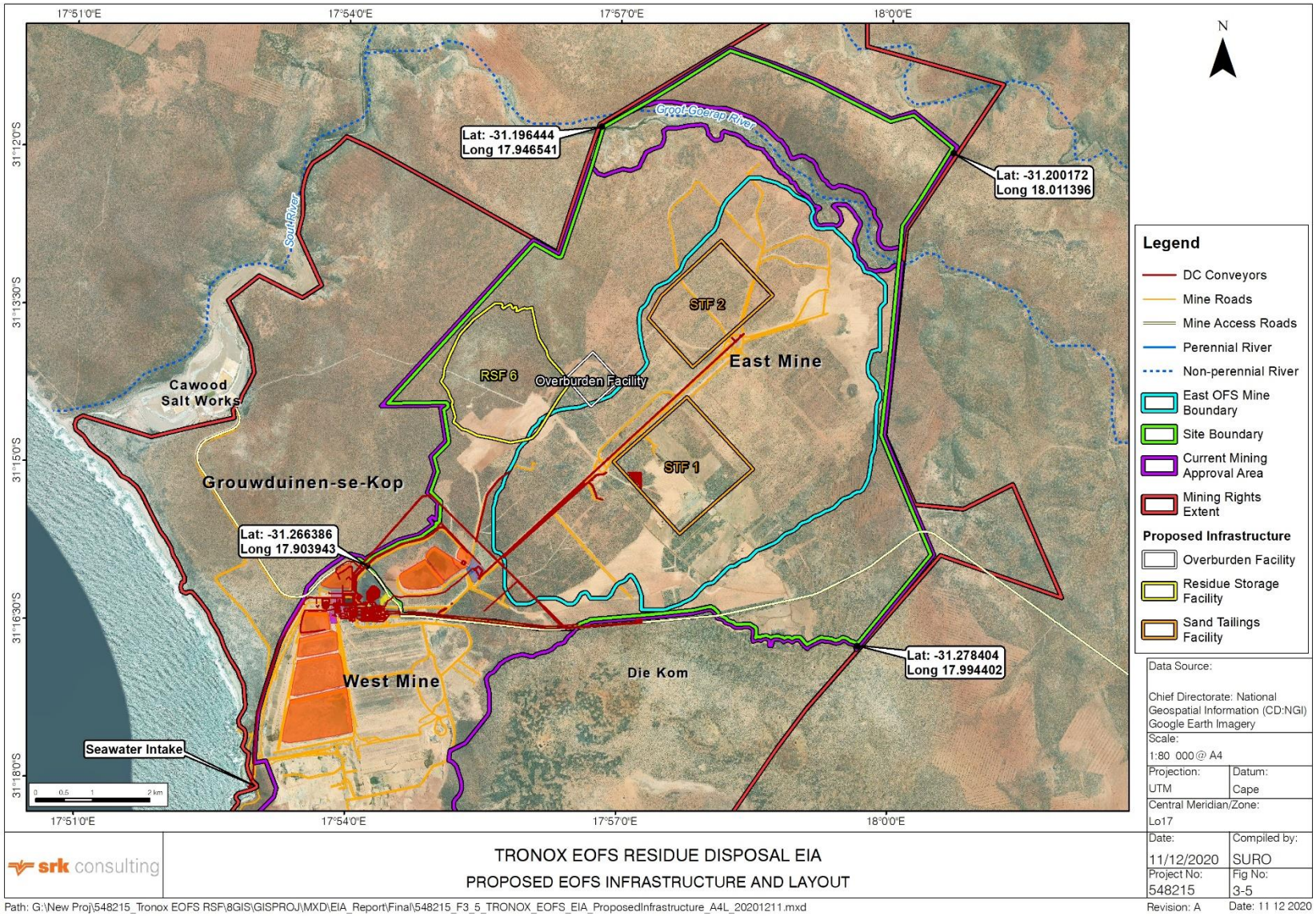

Figure 3-5: Proposed East OFS infrastructure and layout

The outcomes of the Screening Study are summarised below.

3.8.1.1 RSF Site Assessment

Although the 2012 authorisation for the East OFS project includes three smaller RSFs, subsequent engineering studies conducted by Tronox concluded that these facilities are neither operationally practical, nor sufficient for the management of the fine residue from the East OFS ore body. Therefore, Tronox proposes to build a single RSF for the controlled disposal of all fine residue that will be generated by the East OFS project.

In addition to the alternatives considered in the 2012 EIA for the East OFS project, and a subsequent technical feasibility analysis of alternative locations for the RSF in the East Mine, the following two alternative, technically feasible sites in the East Mine for the RSF were identified by Tronox (see Figure 3-6):

- RSF Option 1 – located in a depression on the western boundary of the East Mine, east of Grouwduin se Kop; and
- RSF Option 2 – located in a valley known as Langlaagte in the south-east of the East Mine.

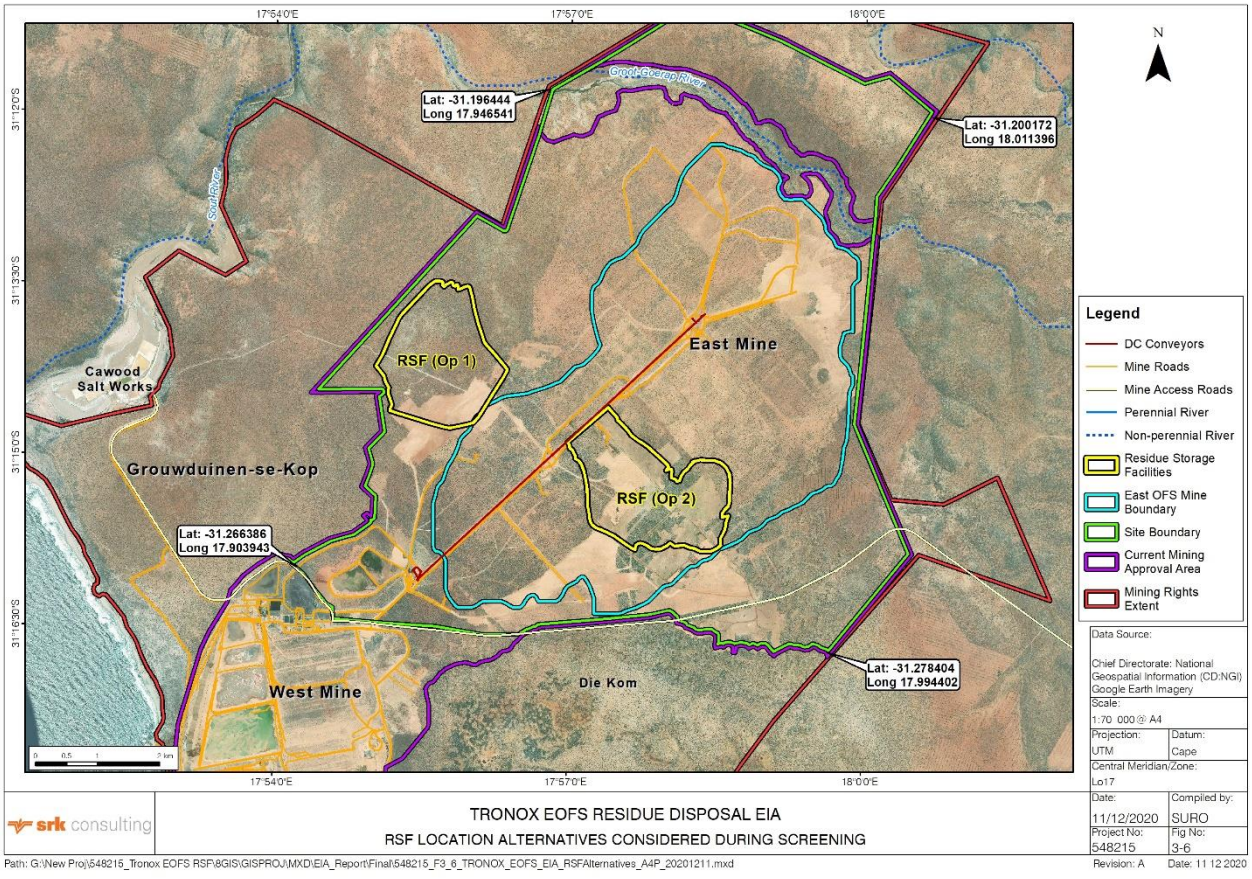

Figure 3-6: RSF location alternatives considered during screening

RSF Option 1 is preferred by Tronox from a technical (operability) and CapEx and OpEx perspectives. RSF Option 2 (site) is also an ideal location (site) for STF 1 from an operational perspective (see Section 3.8.1.2), and therefore if this site was selected for the RSF, an alternative site for STF 1 would need to be identified.

In order to rate the suitability of site alternatives, relevant screening disciplines were identified, *viz*. groundwater, surface water and visual. For each discipline, aspects were identified against which to assess the suitability of area approved for mining in the East Mine for the RSF.

The suitability of the area was then scored between 1 (low suitability) and 5 (high suitability) and mapped for each aspect.

Aspects were weighted based on their relative importance for each discipline, and the suitability of each site was:

- Determined for each site based on its location on the suitability map;
- Scored out of a maximum possible score of 50 for each discipline; and
- Assigned a suitability score for each discipline (see Table 3-2).

Table 3-2: Site suitability scores for each discipline

Overall weighted score	Site Suitability	Suitability Score
45 – 50	High	5
35 – 44	Medium to high	4
25 – 34	Medium	3
15 – 24	Low to medium	2
10 – 14	Low	1

The three disciplines were then weighted in terms of their relative importance, and the integrated (pre-mitigation) suitability for each site was determined.

The results of RSF site screening for each discipline and the integrated suitability of each site is presented below.

