

Modified Namakwa Sands East OFS Project Residue Disposal Plan

Environmental Management Programme

Report Prepared for

Tronox Mineral Sands (Pty) Ltd

TRONOX 

SRK Report Number 548215/8

DMRE Reference Number: WC30/5/1/2/2/10040 MR

DHSWS Reference Number: WU16841



Report Prepared by



February 2021

Modified Namakwa Sands East OFS Project Residue Disposal Plan Environmental Management Programme

Tronox Mineral Sands (Pty) Ltd

DMRE Reference Number: WC30/5/1/2/2/10040 MR

DHSWS Reference Number: WU16841

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

January 2021

Compiled by:

Matthew Law
Principal Environmental Consultant

Sue Reuther
Principal Environmental Consultant

Email: mlaw@srk.co.za

Authors:

Matthew Law, Sue Reuther

Peer Reviewed by:

Chris Dalgliesh
Principal Environmental Consultant

Note:

The EMPr was updated at the end of the comment period to produce this slightly revised EMPr for submission to the Department of Minerals and Energy (DMRE).

All changes in EMPr vis-a-vis the previously released EMPr are italicised and underlined for easier reference.

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.

Project Director and Reviewer: Christopher Dalglish, BBusSc (Hons); MPhil (EnvSci)

Registered EAP No. 2019/413

Chris Dalglish 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 ESIs, 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: Sure 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.

Table of Contents

1. Introduction	1
1.1 Background	1
1.2 Content of the EMPr	2
2. Site and Project Description.....	6
2.1 Site Description	6
2.2 Project Background.....	7
2.3 Project Description	8
2.3.1 Sensitive areas	10
2.4 Potential Impacts	10
2.5 Impact Management Objectives	12
3. Scope and Purpose of the EMPr	14
3.1 Scope of the EMPr.....	14
3.2 Purpose of the EMPr.....	15
4. EMPr Management Structure and Implementation.....	16
4.1 Management Structure and Implementation during Design	16
4.2 Management Structure and Implementation during Construction	16
4.2.1 Roles and Responsibilities of the SPM and NOM.....	17
4.2.2 Roles and Responsibilities of the Radiation and Environmental Specialist or North SHE Leader and EP	17
4.2.3 Roles and Responsibilities of Team Supervisors, Construction Personnel and Contractors 17	17
4.2.4 Compliance Monitoring and Reporting.....	18
4.2.5 Method Statements	18
4.2.6 Non-Compliance and Corrective Action	19
4.3 Management Structure and Implementation during Operations and Closure	19
4.3.1 Compliance Monitoring and Reporting.....	19
4.4 Environmental Awareness Training.....	20
5. Environmental Management Objectives and Commitments	22
5.1 Environmental Management Measures for Detailed Design	23
5.2 Environmental Management Measures for Construction	26
5.3 Environmental Management Measures for Operations	34
6. Decommissioning	40
6.1 Rehabilitation of Backfilled Areas	40
6.1.1 Topsoil and Vegetation Removal, Reprofiling and Replacement	41
6.1.2 Erection of Windbreaks	41
6.1.3 Re-vegetation	41
6.1.4 Monitoring.....	41
6.2 Rehabilitation and Closure of Residue Stockpiles	42
6.2.1 Fine Residue Storage Facilities	42

List of Tables

Table 1-1:	Content of the EMPr as prescribed by the EIA Regulations, 2014.....	2
Table 2-1:	Existing Namakwa Sands Mine properties	6
Table 2-2:	Potential impacts of the proposed project.....	12
Table 2-3:	Impact management objectives	12
Table 4-1:	Compliance monitoring for construction	18
Table 4-2:	Compliance monitoring applicable to the project.....	19
Table 4-3:	Compliance reporting applicable to the project.....	20
Table 5-1:	Environmental management measures for Detailed Design	23
Table 5-2:	Environmental management specifications for construction activities.....	26
Table 5-3:	Environmental management specifications for Operations	34

List of Figures

Figure 1-1:	Locality map	4
Figure 1-2:	Mine layout.....	5
Figure 2-1:	East Mine Operations	8
Figure 2-2:	East OFS project layout and indicative mining sequence	10
Figure 2-3:	Sensitive areas identified in the EIA process.....	11
Figure 6-1:	Residue stockpile (RSF) wall rehabilitation at Namakwa Sands Mine	42

Acronyms and Abbreviations

DHSWS	Department of Human Settlements, Water and Sanitation
DMRE	Department of Mineral Resources and Energy
DCC	Dual Carry Conveyor
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EMS	Environmental Management System
EP	Environmental Practitioner
HMC	Heavy mineral concentrate
HMS	Heavy Mineral Sands
m	Metres
mbgl	Metres below ground level
Mine	the Mine at Brand se Baai
MLM	Matzikama Local Municipality
MPRDA	Mineral and Petroleum Resource Development Act 28 of 2002
MSDS	Material Safety and Data Sheet
MSP	Mineral Separation Plant
NEM:WA	National Environmental Management Waste Act 59 of 2008
NEMA	National Environmental Management Act 107 of 1998, as amended
NOM	Northern Operations Manager
NWA	National Water Act 36 of 1998
PCP East	Primary Concentration Plant East
PCP West	Primary Concentration Plant West
RSF	Residue Storage Facility
S&EIR	Scoping and Environmental Impact Reporting
SPM	Strategic Projects Manager
STF	Sand Tailings Facility
SCP	Secondary Concentration Plant
SHE	Head Safety, Health and Environment
SPM	Special Project Manager
SRK	SRK Consulting (South Africa) Pty Ltd
Tronox	Tronox Mineral Sands (Pty) Ltd
Tronox NS	Tronox Namakwa Sands
WCDM	West Coast District Municipality
WML	Waste Management Licensing
WUL	Water Use Licence

Glossary

Activity	An activity or operation carried out as part of the construction or operation of the power plant
Aspect	An action, event, product or service, occurring as a component or result of an activity, which interacts with the existing environment (or which results in impacts to it)
Contractor	Any company appointed by the proponent to undertake construction or related activities on site, and will include the main Contractor, as well as any Sub-Contractors.
Construction Phase	The stage of project development comprising site preparation as well as all construction activities associated with the development.
Contaminated water	Water contaminated by activities on site, e.g. concrete water and run-off from plant / personnel wash areas.
Design Phase	The stage during which detailed layout and development plans are prepared, including the drafting of contract documents for construction.
Environment	The external circumstances, conditions and influences that surround and affect the existence and development of an individual, organism or group. These circumstances include biophysical, social, economic, historical and cultural aspects.
Environmental Authorisation	The authorisation by a competent authority of a listed activity or specified activity in terms of NEMA.
Environmental Impact Assessment	A process of evaluating the environmental and socio-economic consequences of a proposed course of action or project
Environmental Management Measures	Requirements or specifications for environmental management, as presented in the EMPr, some of which are based on the mitigation measures identified in the EIA Report.
Freeboard limit	The vertical distance between the crest of a dam (RSF) and the pond surface
Hazardous substance	A substance (including materials and waste) that can have a deleterious (harmful) effect on the environment and those substances declared hazardous substances in terms of the Hazardous Substances Act 15 of 1973.
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.
Method Statement	A mandatory written submission by the Contractor to the Head SHE / EP setting out the plant, materials, labour and method the Contractor proposes using to carry out an activity.
Mitigation Measures	Actions identified in the EIA Report to manage (avoid, minimise or optimise) potential environmental impacts which may result from the development.
Non-draining catchment	A catchment that does not drain even in rare rainfall events.
Operations Phase	The stage of the works (including maintenance) following the Construction Phase, during which the development will function or be used as anticipated in the Environmental Authorisation.

Performance indicator	A measurable indicator of the outcome of environmental management, used to assess the success with which mitigation measures have been implemented. Often captures the results of several different monitoring activities.
Phase	A defined period during the life of the power plant project, e.g. the <i>Construction</i> and <i>Operations</i> Phases.
Proponent	The person or organisation implementing the project.
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.
Resources	The personnel, financial, equipment and technical requirements necessary for the successful completion of mitigation measures and for monitoring activities.
Solid waste	All solid waste including construction debris, chemical waste, broken / redundant equipment, oil filters, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).
Sub-Contractors	A Sub-Contractor is any individual or Contractor appointed by the main Contractor, to undertake a specific task on site.
Supernatant Pool	Pool of liquid lying above a solid residue after settlement.
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 Namakwa Sands are either coarse or fine (fine residue).
Vadose Zone	The part of earth between the land surface and the groundwater level.

1. Introduction

1.1 Background

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 *finer*. 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 the establishment of two large Sand Tailings Facilities [STFs] - sand tailings stockpiles) and upgrade of infrastructure.