Groundwater

Table 3-3 lists the groundwater aspects considered and describes the status of each alternative site in terms of each aspect. Each site's suitability is rated for each aspect, and the weighted suitability score is provided, as well as the overall suitability of each site for the groundwater discipline (see Table 3-2).

Table 3-3: RSF groundwater screening scores

Aspect	Weight	RSF 1		RSF 2	
		Suitability Rating / Score	Weighted score	Suitability Rating / Score	Weighted score
Groundwater Flow Direction	3	**2 – Low to medium** A portion of RSF Option 1 overlays groundwater that reports towards the Sout River	6	**4 – Medium to high** Groundwater at RSF Option 2 reports towards the coastline	12
Distance from preferential flow paths	2	**2 – Low to medium** May overlay preferential flow paths that channel groundwater towards the Sout River	4	**4 – Medium to high** May overlay preferential flow paths that channel groundwater towards the coastline	8
Distance from Unconformity	1	**2 – Low to medium** Underlain by an unconformity	2	**2 – Low to medium** Underlain by an unconformity	2
Depth to Groundwater	2	**4 – Medium to high** Groundwater is more than 30 mbgl	8	**5 – High** Groundwater is more than 40 mbgl	10
Depth to Bedrock	1	**3 – Medium** Bedrock is more than 20 mbgl	3	**5 – High** Bedrock is more than 40 mbgl	5
Bedrock Geology	1	**3 – Medium**	3	**2 – Low to medium**	2

Aspect	Weight	RSF 1		RSF 2	
		Suitability Rating / Score	Weighted score	Suitability Rating / Score	Weighted score
		Underlain by bedrock from both the Vanrhynsdorp Group and NMC Group in equal proportions		Predominantly underlain by bedrock from the Vanrhynsdorp Group	
Overall score	**10**	**Medium suitability**	**26**	**Medium to high suitability**	**39**

Surface Water

Table 3-4 lists the surface water aspects considered and describes the status of both sites in terms of each aspect. Each site's suitability is rated for each aspect, and the weighted suitability score is provided, as well as the overall suitability of each site for the surface water discipline.

Table 3-4: RSF surface water screening scores

Aspect	Weight	RSF 1		RSF 2	
		Suitability Rating / Score	Weighted score	Suitability Rating / Score	Weighted score
Distance to watercourses	3.5	**5 – High** No water bodies within RSF extent. A pan is situated more than 50 m away, but it is upgradient.	17.5	**5 – High** No water bodies within RSF extent. No nearby water bodies	17.5
Flow direction	3.5	**3 – Medium** A small portion of the is located on the catchment boundary and some runoff from this area, if uncontrolled, may flow towards the river.	10.5	**2 – Low to medium** Up-catchment of De Kom, an ecologically sensitive pan. However, slopes between the RSF and De Kom are not particularly steep and rainfall is low and consequently the volume of surface water reaching the pan will be low	7
Erosivity (slope)	2	**4 – Medium to high** Surrounding slopes below 10%. Some erosion is likely if no mitigation is applied.	8	**4 – Medium to high** Surrounding slopes below 10%. Some erosion is likely if no mitigation is applied.	8
Alternations to sub-catchments	1	**2 – Low to medium** Catchment boundaries significantly altered as well as flow directions. Nature of flow remains unchanged – non-draining system	2	**1 – Low** Catchment boundaries are merged, divided, significantly increased or reduced in size. Major alterations to flow directions.	1
Overall score	**10**	**Medium to high suitability**	**38**	**Medium suitability**	**33.5**

Visual

Table 3-5 lists the visual aspects and describes the status of both sites in terms of each visual aspect considered. Each site's suitability is rated for each aspect, and the weighted suitability score is provided, as well as the overall suitability of each site for the visual discipline.

Table 3-5: RSF visual screening scores

Aspect	Weight	RSF 1		RSF 2	
		Suitability Rating / Score	Weighted score	Suitability Rating / Score	Weighted score
Sense of place	7	**2 – Low to medium suitability** RSF Option 1 is located on a plain that gently slopes towards the Sout River, and an elevated feature is not entirely consistent with the surrounding landforms, although Gouwduin se Kop does protrude from the landscape to the south-west.	14	**3 – Medium suitability** The RSF would create a new large uniform elevated feature in a portion of a valley. Against the backdrop and visual absorption capacity of the surrounding landscape, which rises to the east, north and south-west, this is to some extent in keeping with existing landforms and sense of place.	21
Visibility	3	**4 – Medium to high suitability** RSF Option 1 has a smaller viewshed and for coastal visitors lies in the background behind the fines dams in the West Mine.	12	**3 – Medium suitability** RSF Option 2 has a larger viewshed and is more visible to motorists.	9
Overall score	**10**	**Medium suitability**	**26**	**Medium suitability**	**30**

Integrated Site Rating

The site and envelope suitability scores of the individual disciplines are weighted and totalled to provide an "overall suitability score", and this is used to determine the final weighted score for each site (see Table 3-2).

Discipline Weighting

The groundwater, surface water and visual disciplines were (also) each assigned a weighting (as a factor of 10) reflecting their importance relative to the other disciplines (see Table 3-6 below), and the overall and relative suitability of each site is calculated. The weightings were based on the anticipated intensity of potential impacts in each discipline.

Table 3-6: Inter-discipline weighting

Aspect	Weighting	Weighting Rationale
Groundwater	5	Notwithstanding the relatively benign characteristics of leachate from residue generated at the Mine and already elevated salinity in groundwater, changes to groundwater quality and levels are key considerations for projects of this nature, and a number of sensitive groundwater receptors (both ecological and social) are located on groundwater pathways.
Surface Water	2.5	Although sensitive ecological and social receptors are located on surface water pathways, precipitation is low, and surface flow is episodic. Potential surface water impacts, should they occur, would be rare.
Visual	2.5	Both site alternatives are located in the area approved for mining. The remoteness of the project area ensures that there are only a very limited number of receptors. The sensitivity of viewers or visual receptors potentially affected by the visual impact of the project is considered to be low because of their previous and ongoing exposure to existing facilities and infrastructure at the Mine.

Overall Site Rating and Ranking

Table 3-7 rates each site's overall suitability in terms of its weighted suitability score for each discipline.

Table 3-7: Overall RSF site rating and ranking

Discipline	Weight	RSF 1		RSF 2	
		Suitability Rating / Score	Weighted score	Suitability Rating / Score	Weighted score
Groundwater	5	3 – Medium suitability	15	4 – Medium to high suitability	20
Surface Water	2.5	4 – Medium to high suitability	10	3 – Medium suitability	7.5
Visual	2.5	3 – Medium suitability	7.5	3 – Medium suitability	7.5
Overall score	**10**	**Medium suitability**	**32.5**	**Medium to high suitability**	**35**

The key outcome of this assessment (noting that both sites are located within the approved mining boundary) was that neither RSF Option 1 nor RSF Option 2 is fatally flawed in terms of the potential groundwater, surface water and visual impacts of the RSF – i.e. both sites are suited to the RSF. Therefore, RSF Option 2 has therefore been screened out by Tronox (as RSF Option 1 is preferred site for RSF 6 from a technical and financial perspective).

3.8.1.2 STF Site Screening

Tronox identified the following two preferred sites for the STFs which align with the current EOFS Mine Plan (they are located in the general locations where Tronox intend to commence mining), and which would be technically feasible to construct and operate (see Figure 3-7):

- STF Site 1 – located in a valley known as Langlaagte in the south-east of the East Mine; and
- STF Site 2 – located adjacent to the DCC in the north west of the East Mine.

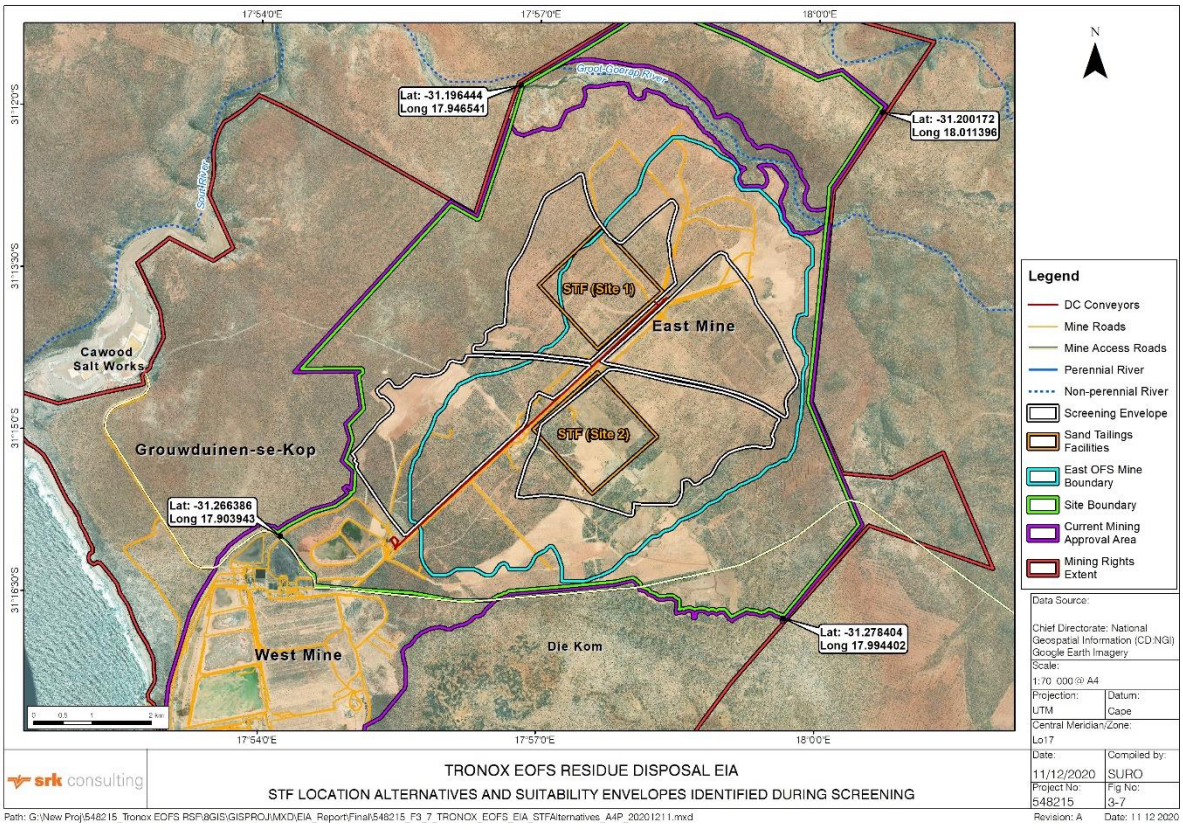

Figure 3-7: STF location alternatives and suitability envelopes identified during screening

In order to rate and rank the suitability of sites identified by Tronox and other potential STF site envelopes identified by SRK within the East Mine boundary, relevant screening disciplines were identified, *viz*. groundwater, surface water and visual.

For each discipline, aspects were identified against which to assess the suitability of the study area for the STFs, the suitability of the study area was mapped and assessed on this basis. Suitability scores were assigned to each site and site envelope based on the mapped sensitivity for each discipline (according to the categories presented in Table 3-8).

Table 3-8: Overall STF site suitability categories for each discipline

Site Suitability	Suitability Score
High	5
Medium to high	4
Medium	3
Low to medium	2
Low	1

The groundwater, surface water and visual disciplines were each assigned a weighting (as a factor of 10) reflecting their importance relative to the other disciplines (see Table 3-9 below). The weightings are based on the anticipated intensity of potential impacts in each discipline.

Table 3-9: Inter-discipline weighting

Aspect	Weighting	Weighting Rationale
Groundwater	5	Notwithstanding the relatively benign characteristics of leachate from tailings generated at the Mine and already elevated salinity in groundwater, changes to groundwater quality and levels are key considerations for projects of this nature, and a number of sensitive groundwater receptors (both ecological and social) are located on groundwater pathways.
Surface Water	2.5	Although sensitive ecological and social receptors are located on surface water pathways, precipitation is low, and surface flow is episodic. Potential surface water impacts, should they occur, would be rare.
Visual	2.5	STFs would be located in mined out areas. The remoteness of the project area ensures that there are only a very limited number of receptors. The sensitivity of viewers or visual receptors potentially affected by the visual impact of the project is considered to be low because of their previous and ongoing exposure to existing facilities and infrastructure at the Mine.

The weighted site and envelope suitability scores of the individual disciplines were then totalled to provide an "integrated site suitability score", and this was used to determine the final weighted score for each site and envelope. In theory, the derived, integrated weighted scores can range between 0 – 50 points. SRK categorised these scores according to the suitability categories presented in Table 3-10.

Table 3-10: Integrated STF site suitability categories

Overall score	Site Suitability
46 – 50	High
36 – 45	Medium to high
26 – 35	Medium
16 – 25	Low to medium
10 – 15	Low

Table 3-11: STF site and envelope screening

Site	Discipline						Integrated Score	Integrated Suitability
	GROUNDWATER		SURFACE WATER		VISUAL			
	Weight							
	5		2.5		2.5			
	Suitability Rating / Score	Weighted score	Suitability Rating / Score	Weighted score	Suitability Rating / Score	Weighted score		
Envelope 1	**5 – High** • Groundwater flows away from sensitive receptors, towards the sea.	25	**5 – High** • Does not drain towards any sensitive watercourses.	12.5	**4 – Medium to high** • Proximity to RSF Option 1 increases visual integrity. • Less visually exposed.	10	47.5	High
Envelope 2	**5 – High** • Groundwater flows away from sensitive receptors, towards the sea.	25	**5 - High** • Does not drain towards any sensitive watercourses.	12.5	**3 –Medium** • Lower visual integrity. • Elevated areas exposed.	7.5	45	Medium to high
Envelope 3	**3 – Medium** • Groundwater flow towards the Groot Goeraap River. • Preferential flow paths towards the Groot Goeraap River.	15	**4 – Medium to high** • Portion of envelope has steeper slopes that drain towards the Groot Goeraap River and potential receptors.	10	**2 – Low to medium** • Lower visual integrity. • Elevated areas exposed	5	30	Medium
Envelope 4	**3 – Medium** • Groundwater flow towards the Groot Goeraap River. • Preferential flow paths towards the Groot Goeraap River.	15	**4 – Medium to high** • Portion of envelope has steeper slopes that drain towards the Groot Goeraap River and potential receptors.	10	**4 – Medium to high** • Proximity to RSF increases visual integrity. • Western portion of approved mining area less visually exposed.	10	35	Medium
STF 1	**3 – Medium** • Groundwater flows towards the Groot-Goeraap and Sout Rivers. • Preferential flow paths towards the Groot Goeraap River.	15	**5 – High** • Does not drain towards any sensitive watercourses.	10	**4 – Medium to high** • Located in lower-lying area near RSF 1, increasing visual integrity and lowering visual exposure.	10	35	Medium
STF 2	**4 – Medium to high** • Generally suitable site. • Preferential flow paths towards the coast.	20	**5 – High** • Does not drain towards any sensitive watercourses.	12.5	**3 - Medium** • Located in more suitable portion of Envelope 2 • Some elevated areas have higher visual exposure, but can mimic natural topography	7.5	40	Medium to high

Site Ranking

Table 3-7 consolidates the screening scores presented in Table 3-8 and ranks the sites and envelopes overall suitability in terms of their (weighted) integrated suitability score.

Table 3-12: Overall site rating and ranking

Rank	Site / Envelope	Suitability Rating	Weighted score
1	Envelope 1	High	47.5
2	Envelope 2	Medium to high	45
3	Site 2	Medium to high	40
4	Site 1	Medium	35
5	Envelope 4	Medium	35
6	Envelope 3	Medium	30

The key outcome of this assessment (noting that both sites are located within the approved mining area) was that neither STF Site 1 nor STF Site 2 is fatally flawed in terms of the potential groundwater, surface water and visual impacts of the STFs – i.e. both preferred sites identified by Tronox are suitable for the facilities. Other potential locations (envelopes) for STFs considered in the Screening Study have therefore screened out by Tronox as STF Site 1 and STF Site 2 are optimal from a technical and financial perspective.

3.8.1.3 Process Water Pipelines

The 40 000 m^3 seawater Buffer Dam located south west of the West Mine RSF 1 (see Figure 3-19) has been approved in a previous application[16]. This approval included process water pipelines between the Buffer Dam and the Seawater dam (near SCP) and PCP East. The routes for these lines have been reconsidered by Tronox as follows:

Buffer Dam to Seawater Dam

Tronox are authorised to install a raw seawater pipeline from the Buffer Dam to the seawater dam south of the Buffer Dam and Freshwater Reservoir (indicated as “Option 2” on Figure 3-19). Tronox propose an alternative route for this pipeline to the north of the Reservoir (see Figure 3-19):

- Option 1 emanates belowground from the east of the Buffer Dam, turns north and then continues east (north of the PCP West), where it will emerge aboveground passing north of the Freshwater Dam and turns south to the Seawater Dam near SCP; or
- Option 2 emanates belowground from the south of the Buffer Dam below an access road, turns east to the Freshwater Dam, where it would be routed aboveground south of the Seawater Dam to the Seawater Dam near SCP (as previously authorised).

Both alternative pipeline routes are belowground in transformed areas (between the Buffer Dam and Freshwater Dam) and aboveground where the routes traverse intact vegetation.

Buffer Dam to PCP East Raw Seawater Dam

Tronox are authorised to install an underground raw seawater pipeline from the Seawater Dam near the SCP to the PCP East in road reserves south of East Mine RSF 4 and RSF 5.

[16] This infrastructure is authorised in amended EMPrs – DMR Reference Numbers: WC30/5/1/2/3/2/1(113) EM and WC30/5/1/2/3/2/1(114) EM - and EA - DEA&DP Reference Number 16/3/1/1/F3/10/3033/14 dated September 2015.

Tronox are now proposing a raw seawater pipeline directly from the new Buffer Dam to the PCP East Raw Seawater Dam north of East Mine RSF4 and RSF5 (see Figure 3-19). Two alternative layouts for this pipeline between the Buffer Dam and the PCP West are proposed by Tronox:

- Option 1 emanates belowground from the east of the Buffer Dam, turns north and then continues east (past PCPW), emerging aboveground north of the Freshwater Dam, turning North-East, between West RSF 1 and Ilmenite stockpile, continuing north of East RSF 4 and East RSF 5 in an access road reserve to the PCP East; or
- Option 2 emanates belowground from the south of the Buffer Dam below an access road, turns east to the Freshwater Dam, where it would be routed aboveground south of the Freshwater Dam and north of East RSF 4 and East RSF 5 in an access road reserve to the PCP East.

Both alternative pipeline routes are belowground in transformed areas (i.e. between the Buffer Dam and Freshwater Reservoir) and aboveground where the routes traverse intact vegetation (i.e. between the PCP West and the PCP East, north of East RSF 4 and East RSF 5).

3.8.2 Activity Alternatives

No activity alternatives (other than the No-Go alternative) are considered by the proponent and activity alternatives (other than the No-Go alternative) are not considered further in the EIA process.

3.8.3 Design Alternatives

Liners for waste storage and disposal facilities reduce the infiltration of contaminants (in this case, seawater) into the environment, and function as a leachate detection, control and collection mechanism. Effective liners can therefore minimise changes to groundwater quality and quantity.