The project is associated with operations that take place within Tronox's East Mine only and does not relate to operations in the West Mine.

The project requires:

- Environmental Authorisation (EA) from the Department of Mineral Resources and Energy (DMRE) in terms of the National Environmental Management Act 107 of 1998, as amended (NEMA), and the Environmental Impact Assessment (EIA) Regulations, 2014 (promulgated in terms of NEMA);
- A Waste Management Licence (WML) from the DMRE in terms of the National Environmental Management Waste Act 59 of 2008 (NEM:WA);
- An amendment to the existing approved EMPr in terms of the Mineral and Petroleum Resource Development Act 28 of 2002 (MPRDA); and
- A Water Use Licence (WUL) amendment from the Department of Human Settlements, Water and Sanitation (DHSWS) in terms of the National Water Act 36 of 1998 (NWA).

In terms of NEMA, and the EIA Regulations, 2014, a Scoping and Environmental Impact Reporting (S&EIR, also referred to as an EIA) process is required to support these applications. NEMA also requires that an EMPr be submitted along with the EIA Report to demonstrate how environmental management and mitigation measures will be implemented.

SRK Consulting (South Africa) (Pty) Ltd (SRK) has been appointed by Tronox to undertake the S&EIR process and compile the EIA Report and EMPr for the project.

The EIA Report and EMPr will be released for public comment before submission to the DMRE and DHSWS for consideration.

The EMPr is a management tool in which the mitigation (and optimisation) measures are presented as *environmental management measures*, with a clear indication of the responsibilities for the

implementation, funding and monitoring of these measures during the Design, Construction and Operational Phases of the project.

Note: This EMPr has been released for stakeholder comment with the EIA Report. Comments by stakeholders may-, and conditions of the various licences that are required will- be incorporated into this EMPr should the project be authorised.

1.2 Content of the EMPr

The EIA Regulations 2014, promulgated in terms of NEMA (GN R982, which came into effect on 8 December 2014, as amended by GN R326) prescribe the required content in an EMPr. These requirements and the sections of this EMPr in which they are addressed, are summarised in Table 1-1.

Table 1-1: Content of the EMPr as prescribed by the EIA Regulations, 2014

GN 982 Ref.:	Item	Section Ref.:
(a) (i)	Details of the person who prepared the EMPr	Page i
(a) (ii)	Expertise of that person to prepare an EMPr	Page i
(b)	A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	2.3
(c)	A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating areas that should be avoided, including buffers;	Figure 2-3
(d)	A description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including-	0 and 2.5
(d)(i)	Planning and design;	
(d)(ii)	Pre-construction activities;	
(d)(iii)	Construction activities	
(d)(v)	Where relevant, operation activities;	
(d)(iv)	Rehabilitation of the environment after construction and where applicable post closure; and	5.2, 5.3 and 6
(f)	A description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraphs (d) will be achieved, and must, where applicable, include actions to-	5.2 and 5.3
(f)(i)	Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;	
f(ii)	Comply with any prescribed environmental management standards or practices;	
f(iii)	Comply with any applicable provisions of the Act regarding closure, where applicable; and	6
f(iv)	Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	6 ¹
(g)	The method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	4.2.4 and 4.3.1
(h)	The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	4.2.4 and 4.3.1
(i)	An indication of the persons who will be responsible for the implementation of the impact management actions;	4.2 and 4.3

¹ The closure cost estimate for the East OFS Project is appended to the EIA Report to be submitted to the DMRE for approval (SRK Report Number 548215/5)

GN 982 Ref.:	Item	Section Ref.:
(j)	The time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	4.2.4 and 4.3.1
(k)	The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f)	4.2.4 and 4.3.1
(l)	A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	4.2.4 and 4.3.1
(m)	An environmental awareness plan describing the manner in which-	4.4
(m)(i)	The applicant intends to inform his or her employees of any environmental risk which may result from their work; and	
(m)(ii)	Risks must be dealt with in order to avoid pollution or the degradation of the environment; and	
(n)	Any specific information that may be required by the competent authority.	

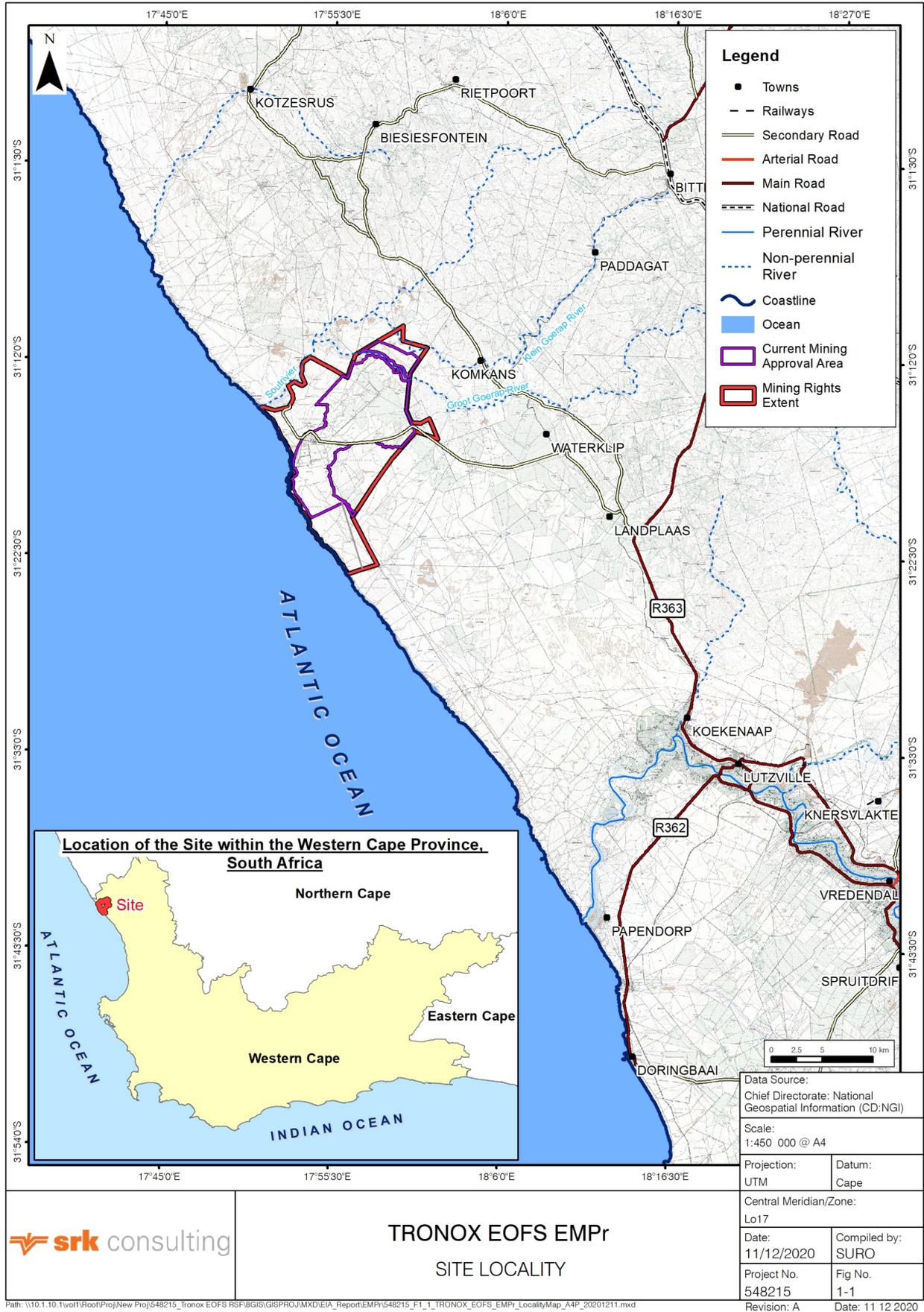
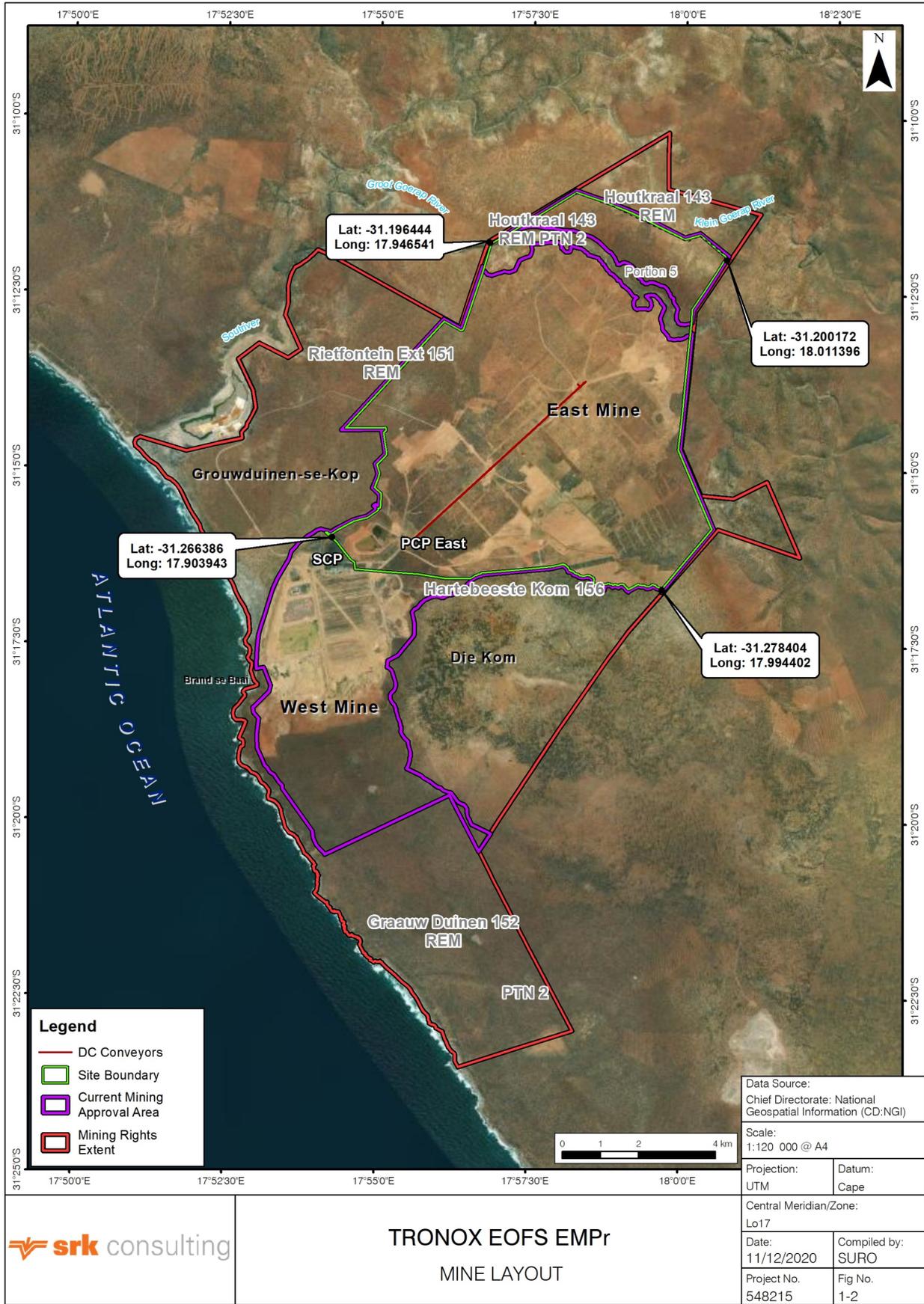