The *Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits* (GN R632 of 2015) specify requirements for the management of residue stockpiles and deposits (for example, containment barriers) based on the type of the residue and potential risk to the environment. The regulations allow for a risk based approach to design (i.e. design and management measures, including containment, should be commensurate with the level of risk posed to the environment).

Waste characterisation of the East OFS fines and tailings have indicated that (see Appendix C3):

- Fines residue (in the RSF): the leachable concentrations of Chlorine (Cl), Boron (B) and Total Dissolved Salt (TDS) in the leachate from East OFS processing (all of these constituents have their source in seawater used as process water in the PCPs and SCP) will categorise this residue a Type 3 Waste; and
- Overburden RAS tailings: this residue has been assumed a Type 4 waste as a) this waste is similar to East OFS tailings to be produced by the PCP East[17], and b) process (sea) water and other chemicals (especially TDS) will have leached from this waste over time.

In the absence of a risk-based motivation to design as prescribed by GN R632 of 2015, the *National Norms and Standards for the Disposal of Waste to Landfill* (GN R636 of 2013 - promulgated in terms of NEM:WA) indicate that Type 3 wastes (fines) typically require a disposal facility that is designed to the prescribed standards of a Class C landfill, i.e. including the installation of a geosynthetic liner; and Type 4 wastes (tailings) typically require a disposal facility that is designed to the prescribed standards of a Class D landfill, i.e. the *in-situ* preparation of a 150 mm thick engineered base layer.

[17] Sand tailings: the leachable concentrations of Cl, B and TDS in the leachate from East OFS processing categorise this residue a Type 4 Waste.

However, noting that natural groundwater quality in the area is highly saline and not suitable for potable use, Tronox NS and their design engineers do not consider this specification to be appropriate at this site. Therefore, in order to assess the relative risk posed to the environment and to guide a risk based approach to the design of the RSF, Tronox, their appointed design consultants and SRK hydrogeologists considered and compared the financial, technical and environmental implications (risks) of the following liner design alternatives:

- A liner with the specifications of a moderate quality Class C disposal facility at the RSF, i.e. base preparation layer and the installation of a High-density polyethylene (HDPE) liner;
- A liner with the specifications of an excellent quality Class C disposal facility at the RSF, i.e. base preparation layer and the installation of a HDPE liner;
- A liner with the specifications of a Class D disposal facility, i.e. an engineered base compaction layer; and
- "No liner", i.e. in-situ material without base preparation (as is the design of SD1 – SD5 at the East Mine) with mitigation (e.g. groundwater interception boreholes).

The permeability of engineered in-situ soils (i.e. a Class D disposal facility) is likely to be three orders of magnitude higher than in the fine residue material (i.e. infiltration through initial layers of deposited fines will be lower than an engineered base preparation layer on in-situ material) (Epoch, 2020). **Therefore, in-situ base preparation has a higher permeability than consolidated fines, and the no base preparation [or "no liner"] alternative equates to a Class D liner *in this circumstance*. Model outputs for the "no liner" alternative replicate groundwater dynamics for the "Class D" alternative, and separate model runs for the "no liner" alternative were therefore not required.**

Similarly, in order to assess the relative risk posed to the environment and to guide a risk based approach to the design of the Overburden stockpile, Tronox, their design consultants and SRK hydrogeologists considered the financial, technical and environmental implications (risks) of the following liner design alternatives for the Overburden stockpile:

- A liner with the specifications of a Class D disposal facility, i.e. an engineered base compaction layer will be installed; and
- "No liner" (the current, approved backfill strategy).

The results of these assessments (financial, technical and environmental) are presented below.

3.8.3.1 Changes to Groundwater Quality and Depth

From groundwater monitoring at the Mine it is understood that process water that is disposed of with fines and tailings in existing storage facilities and the pit infiltrates and elevates groundwater salinity (see Section 4.1.8.4). Infiltration, and the consequent impacts to receptors, is therefore a key consideration in the design (and applications for authorisation) of the East OFS RSF and Overburden stockpile.

The primary motivation for containing waste in a lined system is to prevent the mobilisation of contaminants to receptors (human or ecological) (SRK, 2016). In the context of this project, the receptors would be exposed through contaminants reaching them via groundwater (as a pathway). Specialist groundwater assessment (see Section 4.1.8) has determined that the only potential receptors to infiltration from existing operations are the Cawood Saltworks and ecological receptors in nearby ephemeral rivers (see Section 0).

In order to comparatively characterise infiltration from East OFS project for liner alternatives for the RSF and Overburden stockpile (and therefore inform a risk based approach to design), a three-dimensional (3D) groundwater model of both the Primary and Secondary Aquifers at the site was used

to model hydrogeological responses (groundwater infiltration and contamination) for the various contaminant transport scenarios (see Appendix D1).

Predictive scenarios were run over a period of 31 years (the life of the East OFS project). As mining and backfilling have been underway for many years at the site, the baseline (water levels and concentrations) are set to those previously modelled (SRK, 2019).

Post-mining predictive scenarios cover a period of 100 years, with outputs at 20, 50- and 100-years post-closure. During post-mining the model takes on the assumption that the deposited material over the RSF, STFs and Overburden stockpile have reduced in permeability and consolidate, causing a reduction in infiltration (K) by ~40% (SRK, 2016).

Natural baseline water quality in the study area ranges between ~600 to ~1 500 mS/m, with a mean of ~1000 mS/m, and is not potable (see Section 4.1.8.4). As seawater is used to process ore, and no chemical processes or treatments (besides separation of material using a flocculant) is proposed, leachate quality is assumed to be primarily that of seawater (i.e. with an Electrical Conductivity [EC] of ~5 000 mS/m) – i.e. source concentration is assumed to be 5 000 mS/m.

The results of modelling for the **baseline groundwater conditions** (pre-East OFS project) are summarised as follows:

- Pre-mining contaminant plumes (current Tronox operations until 2020) (Figure 3-8 and Figure 3-9) have an average concentration (primarily salinity) in the EOFS area of ~20% of source (i.e. ~1 000 mS/m) and similar to baseline conditions;
- The Primary Aquifer has higher concentrations than the Secondary Aquifer due to the increased vertical travel time and greater dilution potential due to the saturated thickness of this aquifer (see Figure 3-8);
- Higher concentrations in the Primary Aquifer *(*~50% of source - ~2 500 mS/m) are found near the Groot Goeraap River in the north-east as well as the eastern edge of the proposed location of STF2; and
- The Secondary Aquifer has concentrations of less than 10% of source (1 000 mS/m) throughout most of the East OFS mine footprint, with the exception of slightly higher concentrations *(*~30% of source) towards the Groot Goeraap River in the north-east.

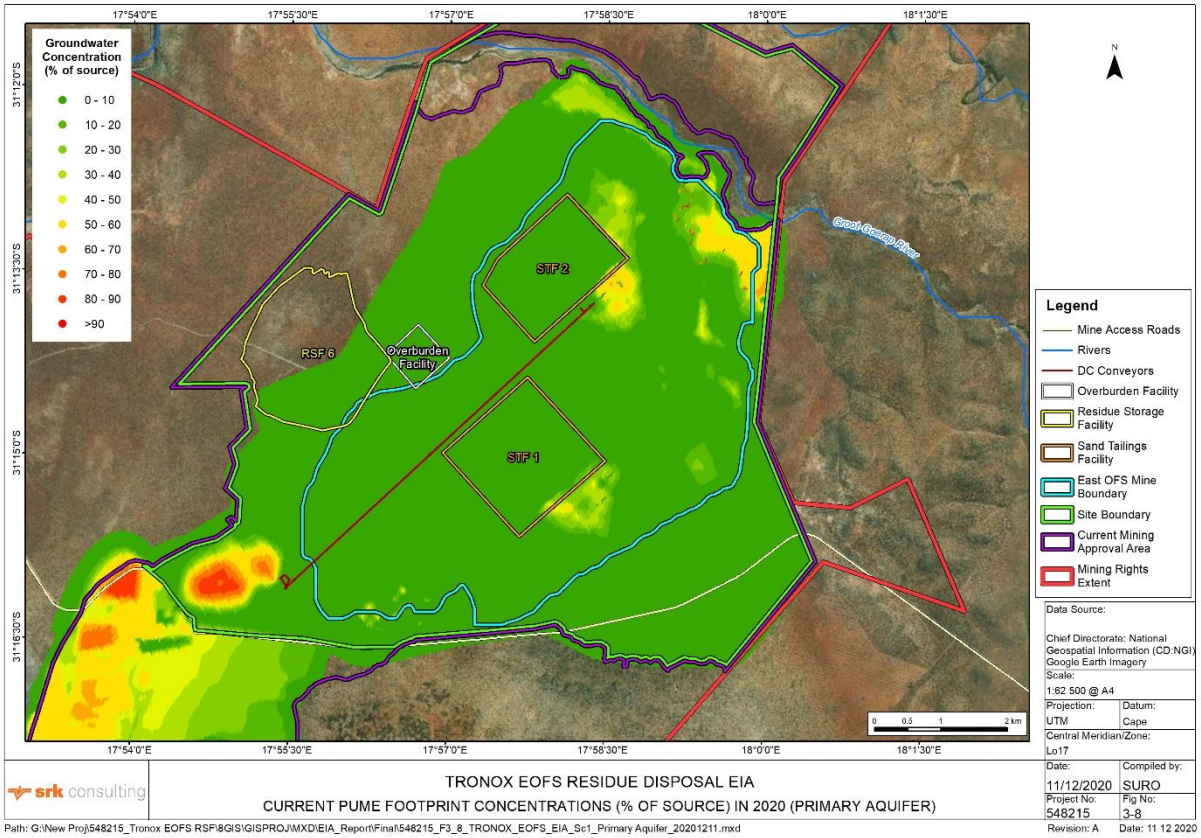

Figure 3-8: Current Plume Footprint Concentrations (% of source - Primary Aquifer)