Figure 1-1: Locality map



Path: \\10.1.10.1\vol11\Root\Proj\New Proj\548215_Tronox EOFS RSF\GIS\GISPROJ\MXD\EA_Report\EMPr\548215_F1_2_TRONOX_EOFS_EMPr_MineLayout_A4P_20201211.mxd Revision: A Date: 11 12 2020

Figure 1-2: Mine layout

2. Site and Project Description

2.1 Site Description

The Mine is located at Brand se Baai 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.

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 22 February 2016 respectively – see area demarcated with red on Figure 1-2. This area consists of the 13 properties listed in Table 2-1. 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 heavy minerals using open-cast strip-mining methods from the East Mine and the West Mine – see Figure 1-2 and Table 2-1. Properties to which this application relates are indicated in **bold**. The Mine precinct comprises long-term surface infrastructure to support mining, including administration and workshop buildings, two large PCPs and an 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, tailings and rejects stockpiles, a wide network of haul roads and conveyors and earthmoving machinery and equipment.

Table 2-1: 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), 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.

2.2 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.

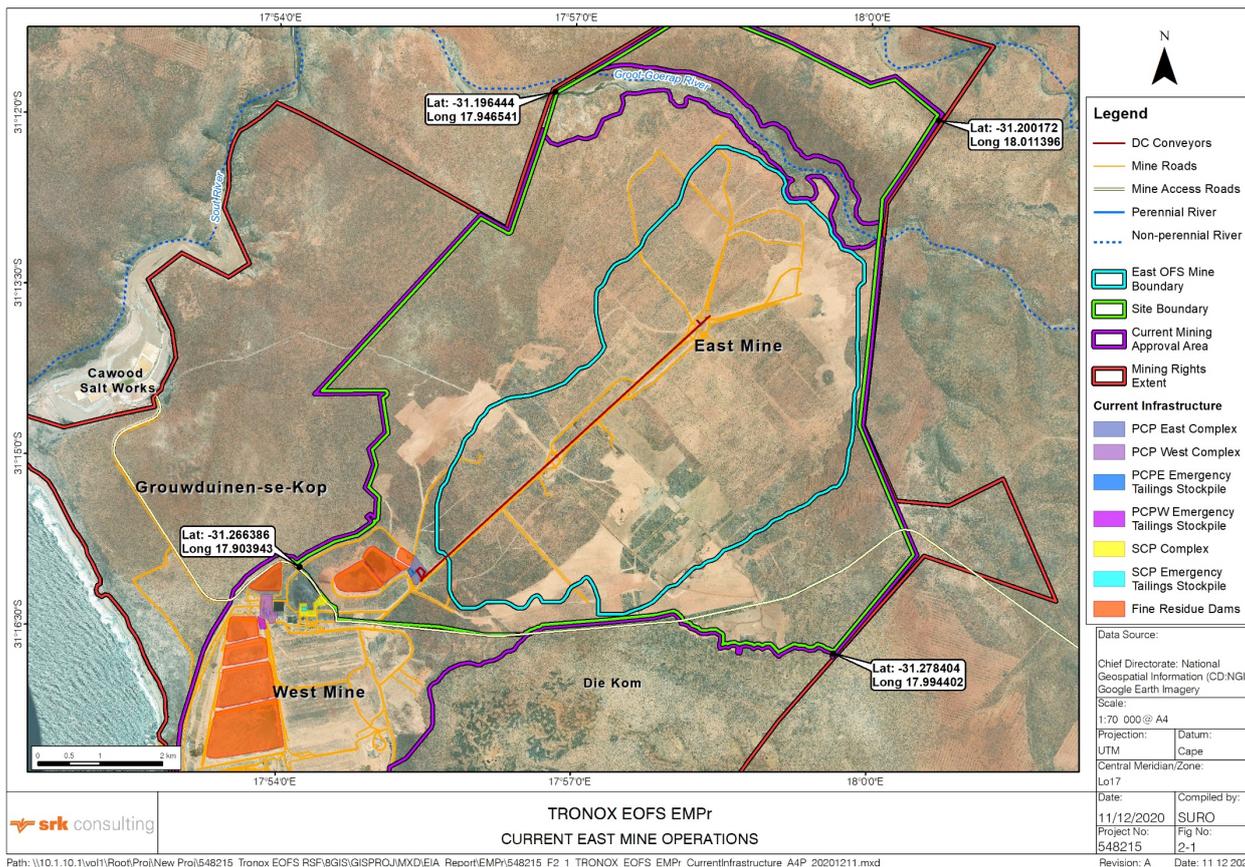


Figure 2-1: East Mine Operations

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 Figure 2-1), and to upgrade the PCP East in order to process East OFS ore.

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).

2.3 Project Description

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 the current EIA process (and referred to as “the project”). The project description therefore focusses predominantly on these changes only.

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

- The current EMPr 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 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;

- Tipping (single stacking²) sand tailings by haul truck to a minimum depth of 1 m in portions of the 8 m deep mining pit; and
- Deeper backfilling of sand tailings with conveyor and stacker systems at two STFs (sand tailings facilities)³ 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 2-2).

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/higher backfill (the STFs) that would protrude on average 14 m above the mined out pit.

- Establishing a ~400 ha, approximately 66 Mm³ (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;
- Establishing a 50 ha RAS tailings Overburden Stockpile with a capacity of 3.15 Mm³ in an area approved for mining east of the proposed RSF (see Figure 2-2);
- Expansion of the seawater intake by installing a new de-aeration sump; and
- Demolishing three structures within the East OFS pit, each more than 60 years old.

² 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).

³ 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).