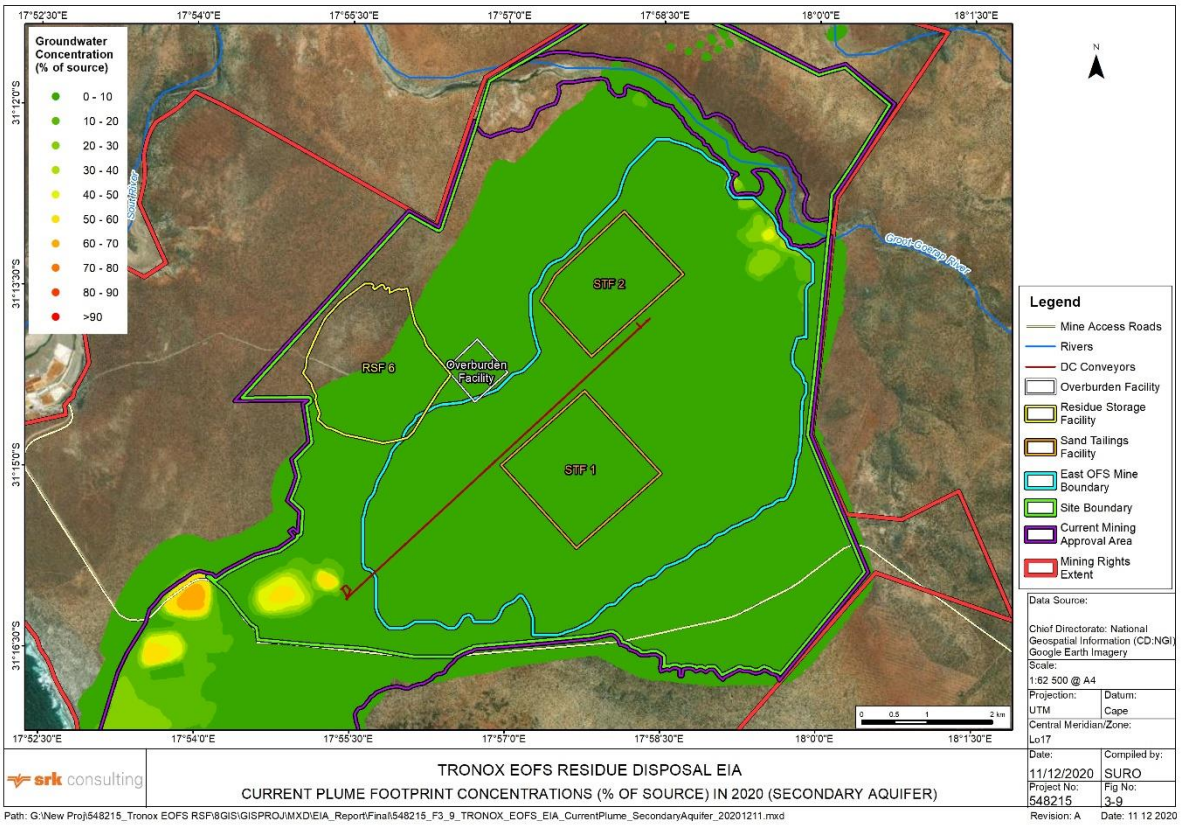

Figure 3-9: Current Plume Footprint Concentrations (% of source - Secondary Aquifer)

The results of modelling for the **end-of-mine and post-mining** groundwater contamination (quality) conditions are summarised as follows:

- Although the contaminant plume largely mimics the shape of the seepage area and remains largely within the mine area during mining and post-closure, the plume migrates from the East OFS mining area north-westerly and north-easterly towards the Sout River and the Groot Goeraap River respectively (see Figure 3-10 to Figure 3-15);
- The majority (~70%) of the contaminant plume footprint at the end of the East OFS project is under 5% source concentration for all liner scenarios, but the maximum concentrations in the Primary Aquifer are ~8% higher than the Secondary Aquifer, but the Secondary Aquifer contaminant plume extends further (~500 m) than the Primary Aquifer;
- The RSF contaminant plume is localised and has a maximum % source concentration of ~100% and 90% for the Primary and Secondary Aquifer respectively for all alternatives considered;
- The sand tailings (STF's and mine void) contaminant plume has a maximum % source concentration of ~60% and ~20% for the Primary and Secondary Aquifer respectively;
- The RAS tailings Overburden stockpile contaminant plume has a maximum % source concentration of ~60% without base preparation, and ~40% with base preparation in the Overburden stockpile footprint area, and the contaminant plume does not migrate beyond 200 m from the facility for both base preparation options (i.e. are confined to the RSF footprint area);
- Lining the RSF would reduce the concentration of the contaminant plume by ~7% and ~13% for the Class C "moderate installation" and Class D "excellent installation" alternatives respectively at the RSF footprint at the end of East OFS mining;
- The concentration of the contaminant plume at the RSF is similar further than 200m from the facility for all RSF liner alternatives;
- The contaminant plume migrates below the Groot Goeraap River (~10 mbgl in the Primary Aquifer) with a maximum concentration of ~10% of source (~1 000 mS/m) for all RSF liner alternatives (see Figure 3-10, Figure 3-12 and Figure 3-14);
- The contaminant plume may reach up to 5% of the source concentration (250 mS/m) in the Primary Aquifer at a stretch of ~50 m along the southern banks of the Sout River (see Figure 3-10, Figure 3-12 and Figure 3-14);
- The contaminant plume dissipates/decreases by an average ~30%, ~50% and ~80% for 2070, 2100 and 2150 respectively for all scenarios (see Figure 3-10 to Figure 3-15); and
- Negligible differences in plume extent are apparent between all RSF and Overburden stockpile liner alternatives considered. Concentration differences between scenarios are also relatively minor and confined to local footprint areas.

The results of modelling for the **end-of-mine and post-mining** groundwater mounding (quantity) conditions are summarised as follows:

- The greatest mounding effect (up to ~20 m) in local groundwater levels occur below the RSF (see Figure 3-10 to Figure 3-15); and
- Groundwater level mounding is very localised (within ~300 m of the source).

In conclusion, specialist hydrogeological assessment (see Appendix D1) has found that although the extent of the contamination plume would differ slightly (see Figure 3-10 to Figure 3-15), the potential impacts on human and ecological receptors is the same regardless of the liner alternative selected for the RSF and Overburden stockpile.

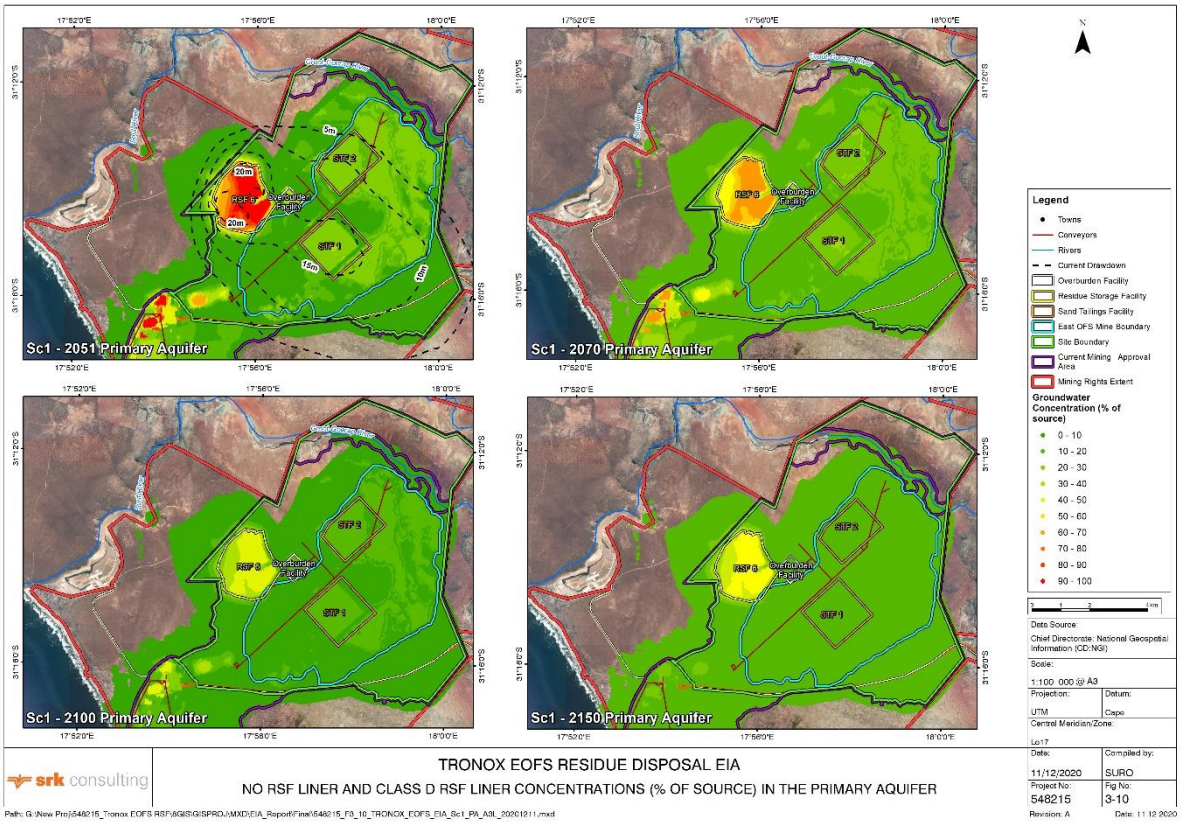

Figure 3-10: No RSF Liner and Class D RSF Liner Concentrations (% of source) in the Primary Aquifer