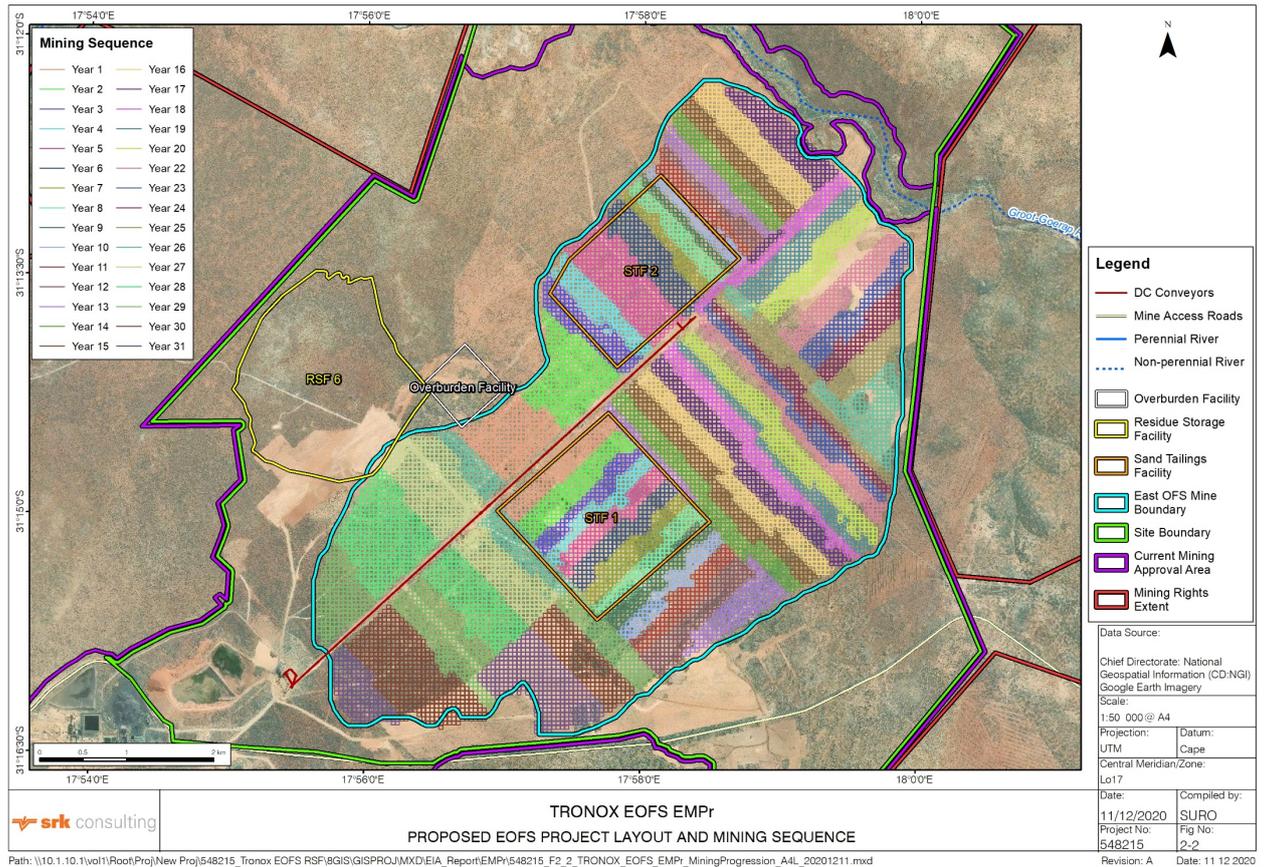


Figure 2-2: East OFS project layout and indicative mining sequence

2.3.1 Sensitive areas

Sensitive, or No-Go areas, relevant to the project are the “Hardpan” area located to the west of the RSP and Overburden Stockpile and the Groot Goeraap River. These areas are mapped in Figure 2-3.

2.4 Potential Impacts

A summary of the potential impacts of the proposed development identified and assessed in the EIA Report is presented in Table 2-2. Additional details on the nature of these impacts are provided in the EIA (SRK Consulting Report No: 548215/5, January 2021).

Figure 2-3: Sensitive areas identified in the EIA process

Table 2-2: Potential impacts of the proposed project

Impact	Description	Impact Status
Construction Phase		
Air Quality	Impaired air quality caused by increased particulate matter concentrations and dust fallout	Negative
Groundwater	Groundwater contamination	Negative
Marine Ecology	Loss of Littorina habitat in the de-aeration sump development footprint	Negative
	Pollution of the marine ecosystem and seawater contamination	Negative
Aquatic and terrestrial ecology	Vegetation loss from the installation of pipelines	Negative
	Physical disturbance to aquatic ecosystems	Negative
Socio-economic	Increased revenue to government and economic investment during construction	Positive
Visual	Altered sense of place and visual intrusion caused by earthworks and dust	Negative
Traffic	Increased traffic causing congestion or delays during construction	Negative
Heritage	Loss of heritage structures	Negative
Operation Phase		Negative
Air Quality	Impaired air quality caused by increased particulate matter concentrations and dust fallout	Negative
Hydrology	Alterations to surface water flow patterns	Negative
Groundwater	Groundwater contamination	Negative
Aquatic and terrestrial ecology	Degradation of natural ephemeral pans	Negative
	Vegetation loss from increased erosion	Negative
	Physical disturbance to aquatic ecosystems	Negative
	Changes in plant communities in the Sout River	Negative
	Changes in plant communities in the Groot Goeraap River	Negative
Socio-economic	Decline in production at the Cawood Saltworks	Negative
Visual	Altered sense of place and visual intrusion caused by earthworks and dust	Negative
	Altered sense of place and visual intrusion caused by the RSF, Overburden Stockpile and change in topography	Negative
Decommissioning Phase		
Socio-economic	Delayed return to the agricultural potential of the footprint of RSF6	Negative
Visual	Altered sense of place and visual intrusion caused by the RSF, Overburden Stockpile and change in topography	Negative

2.5 Impact Management Objectives

Impact management objectives, which the management measures listed in Table 5-1, Table 5-2 and Table 5-3 are recommended in order to achieve, are listed in Table 2-3.

Table 2-3: Impact management objectives

Impact Description	Management Objective
Construction Phase	
Impaired air quality caused by increased particulate matter concentrations and dust fallout	Maintain air quality within South African air quality standards at the Mine boundary to prevent offsite impacts
Groundwater contamination	Implement sound waste management procedures and control hydrocarbon and hazardous substance use on site to prevent contamination

Impact Description	Management Objective
Loss of Littorina habitat in the de-aeration sump development footprint	Restrict the footprint of construction activities
Pollution of the marine ecosystem and seawater contamination	Prevent pollution of the marine environment
Vegetation loss from the installation of pipelines	Restrict the footprint of construction activities
Physical disturbance to aquatic ecosystems	Prevent access to No-Go areas (see Figure 2-3).
Increased revenue to government and economic investment during construction	Promote local procurement
Altered sense of place and visual intrusion caused by earthworks and dust	Maintain air quality within South African air quality standards at the Mine boundary to reduce visible dust plumes
Increased traffic causing congestion or delays during construction	None
Loss of heritage structures	None
Operation Phase	
Nuisance caused by increased particulate matter concentrations and dust fallout	Maintain air quality within South African air quality standards at the Mine boundary to prevent offsite impacts
Alterations to surface water flow patterns	Prevent uncontrolled (unplanned) surface flow dynamics during severe storm events
Groundwater contamination	Confirm groundwater model outputs through continued monitoring, and apply additional mitigation (if found to be necessary) to prevent impacts on groundwater receptors
Degradation of natural ephemeral pans	Prevent access to No-Go areas (see Figure 2-3) and respond to impacts in the Hardpan area (from sand accretion)
Vegetation loss from increased erosion	Manage stormwater on site and prevent further erosion where it is observed
Physical disturbance to aquatic ecosystems	Prevent access to No-Go areas (see Figure 2-3)
Changes in plant communities in the Sout River	Confirm groundwater model outputs through continued monitoring, and apply additional mitigation (if found to be necessary) to prevent impacts on the Sout River
Changes in plant communities in the Groot Goeraap River	Confirm groundwater model outputs through continued monitoring, and apply additional mitigation (if found to be necessary) to prevent impacts on the Groot Goeraap River
Decline in production at the Cawood Saltworks	Manage air quality and groundwater impacts to prevent a decline in production at the Saltworks
Altered sense of place and visual intrusion caused by earthworks and dust	Maintain air quality within South African air quality standards at the Mine boundary to reduce visible dust plumes
Altered sense of place and visual intrusion caused by the RSF, Overburden Stockpile and change in topography	Create a post mining landscape that resembles natural topography as far as possible
Decommissioning Phase	
Delayed return to the agricultural potential of the footprint of RSF6	Revegetate the RSF with local plant species during operations
Altered sense of place and visual intrusion caused by the RSF, Overburden Stockpile and change in topography	Create a post mining landscape that resembles natural topography, during operations

3. Scope and Purpose of the EMPr

Namakwa Sands operates in terms of a number of environmental authorisations in terms of NEMA and the MPRDA. Namakwa Sands has made a number of environmental management commitments in terms of these authorisations and has integrated these commitments into its Environmental Management System (EMS) for the Mine. So that current management and monitoring practices can be applied to the project, and Mine performance can be assessed in terms of a single set of commitments, the management measures specified in this EMPr reflect existing commitments wherever possible.

This EMPr has therefore drawn on:

- The Consolidated EMPr for the Namakwa Sands Mine (Golder, 2008);
- The EMPr amendment for the East OFS Project (Golder, 2011a);
- The EMPr amendment for changes to infrastructure requirements for the East OFS Project (SRK, 2015); and
- The EMPr amendment for the West Mine RSF6 6 (SRK, 2017).

Wording from these documents is, in some cases, repeated verbatim, and is hereby acknowledged.

Namakwa Sands will update their EMS to reflect new commitments contained in this EMPr.

3.1 Scope of the EMPr

This EMPr is intended to provide an overview of the on-site environmental management philosophy and organisational structure at the Mine. In addition, it specifies common environmental management and monitoring principles that are to be applied to the construction and operation of infrastructure changes required for the project (most notably the RSF and STFs – see Section 2.3) and recommends additional management and monitoring to account for potential impacts of these facilities / changes to the overall East OFS Project description **only where necessary**.

In terms of EIA Regulations, 2014, the EMPr is required to deal with all relevant phases of the project, including:

- Planning and Design Phases;
- Construction Phase;
- Operational Phase;
- Rehabilitation of the environment, where relevant; and
- Closure, where relevant.

This EMPr addresses all the activities associated with the changes to the approach to residue disposal for the East OFS Project that have potential impacts on the environment during the Design, Construction and Operational Phases as described in Section 2.3 above. The overall East OFS Project, including construction of all other infrastructure and mining have been authorised and will be managed in terms of these existing authorisations.

Tronox intend to close and revegetate the RSF and STFs concurrent with operations at the Mine (although full rehabilitation of the RSF is only anticipated in the long term). Therefore, closure procedures and management measures are recorded as operational activities (see Table 5-3).

The West Mine will only be decommissioned after 2055. Decommissioning of the Mine will have impacts, and these impacts are addressed in the approved EMPr and Closure Plan. Furthermore, the decommissioning and closure of the Mine will require EA in terms of NEMA (informed by an EIA

process). The management of impacts of decommissioning and closure of the entire Mine site is therefore not specified in this EMPr; however Namakwa Sands' existing commitments relating to closure are summarised in Section 6.

3.2 Purpose of the EMPr

The primary purpose of this EMPr is to specify management measures for the construction, operation and closure (where relevant – see above) of residue management facilities and approaches not originally approved for the East OFS Project, and to describe existing management measures at the Mine that will pertain specifically to these components of the project. The EMPr also aims to ensure that the mitigation (and optimisation) measures specified in the EIA Report are effectively integrated into existing management procedures at the Mine and are implemented. This EMPr also ensures that any unforeseen or unidentified impacts of activities are detected and addressed.

By formally documenting environmental management measures and commitments, the EMPr serves a vital role in ensuring that potential negative impacts of the project are minimised, and positive impacts maximised. The EMPr, therefore, is a tool that guides the management and monitoring of impacts. In the event that the significance of impacts is found to be higher than initially predicted in the EIA Report, additional mitigation measures will need to be implemented to control, reduce or prevent an impact from occurring (see Section 4.2.5).

4. EMPr Management Structure and Implementation⁴

Tronox, its employees and Contractors are required to comply with relevant local and national legislation. Tronox must be familiar with all relevant legal requirements as well as permit and licence conditions and agreements and be able to communicate these to the relevant persons and to monitor compliance. Failure to meet legal environmental requirements could result in various licences/authorisations for activities at the Mine being withdrawn and effectively result in operations having to cease until such non-compliances are addressed.

Although Tronox will take ultimate responsibility for the implementation of the environmental management measures during all phases of the project, there are a number of key role players who will take responsibility for the implementation of the EMPr, these include:

- The Site Director Northern Operations (SDNO) – who has overall responsibility for the implementation of the EMPr;
- Strategic Projects Manager (SPM) – responsible for the implementation of the EMPr during planning, design, and construction of infrastructure (especially the RSF) and commissioning;
- Environmental team consisting of Radiation and Environmental Specialist or Safety, Health and Environment (SHE) Lead and Environmental Practitioner (EP) – communication, implementation and compliance monitoring;
- Production Leads – implementation of EMPr during Operational Phase in the East mine and at PCPE; and
- Contracting companies working at the Mine (some semi-permanently) – communication and implementation.

Tronox will ensure that all personnel working on the project are made aware of the EMPr for the Mine, including the environmental management measures included in this document, and understand their responsibility to operate within the framework of the measures defined.

Contractor SHE inductions are compulsory for all personnel working at the Mine. Inductions include environmental and social awareness training to build capacity (see Section 4.4).

4.1 Management Structure and Implementation during Design

The SPM must take cognisance of the relevant environmental management measures applicable to project planning and design and ensure their implementation. Ultimately, however, it remains the responsibility of Tronox to ensure the implementation of these requirements.

4.2 Management Structure and Implementation during Construction

The SPM will be responsible for the management of activities associated with the construction required for the project and associated infrastructure⁵.

⁴ Note that the responsibilities are assigned to the various staff positions representing current roles at Namakwa Sands. If the management and / or organisational structure at the Mine changes during the implementation of this EMPr, implementation responsibilities described in this document will change to reflect the new structure. Provided that all implementation responsibilities are assigned to suitable on-site management, these changes will not require a formal amendment to the EMPr.

⁵ As RSF wall construction forms part of normal operational activities at the Mine (backfilling), the existing EMS will apply to this aspect of construction.

4.2.1 Roles and Responsibilities of the SPM and NOM

The SDNO and SPM shall (in their respective areas of responsibility):

- Ensure the sections of this EMPr that relate to construction are included in the contracts issued to Contractors (if applicable);
- Ensure the implementation of the relevant sections of the EMPr;
- Issue instructions relating to Environmental or Safety management made by the SHE Leader or EP to employees and Contractors; and
- Ensure corrective action is implemented by employees and Contractors as required.

4.2.2 Roles and Responsibilities of the Radiation and Environmental Specialist or North SHE Leader and EP

The SHE Leader and / or the EP will act as the Environmental Control Officer during construction activities. It is therefore essential that the SHE Leader and / or EP is sufficiently skilled in environmental management to monitor compliance with the sections of this EMPr which relate to construction, including any activities associated with site preparation.

The SHE Leader and / or EP shall:

- Inform all employees and Contractors of the EMPr (and existing EMS) and associated responsibilities and implications prior to commencement of construction;
- Inspect the site twice a month to monitor compliance with the sections of this EMPr that relate to construction;
- Record compliance to demonstrate that the EMPr is being effectively implemented;
- Immediately notify the SPM/SDNO (or designated supervisor) of any non-compliance with the EMPr, or any other issues of environmental concern;
- Negotiate corrective action and measures to rectify non-compliance; and
- Ensure that records of compliance are retained (for a period of at least two years following the completion of construction activities).

4.2.3 Roles and Responsibilities of Team Supervisors, Construction Personnel and Contractors

Personnel employed by Tronox that will be involved in construction (permanent employees) and Contractors employed for the construction of the project will have a duty to comply with this EMPr and the existing EMS, and to demonstrate respect and care for the environment. These staff members will be responsible for the cost of rehabilitation of any environmental damage that may result from non-compliance with the EMPr, environmental regulations and relevant legislation, resulting from activities on site.

Team Supervisors (of construction personnel and construction Contractors) shall:

- Ensure that all employees and sub-contractors are duly informed of the EMPr (and existing EMS) and associated responsibilities and implications prior to commencement of construction; and
- Undertake daily inspections of the work area(s); and
- Ensure that all activities on site are undertaken in accordance with the EMPr.

Employees and Contractors shall:

- Comply with the sections of this EMPr and the existing EMS that relate to construction;

- Immediately notify the relevant environmental team member of any non-compliance with the EMPr, or any other issues of environmental concern; and
- Take required corrective action within specified time frames and close out of environmental incidents.