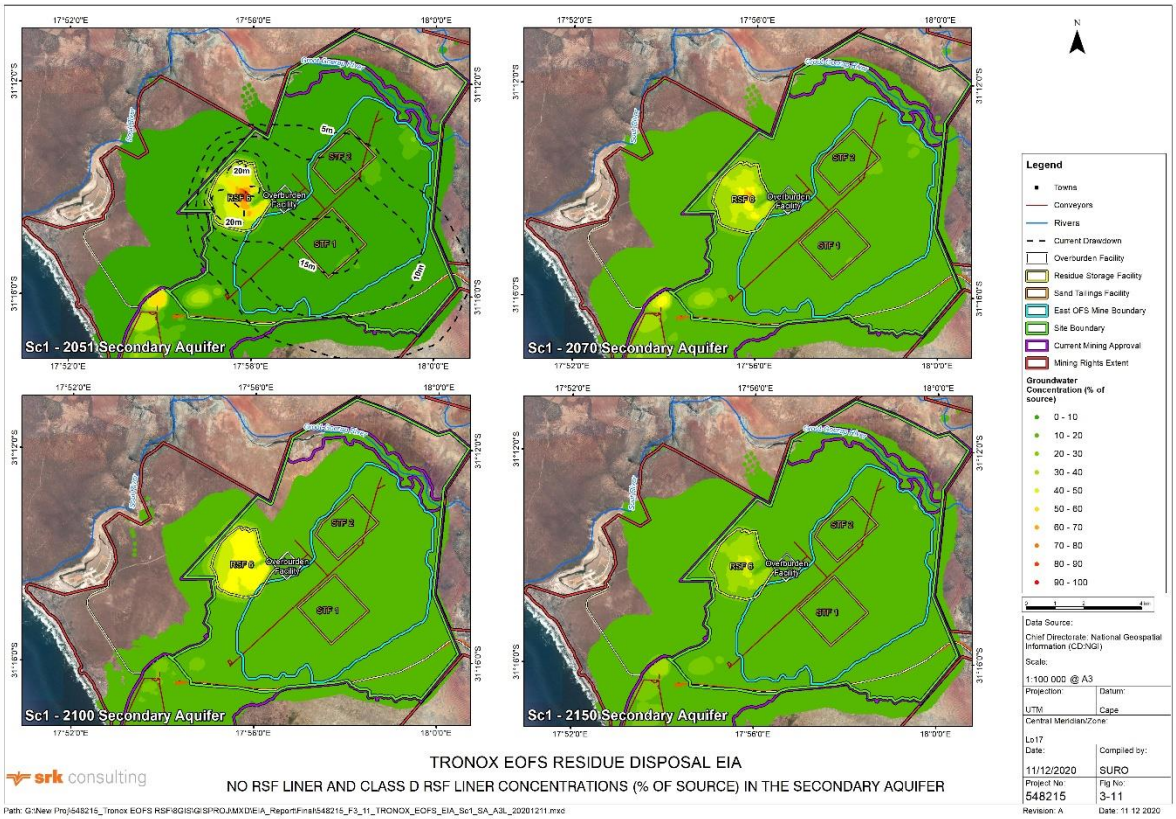

Figure 3-11: No RSF Liner and Class D RSF Liner Concentrations (% of source) in the Secondary Aquifer

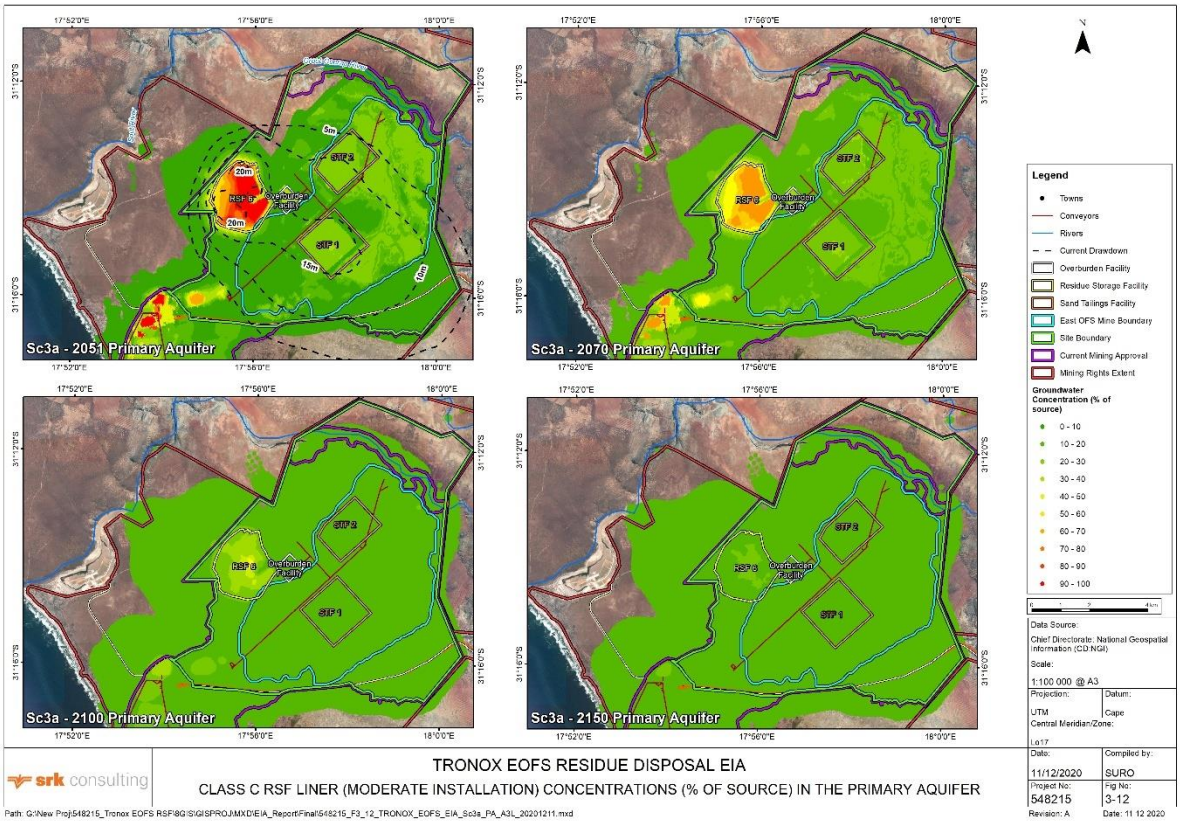

Figure 3-12: Class C RSF Liner (moderate installation) Concentrations (% of source) in the Primary Aquifer

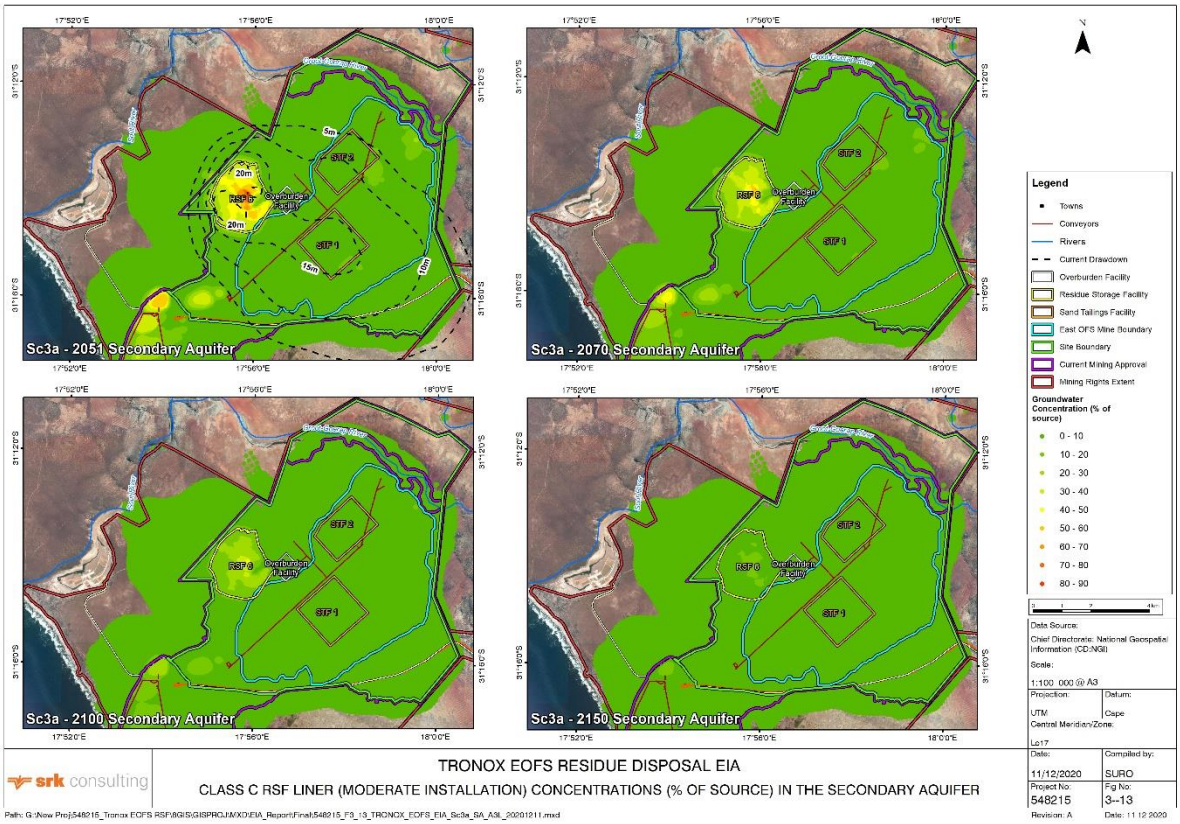

Figure 3-13: Class C RSF Liner (moderate installation) Concentrations (% of source) in the Secondary Aquifer