4.2.4 Compliance Monitoring and Reporting

Compliance monitoring applicable to construction is listed in Table 4-1.

Table 4-1: Compliance monitoring for construction

Aspect	Indicator	Description	Frequency
Environmental Compliance Reports	Compliance with EMPr	The SHE Leader and / or the EP will prepare Environmental Compliance Reports following each site inspection, detailing any environmental issues, non-compliance and corrective actions implemented / to be implemented as agreed with SPM. These reports will be based on the SHE Leader and / or the EP's observations.	Twice a month
Site Closure Audit	Compliance with EMPr	The SHE Leader and / or the EP will undertake a final Site Closure Audit on completion of the Construction Phase. The purpose of this is to confirm compliance with all site closure requirements identified in the EMPr and by the SHE Leader and / or the EP, and that the site has been left in an environmentally acceptable condition.	Completion of construction

4.2.5 Method Statements

A Method Statement is a document prepared by the Contractor or SPM and submitted to the SHE Leader and / or the EP setting out specific details regarding the plant, materials, labour and method for carrying out certain specific activities, usually activities that may have a harmful effect on the environment.

The purpose of a Method Statement is for the Contractor or SPM to provide additional details regarding the proposed methodology for certain activities, and for the SHE Leader and / or the EP to confirm that these meet the requirements of the EMPr and acceptable environmental practice. This allows the EMPr to be less prescriptive and affords the Contractor and SPM a certain amount of flexibility.

It is an extremely useful tool as it provides a clear and documented statement of the approaches that employees and Contractors will pursue to undertake an activity, particularly one that may have adverse environmental impacts. It also provides a reference point to detect deviations from the agreed approach to each planned activity.

Each Method Statement will address environmental management aspects relevant to the activity and will typically provide detailed descriptions of items including, but not necessarily limited to:

- Nature, timing and location of activities;
- Procedural requirements and steps;
- Management responsibilities;
- Material and equipment requirements;
- Transportation of equipment to and from site;
- Method for moving equipment/material while on site;
- How and where material will be stored;
- Emergency response approaches, particularly related to spill containment and clean-up;

- Response to compliance/non-conformance with the requirements of the EMPr; and
- Any other information deemed necessary by the SHE Leader and / or the EP.

The Method Statements that will need to be completed by the Contractor(s) or SPM during construction will be at the discretion of the SHE Leader and / or the EP.

The Method Statements will be submitted by the Contractor(s) or SPM to the SHE Leader and / or the EP prior to the intended date of commencement of an activity. The SHE Leader and / or the EP shall approve / reject the Method Statement prior to commencement. An activity covered by a Method Statement shall not commence until the SHE Leader and / or the EP has approved of such method and once approved, employees and Contractors shall abide by the specifications listed in these Method Statements.

4.2.6 Non-Compliance and Corrective Action

Tronox (or Contractors via contract obligations) will be liable should construction activities inflict damage to the environment and for non-compliance with the environmental management measures. Tronox shall repair and rehabilitate any damage and any consequence resulting from such damage.

If environmental compliance monitoring by the SHE Leader and / or the EP indicates non-conformance with the EMPr or approved Method Statements, he/she will formally notify employees or Contractors of the non-conformance by reporting an environmental incident through Tronox's existing incident reporting and investigation system. The notification will include:

- The nature of the non-conformance/environmental damage;
- The actions or outcomes required to correct the situation; and
- The date by which each corrective or preventive action must be completed.

The corrective action must be carried out within the time limits stipulated. The SHE Leader and / or the EP will then be required to confirm and report on the success or failure of the corrective action during weekly inspections and reports.

4.3 Management Structure and Implementation during Operations and Closure

Tronox (via the SDNM) will be responsible for ensuring implementation of the conditions of authorisation of the project and thus for the required management and monitoring during operations. Tronox employ a number of staff and Contractors that operate at the Mine site who are contractually committed to compliance with the existing EMS at the Mine, which sections of this EMPr relating to operations will inform.

4.3.1 Compliance Monitoring and Reporting

Compliance monitoring applicable to the project that will be undertaken by Tronox at the Mine during operations is listed in Table 4-2.

Table 4-2: Compliance monitoring applicable to the project

Aspect	Indicator	Description	Frequency
EMPr Performance Assessment	Commitments complied with	External audit, including site inspection, of compliance and progress with the implementation of commitments made in terms of various environmental approvals for mining and processing at the Mine.	Every 2 years

Aspect	Indicator	Description	Frequency
Ongoing incident reporting system	Compliance with EMS	Employee monitoring and reporting of effective implementation of EMS policies and procedures.	Continuous

Compliance reporting applicable to project undertaken by Tronox at the Mine is listed in Table 4-3.

Table 4-3: Compliance reporting applicable to the project

Authority	Report	Frequency
DHSWS, Western Cape	Water Management Report – water consumption, effluent disposal and any water-related incidents	Annually / following incidents
DMRE	EMPr Performance Assessment – independent audit report on compliance with all EMPr commitments	Every 2 Years

4.4 Environmental Awareness Training

Tronox has implemented an environmental awareness plan which informs employees and Contractors of environmental risks which may result from their work and the manner in which the risks must be managed to avoid pollution and or the degradation of the environment.

Tronox uses various channels to ensure communication with both internal and external parties on issues of environmental management, reporting and implementation of the EMS.

The following also forms part of environmental communication and awareness training at the Mine which will continue to be implemented during the East OFS Project:

- SHE inductions are compulsory for all personnel working on the Mine⁶. Roles and responsibilities, as well as those of the Environmental Department, are presented during these sessions. Inductions provide environmental and social awareness training to build capacity, and include:
 - A summary of pertinent environmental legislation;
 - A review of the environmental policy;
 - An overview of systems and procedures;
 - A description of the EMPr and the importance of conformance with its requirements;
 - A review of significant environmental aspects and impacts;
 - General responsibilities of Mine personnel with regard to the EMPr, and
 - A review of the emergency and corrective action processes.
- Noticeboards are located at various locations at the Mine, and the computer network system is available to advise personnel on environmental policy, procedures, environmental performance and initiatives for environmental improvement;
- Departmental SHE and Quality (SHEQ) meetings are conducted by Department Managers or Supervisors to advise personnel of current issues, including environmental issues, and to seek ideas and opinions;

⁶ Refresher induction is given to permanent employees once every two years.

- The “environmental theme of the month” is distributed via internal channels to all employees. These briefs contain a monthly environmental topic for discussion. Changes in specific roles and responsibilities in the environmental department are communicated in these briefs;
- Key performance indicators and issues, including those relating to the EMS are reported at monthly Operations Review Meetings;
- Non-conformance and incident reporting systems highlight current areas of concerns and are discussed at morning meetings; and
- Internal audit reports are submitted to the relevant task team and steering committee members. Reports are filed by all group leaders who are expected to communicate and discuss the outcomes with their sections.

Managers will respond to and act on communications received from external parties in line with the operating procedure.

5. Environmental Management Objectives and Commitments

This section of the EMPr details:

- Recommendations made in the EIA Report that should inform detailed design of infrastructure;
- The environmental management measures to be implemented during construction;
- Environmental aspects, objectives and specifications of the existing EMS where they relate to the operation and closure of infrastructure associated with residue management at the Mine. This section of the EMPr also highlights management measures which are specific to activities under consideration in this S&EIR process, which should be incorporated into the exiting EMS; and
- Specific requirements included for environmental management specified in the various licences for the project (to be updated following project approval).

The current list of requirements included in this section includes some measures which may already have been incorporated into the project design. They have, however, been listed here to ensure that they are not later excluded, if considered essential to manage potential environmental impacts.

These schedules will be further updated to include additional requirements that may be identified in authorisations for the project.

NOTE: An application for amendment to the EMPr must be submitted to the competent authority if any changes are to be made to the EMPr. These may only be implemented once the amended EMPr has been authorised by the competent authority.

5.1 Environmental Management Measures for Detailed Design

In order to ensure continuity in environmental management of the site, Table 5-1 presents approved Design Phase environmental management measures for infrastructure upgrades required for the East OFS Project⁷, as well as **new environmental management measures** applicable to this phase of the project identified during the current EIA process (these measures are indicated in **bold underlined text**). Management measures which are not applicable to the current application are greyed.

The management specifications listed here are only applicable to construction of East OFS infrastructure and do not form part of Namakwa Sands' ongoing environmental commitments at the Mine.

Table 5-1: Environmental management measures for Detailed Design

MATRIX NAME: Environmental Management Measure: Detailed Design of the East OFS Project		DURATION OF ACTIVITY: Detailed Design Phase of East OFS Project			REVISION NO. 1
Aspect	No.	Management Measures	Responsible Parties	Monitoring and Performance Evaluation	
				Performance Indicators	Monitoring Methods
A Detailed Design of Infrastructure	A1	Surface and bund vehicle refuelling and maintenance facilities.	Special Projects Manager or Site Director Northern Operations	<ul style="list-style-type: none"> Final designs of all infrastructure. 	<ul style="list-style-type: none"> Audit; and Visual observation.
	A2	Bund new infrastructure at the PCP East to prevent sea water spillages.			
	A3	Ensure provision is made for adequate bunding in the design of the diesel storage tank (at least 110% of the total volume of the tank).			
	A4	Design pipelines, pump stations and storage dams to prevent leakage / seepage of sea water.			
	A5	Line sea water dams to prevent leaks and sea water seepage.			
	A6	Locate the expansion of the seawater intake pumping facilities to the north east of the existing facility (i.e. within the disturbed, fenced area and screened from the view of recreational users of the camp site).			
	A7	Install instrumentation that will aid in detecting sea water leaks and record consumption levels.			
	A8	Design the sea water intake to reduce the current flow rate			
	A9	Position sea water intake pipes at least 0.5 m off the seabed and 0.5 m below the Mean Low Water Spring Tide mark (i.e. the intake must remain >0.5 m below the water surface at spring low tide).			

⁷ Amended EMPr – 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

MATRIX NAME: Environmental Management Measure: Detailed Design of the East OFS Project		DURATION OF ACTIVITY: Detailed Design Phase of East OFS Project			REVISION NO. 1	
Aspect	No.	Management Measures	Responsible Parties	Monitoring and Performance Evaluation		
				Performance Indicators	Monitoring Methods	
	A10	Design the inlet of the suction pipelines to include a vortex inhibitor and (as far as possible) create a horizontal flow of water rather than vertical.				
	A11	Design the terminal end of intake pipes to be as large as possible to minimise intake velocity at the intake screen (i.e. not more than 0.25 m/s).				
	A12	Design storm water management infrastructure to cater for the 1:50 year return flood period, as well as abnormal and emergency operating situations.				
	A13	Ensure that professional engineers use BATNEEC technology to design and construct mineral stockpiles.				
	A14	Commission an independent registered professional engineer to review design parameters and overall stability (erosion, slumps etc.).				
	A15	Design storage facilities for dangerous goods to include a bunded area with the capacity of not less than 110% of the storage container(s) capacity.				
	A16	<u>Verify that new basins created in the post mining topography do not overtop during a 1:50 year storm event (and construct berms to prevent this occurrence should it be found that they do).</u>				
	A17	<u>Verify that stormwater flows from diversion channels and other stormwater infrastructure will not exceed 1 m/s in the 1:50 year flood event.</u>				
B Socioeconomic Aspects	B1	Favour employment of people (and contractors) from the local region.				
	B2	Employ contractors and staff through recognized employment agencies and tender processes.				
	B3	Continue with the existing corporate social responsibility initiatives aimed at improving the quality of life of staff and community by investing in the broader region.				
C Environmental Management Systems	C1	Update operational procedures to reflect new commitments recommended in this report.	Special Projects Manager or Northern Operations Manager	<ul style="list-style-type: none"> Updated environmental management procedures; and Awareness Training Slides. 	<ul style="list-style-type: none"> Audit 	
	C2	Update environmental monitoring procedures to reflect the recommendations made in this report.				
	C3	Include the EMPr in all contract documentation for all phases of its implementation.				
	C4	<u>Incorporate the East RSF 6 and East OFS Mine tailings backfill area into the seawater management plan and seawater balance for the Mine.</u>				

MATRIX NAME: Environmental Management Measure: Detailed Design of the East OFS Project		DURATION OF ACTIVITY: Detailed Design Phase of East OFS Project		REVISION NO. 1	
Aspect	No.	Management Measures	Responsible Parties	Monitoring and Performance Evaluation	
				Performance Indicators	Monitoring Methods
<u>D</u> <u>Authorisations</u>	<u>D1</u>	<p><u>Ensure that all required licences and permits have been obtained before the start of construction. These include, but may not be limited to:</u></p> <ul style="list-style-type: none"> • <u>Environmental Authorisation;</u> • <u>Waste Management Licence;</u> • <u>Amendment of the EMPr; and</u> • <u>Water Use Authorisation.</u> 	<p><u>Special Projects Manager</u> or <u>Environmental specialist</u></p>	<ul style="list-style-type: none"> • <u>Required licences/permits available</u> 	<ul style="list-style-type: none"> • <u>Audit</u>

5.2 Environmental Management Measures for Construction

In order to ensure continuity in environmental management of the site, Table 5-2 presents approved Construction Phase environmental management measures for infrastructure upgrades required for the East OFS Project⁸, as well as new environmental management measures applicable to this phase of the project identified during the current EIA process (these measures are indicated in **bold underlined text**). Management measures which are not applicable to the current application are greyed.

The management specifications listed here are only applicable to construction of East OFS infrastructure and do not form part of Namakwa Sands' ongoing environmental commitments at the Mine.

Table 5-2: Environmental management specifications for construction activities

MATRIX NAME: Environmental Management Measures: Construction of Infrastructure for the East OFS Project		DURATION OF ACTIVITY: Construction Period			REVISION NO. 1	
Aspect	No.	Mitigation Measures	Responsible Parties	Monitoring and Performance Evaluation		
				Performance Indicators	Monitoring Methods	
A Establishment of Site	A1	Establish site camps within a disturbed / mined out area within the existing operational area of the Mine or at the designated parking area at the sea water intake.	Contractor	<ul style="list-style-type: none"> Number of incidents of disturbance outside designated construction area. 	<ul style="list-style-type: none"> Visual inspections by ECO. 	
	A2	Demarcate all construction site boundaries upon establishment in consultation with the SHE Leader and / or the EP.	Contractor			
	A3	Designate areas beyond the boundary of the site and all sensitive areas (i.e. the coastal ecological corridor [other than when works in this area are required], <u>the Hardpan and Groot Goeraap River</u>) as No-go areas for all personnel on site. No vehicles, machinery, materials or people shall be permitted in the No-go areas at any time without the express permission of the SHE Leader and / or the EP.	Contractor			
B Handling of Construction and Hazardous Materials	B1	Store fuels within a bunded area within the site camp(s).	Contractor	<ul style="list-style-type: none"> Number of incidences of disturbance outside works footprint; and Number and size of spills. 	<ul style="list-style-type: none"> Visual inspection and approval by SHE Leader and / or the EP; and Records of remediation measures. 	
	B2	Handle fuels, oils and chemicals so as to avoid the risk of spillage, e.g. use groundcover.	Contractor			
	B3	Refuel machinery and equipment in existing designated refuelling areas / on impervious surfaces or use drip trays when refuelling at the site.	Contractor			
	B4	Place a drip tray strategically under machinery if they are to remain in one position for longer than two days.	Contractor			
	B5	Place a drip tray strategically under generators when in use.	Contractor			

⁸ Amended EMPr – 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

MATRIX NAME: Environmental Management Measures: Construction of Infrastructure for the East OFS Project			DURATION OF ACTIVITY: Construction Period		REVISION NO. 1	
Aspect	No.	Mitigation Measures	Responsible Parties	Monitoring and Performance Evaluation		
				Performance Indicators	Monitoring Methods	
	B6	Ensure drip trays are kept clean and functional.	Contractor			
	B7	Empty drip trays regularly and dispose of contaminated water at a facility capable of handling such wastewater.	Contractor			
	B8	Store dangerous goods in a bunded area of a capacity not less than 110% of the storage container(s) capacity.	Contractor			
	B9	Maintain relevant Material Safety Data Sheets (MSDS) at the site for all potentially hazardous substances (as defined in the regulations for hazardous chemical substances). Follow procedures listed in the MSDS in the event of an emergency.	Contractor			
	B10	Prevent discharge of any hazardous substances or pollutants, such as cements, concrete, chemicals, and other contaminated wastewater and fuels into the ground, surface or stormwater systems or the sea	Contractor			
	B11	Ensure a quantity of appropriate remedial agent, capable of containing and/or remediating a hydrocarbon spill is available on site at all times in case of an emergency spill. The material shall be capable of handling a spill of at least 200L.	Contractor			
	B12	Have emergency spill kits available to address any oil spills into the marine environment.	Contractor			
	B13	Report all fuel, oil or hydraulic fluid spills to the SHE Leader and / or the EP so that appropriate clean-up measures can be implemented.	Contractor			
	B14	Report all spills greater than 200L into freshwater, marine or ecologically sensitive areas to the Department of Water and Sanitation or DEA: Oceans and Coasts (as appropriate) and DEA&DP.	SHE Leader and / or the EP			
	B15	Address all hydrocarbon spills by collection and remediation or disposal, or <i>in situ</i> remediation.	Contractor			
	B16	Remove and dispose of all contaminated soil that cannot be remediated on site at a licensed hazardous waste facility.	Contractor			
C	Water Management	C1	Stabilise cleared areas to prevent and control surface erosion. The method of stabilization shall be determined in consultation with the SHE Leader and / or the EP.	Contractor	<ul style="list-style-type: none"> Incidents of contaminated water in sensitive areas; Visible leaks/ water wastage; and Visible surface erosion. 	<ul style="list-style-type: none"> Visual inspection by SHE Leader and / or the EP.
		C2	Prevent run-off from work areas entering sensitive areas (the coastal ecological corridor, the Hardpan and the Groot Goeraap River).	Contractor		