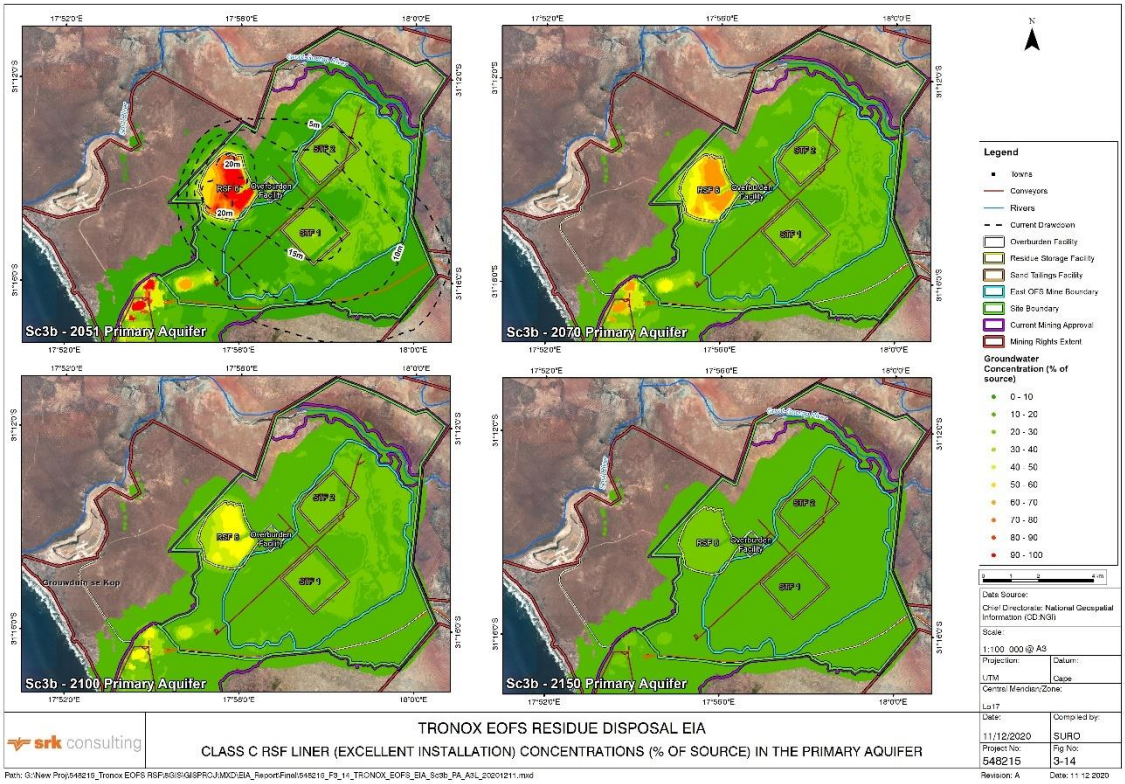

Figure 3-14: Class C RSF Liner (excellent installation) Concentrations (% of source) in the Primary Aquifer

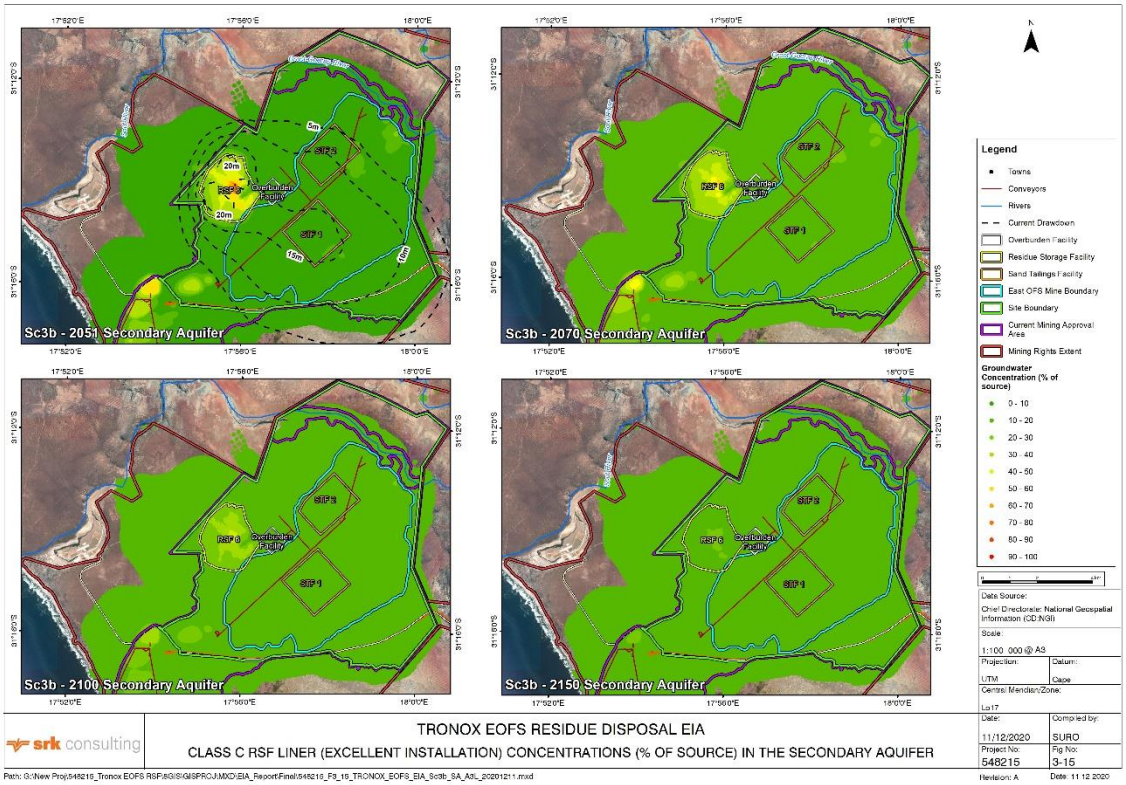

Figure 3-15: Class C RSF Liner (excellent installation) Concentrations (% of source) in the Secondary Aquifer

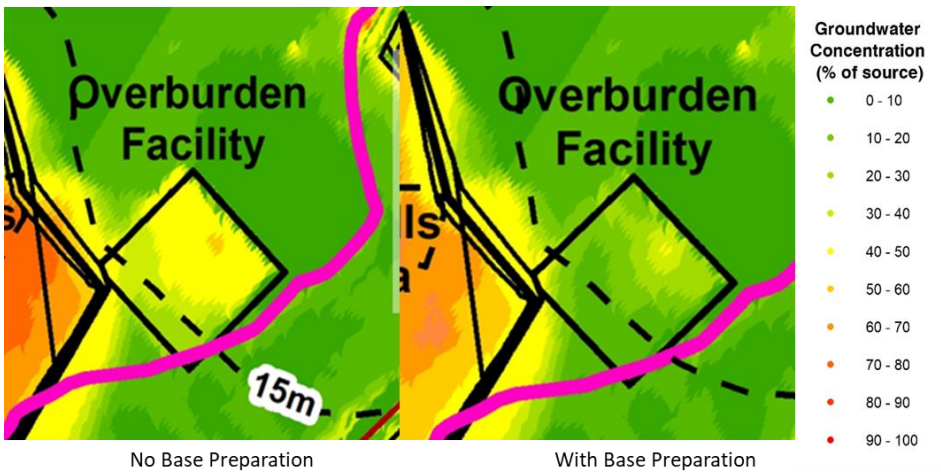

Figure 3-16: Overburden stockpile with and without base preparation at the of East OFS mining

3.8.3.2 Financial Considerations

The total cost (Capex) of the unlined RSF is estimated to be ~R78 million (in 2019 prices). The additional cost to prepare the base of the facility to Class D specification is estimated to be R51 million (a 65% increase in cost), and the additional cost to line the facility to Class C specification (i.e. including an HDPE liner) is estimated by Tronox to be R478 million over the base cost (a ~600% increase in cost). Tronox has advised that it is not financially feasible to install a geosynthetic liner at the RSF, and that the in-situ preparation of Class D base layer would affect project viability significantly (and is therefore not preferred).

No additional Capex is required to establish an unlined Overburden stockpile (as this stockpile would be established through normal operations, and therefore costs would be accounted for as Opex). The additional cost to prepare the base of the Overburden stockpile to Class D specification is estimated to be R7 million.

The Class C liner alternatives will also entail additional operational and maintenance costs over the "no liner" alternative.

3.8.3.3 Conclusion

Noting the findings of the groundwater impact assessment (Appendix D1) and waste classification (Appendix C3), Epoch (2020) find that as fines are non-acid forming and inert, and as the Geochemical Abundance Index (GAI) shows no significant enrichment relative to the global soil medium concentration, a Class D or similar seepage containment barrier would be appropriate for the RSF. **However, as the fines material has an order of magnitude lower permeability than the in-situ soil, Epoch (2020) conclude that a Class D containment barrier would result in no real benefit.**

Similarly, SRK (2020) concludes that the contaminant plume does not migrate further than 200 m from the facility.

Therefore, considering the impacts on revenue at the Mine, the assessment that receptors will not be affected by the containment alternative selected for either the RSF or Overburden stockpile (see Section 3.8.3.1), and in-situ base preparation has a higher permeability than consolidated fines (i.e. no base preparation [or "no liner"] equates to a Class D liner in this circumstance), Tronox believe that the additional capital expenditure required for containment of the RSF and Overburden stockpile is not justified.

Furthermore, based on the results of the risk based assessment, practicality and financial considerations, Tronox motivate that the “no liner” alternative (which in this case equates to a Class D liner alternative) is the only reasonable and feasible containment design alternative for the RSF and Overburden stockpile. SRK agrees that the “no liner” alternative is environmentally acceptable, based on the risk based assessment.

3.8.4 Technology Alternatives

Return Water Recovery

No technology alternatives (other than the No-Go alternative) are considered in this EIA process; however, Tronox has in the past investigated a number of alternatives to return process water from the RSF. These include:

- Barge decant – as is proposed;
- Penstock intakes – not viable as this alternative requires gravity feed (see below); and
- Underdrainage – not viable as this alternative requires gravity feed (see below).

A penstock is a vertical tower, most commonly positioned in the centre of an RSF, which decants water from the supernatant pool by feeding it (via gravity) into a horizontal outlet pipeline which conveys the decanted water to a return water structure. An underdrainage system collects seepage from below an RSF.

Given that the selected site is a depression (is bowl shaped), the lowest point in the RSF will be in the middle of the depression. There is over 25 m difference in elevation between the lowest point (centre of the depression) and the highest point (edge of the RSF). Therefore, the outlet of either a penstock or underdrainage system would need to be installed underground in order to naturally drain and daylight into a return water structure. Based on the topography of the site, the underground outlet pipe would need to extend over 300m beyond the downstream toe/edge of the RSF to an area of lower elevation than the centre of the RSF / depression.

These options would require significant earthworks and be extremely costly. They have thus been excluded as options.

Barge decant technology (including a tailings embankment) has therefore been selected by Tronox as the preferred alternative for the recovery of process water. This system will include a floating barge/inlet with a semi-mobile pump installed on an access ramp at the supernatant pool.

Co-disposal of Fines and Tailings

Over the past ten years Tronox has investigated co-disposal of tailings and fines at the Mine, but none of the options investigated by Tronox are financially viable.

Tailings Backfill Strategy

Tronox is currently authorised to haul and backfill all sand tailings from existing load-out bins at the DCC into the East OFS pit. Since only a very small proportion (~5.57%) of processed OFS reports as product, the remaining residue (~94.43%) is either disposed of in RSFs or backfilled (tipped) into the shallow void, almost to pre-mining ground level, and thereafter profiled to very closely mimic pre-mining topography. However, further analysis of deeper mining of OFS has demonstrated to Tronox that this approach to sand tailings disposal will not be feasible because haul trucks cannot tip under these conditions (posing a safety risk) or get stuck when driving over thick backfilled layers of sand tailings leading to risky operations (i.e. potential risks), mechanical breakdowns (drivetrain failure) and delays, with concomitant increased operational costs and decreased production.

The revised sand tailings disposal method (conveying to STFs) is therefore a technology alternative to the approved sand tailings disposal methodology.

3.8.5 No-Go Alternative

The No-Go alternative has been be considered in the EIA in accordance with the requirements of the EIA Regulations, 2014.

Should the application for the modified residue disposal method proposed in this application be refused, the East OFS project will not be technically feasible, and mining activities would cease in the East Mine in 2024. The financial viability of the Mine (operating out of the West Mine only) and smelter in Saldanha Bay would be threatened, and those employed directly at the East Mine would be retrenched.

3.9 Project Design and Construction

The following section outlines the approach to construction of the infrastructural components and upgrades as listed in Section 3.7.

3.9.1 Design and Construction of RSF 6

3.9.1.1 Design and Layout

The design *report* for RSF 6 is included as Appendix C2.

The walls of the facility will be a maximum of 25.5 m high and will be built at a slope of 1:2 – 1:3. The facility will have a ~380 ha footprint, located north of the PCP East and on the northern boundary of the East Mine (see Figure 3-18 and Figure 3-21)[18].

Stormwater diversion channels will be installed to divert stormwater away from the facility (see Figure 3-18 and Section 3.10.7)

3.9.1.2 Capacity and Lifespan

The RSF (6) will have a volumetric capacity (for slurried fines) of ~66 Mm^3, sufficient to store approximately 38.9 Mt / 14.6 Mm^3 of dry-fine residue equating to approximately 20 years of fines production (assuming a 0.56% grade cut-off resource) from the East OFS project (noting that constant dewatering will take place during operations).

Should favourable financial circumstances prevail during mining and Tronox is able to mine to the 0.4% grade cut-off, an additional RSF will be required for the East OFS project, and will be the subject of a subsequent application.

3.9.1.3 Base Preparation

Based on the findings of specialist and technical assessment, Tronox motivate that the “no liner” alternative is the only reasonable and feasible containment design alternative for the RSF (see Section 3.8.3), and the “no-liner” alternative is assessed in the EIA.

3.9.1.4 Wall Construction

Walls of the facility will be built from sand tailings conveyed from the PCP East during the first four months of the East OFS mining operation (see Section 3.10.5). Both the internal and external slopes

[18] Mining is approved on the RSF footprint and the RAS resource will be mined in most of the footprint of this facility.

of the walls will be constructed at an approximate slope angle between 1:25 and 1:3, with a crest width of approximately 30 m. RSF walls will be sloped to an angle of 1:5 prior to closure.

3.9.1.5 Pump and Pipeline Installations

Two ~2 800 m long fine residue pipelines and one 2 800 m long return water pipeline will be installed in the same corridor directly between the PCP East and the RSF, on the south-eastern boundary of the East OFS mining project (see Figure 3-19). The corridor is transformed / approved for mining.

The Ø513 mm fine residue pipelines will each have a maximum throughput of 2 000 m^3 / hour (i.e. 556 l/s), and the Ø513 mm return water pipeline 2 000 m^3 / hour (i.e. 556 l/s).

Two pumps will be installed (one on a floating barge in the supernatant pool of the RSF and the other in a pumphouse on the RSF wall) to pump recovered water from the RSF through a return water pipeline to the existing process water dam at the PCP East. These pumps will have a capacity of 860 m^3 / hour. Two additional (and identical) pumps will be available on site as a stand-by system.

3.9.2 Design and Construction of Overburden Stockpile

3.9.2.1 Design and Layout

A conceptual design of the Overburden stockpile is provided in Appendix C1.

The stockpile will be approximately 7 m high, ~700 m in length and width, occupying ~45.5 ha at the location indicated in Figure 3-21. The outer slopes of the stockpile will be constructed to a slope angle of 1:1.73 (30°), and stormwater diversion channels will be installed to divert stormwater away from the stockpile (see Figure 3-17 and Section 3.10.7).

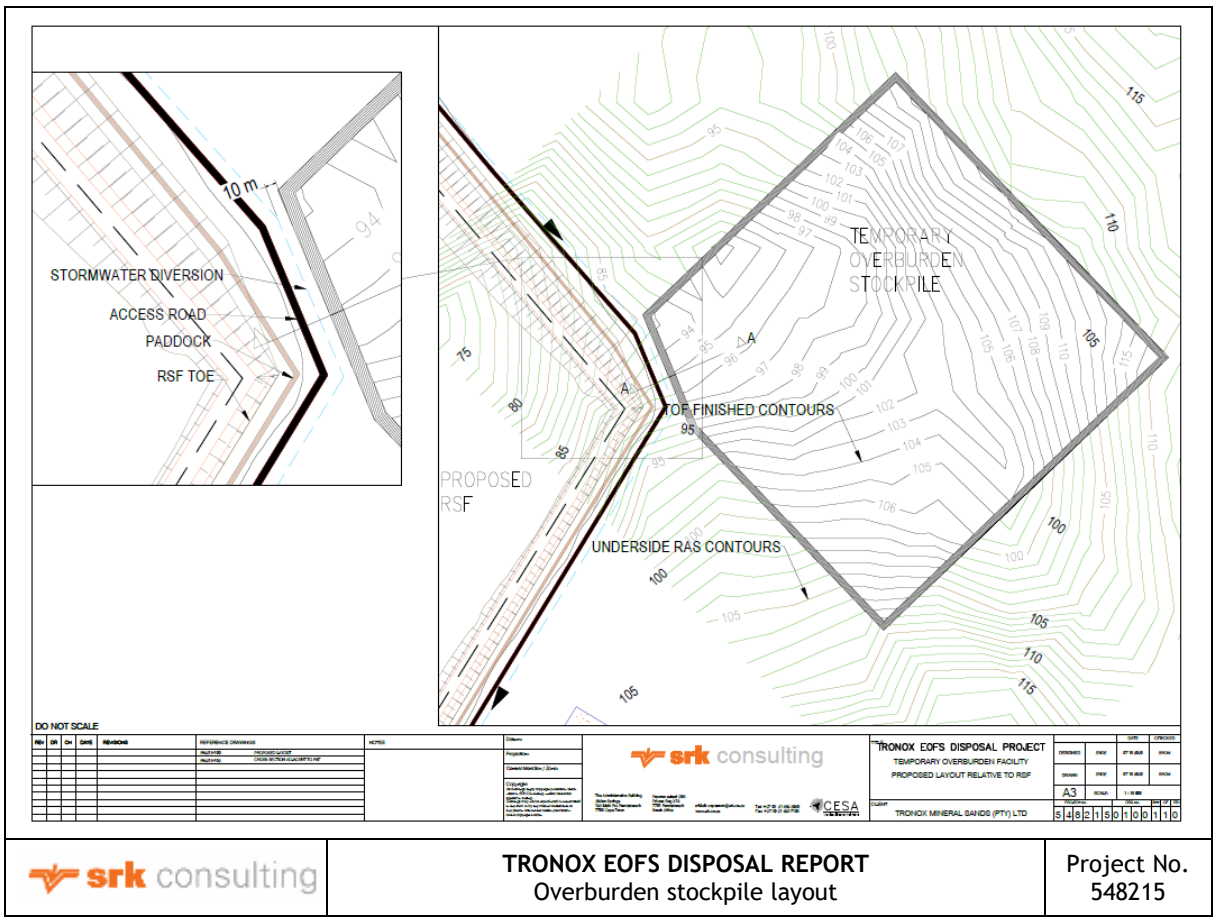

Figure 3-17: Overburden stockpile layout

Source: Tronox