MATRIX NAME: Environmental Management Measures: Construction of Infrastructure for the East OFS Project		DURATION OF ACTIVITY: Construction Period			REVISION NO. 1	
Aspect	No.	Mitigation Measures	Responsible Parties	Monitoring and Performance Evaluation		
				Performance Indicators	Monitoring Methods	
D Waste Management	D1	Empower all staff to suitably dispose of construction waste.	Contractor	<ul style="list-style-type: none"> Incidents of littering / waste disposal on site; and Waste disposal records 	<ul style="list-style-type: none"> Visual inspection by SHE Leader and / or the EP; and Audit 	
	D2	Collect, separate and dispose of all waste generated during construction according to procedures specified in standard operating procedures at the Mine.	Contractor			
	D3	Ensure that waste is not disposed of / burned / or buried on construction site	Contractor			
	D4	Provide separate weather- and vermin- proof bins at all construction areas for the disposal of general and hazardous waste and litter. Bins to be provided with lids and external closing mechanisms and waste must not be allowed to blow off site.	Contractor			
	D5	Collect and contain all waste and litter immediately and ensure that all waste and litter is deposited in the appropriate waste bins.	Contractor			
	D6	Empty bins at active construction areas as required.	Contractor			
	D7	Employ an integrated waste management approach.	Contractor			
	D8	Dispose of solid waste at a licensed landfill.	Contractor			
E Equipment Maintenance	E1	Maintain vehicles in good working order to prevent hydrocarbon leaks and excessive noise.	Contractor	<ul style="list-style-type: none"> Visible leaks; Number and size of spills from machinery/plant; and Contamination of soil and water. 	<ul style="list-style-type: none"> Visual inspections by SHE Leader and / or the EP; and Records of remediation. 	
	E2	Repair or remove all leaking equipment as soon as possible.	Contractor			
	E3	Service and refuel equipment that use hydrocarbon fuels, oils, lubricants and other hazardous chemicals at site camp only under conditions approved by the Head of SHE / EP.	Contractor			
	E4	Ensure that Drizit pads (or equivalent) and / or drip trays are available to collect any oil, fluid, etc. in the case of a breakdown or emergency repair outside the designated area for servicing of equipment.	Contractor			
	E5	Store vehicles, equipment and construction materials associated with works at the sea water intake and pipelines at the construction site camp when not in use.	Contractor			
F Protection of terrestrial flora and fauna	F1	Limit clearing of vegetation to those areas within the construction footprint	Contractor	<ul style="list-style-type: none"> Incidents of harm coming to fauna / flora; Number of incidents of disturbance of vegetation in No-go areas; and Incidences of erosion. 	<ul style="list-style-type: none"> Visual inspection SHE Leader and / or the EP; 	
	F2	Demarcate the <u>all</u> pipeline footprints prior to vegetation clearing.	Head of SHE / EP			
	F3	Limit clearing of vegetation to those areas within the sea water pipeline construction footprint (5m in the CBA and 10 m in all other areas).	Contractor			
	F4	Flush faunal species prior to vegetation clearing.	Contractor			
	F5	Prohibit hunting of wildlife.	Contractor / Head of SHE / EP			

MATRIX NAME: Environmental Management Measures: Construction of Infrastructure for the East OFS Project		DURATION OF ACTIVITY: Construction Period		REVISION NO. 1	
Aspect	No.	Mitigation Measures	Responsible Parties	Monitoring and Performance Evaluation	
				Performance Indicators	Monitoring Methods
	F6	Keep surface disturbance to the absolute minimum	Contractor		
	F7	Restrict vehicle movement to existing roads/tracks	Contractor / Head of SHE / EP		
	F8	Keep all areas outside of designated construction areas off limits during the Construction Phase of the development.	Contractor		
	F9	Recover conservation-worthy floral species within the sea water pipeline footprint where possible.	Head of SHE / EP		
	F10	Harvest topsoil in disturbed areas.	Head of SHE / EP		
	F11	Stockpile topsoil in previously disturbed areas (e.g. on the Mine side of the access road)	Contractor		
	F12	Ensure that topsoil stockpiles are no higher than 2m.	Contractor		
	F13	Prevent loss of topsoil by wind and water erosion (especially to the seaward side of the pipeline footprint).	Contractor		
	F14	Do not harm, catch or kill birds or animals by any means, including poisoning, trapping, shooting or setting of snares.	Contractor		
	F15	Ensure that no excavated fill / sand is pushed or dumped into the coastal ecological corridor.	Contractor		
	F16	Use harvested topsoil for rehabilitation of the pipeline footprints following construction	Head of SHE / EP		
	F17	Rehabilitate, including re-vegetation, the sea water pipeline footprint concurrently with construction.	Head of SHE / EP		
	F18	Base re-vegetation in the sea water pipeline footprint on technology continuously developed and refined by Namakwa Sands.			
	F19	Undertake revegetation of the sea water pipeline footprint using a mixture of harvested local veld species seeds, rooted local veldt species cuttings, transplanted local indigenous species and the existing topsoil seed bank.			
	F20	Implement erosion protection measures during rehabilitation.			
	F21	Keep the rehabilitated areas clear of alien vegetation through regular inspection and clearing of young plants.			
	F22	Inspect the site for erosion monthly during construction and annually during operations, and after storm events exceeding the 1 in 10 year event.	Head of SHE / EP		

MATRIX NAME: Environmental Management Measures: Construction of Infrastructure for the East OFS Project		DURATION OF ACTIVITY: Construction Period		REVISION NO. 1			
Aspect	No.	Mitigation Measures	Responsible Parties	Monitoring and Performance Evaluation			
				Performance Indicators	Monitoring Methods		
	F23	<u>Dissipate stormwater where it discharges from defined channels</u>	<u>Contractor and Head of SHE / EP</u>				
	F24	<u>Close erosion gullies where these are observed and rehabilitate (revegetate) these areas.</u>					
	F25	<u>Install the process water pipelines between January and May, if possible</u>	<u>Head of SHE / EP</u>	<ul style="list-style-type: none"> <u>Dates of construction</u> 	<ul style="list-style-type: none"> <u>Visual inspection</u> <u>Audit</u> 		
	F26	<u>Access the pipeline routes from existing access roads (i.e. prohibit vehicle access into the veld for pipeline installation).</u>	<u>Contractor</u>	<ul style="list-style-type: none"> <u>Indiscriminate access into undisturbed areas</u> 	<ul style="list-style-type: none"> <u>Visual inspection</u> 		
	F27	<u>Implement a 100m buffer between a) the RSF and the Hardpan and b) Overburden Stockpile and the Hardpan.</u>	<u>Head of SHE / EP</u>	<ul style="list-style-type: none"> <u>Hardpan demarcated; and</u> 	<ul style="list-style-type: none"> <u>Visual inspection</u> 		
	F28	<u>Demarcate the Hardpan (and buffer) and prevent access into it.</u>	<u>Contractor and Head of SHE / EP</u>	<ul style="list-style-type: none"> <u>Access restricted</u> 			
	F29	<u>Monitor sand accretion into the Hardpan and buffer every six months.</u>	<u>Head of SHE / EP</u>	<ul style="list-style-type: none"> <u>Monitoring Records</u> 	<ul style="list-style-type: none"> <u>Audit</u> 		
	F30	<u>Install wind breaks within the Hardpan buffer area if significant sand accretion is observed</u>	<u>Head of SHE / EP</u>	<ul style="list-style-type: none"> <u>No accretion / windbreaks installed</u> 	<ul style="list-style-type: none"> <u>Visual inspection</u> 		
	G	Protection of Marine Ecology	G1	Use Nonex® & Nxburst® Rock Breaking Cartridges or equivalent for all blasting requirements.	Contractor	<ul style="list-style-type: none"> Incidents of harm coming to marine ecology; Number of blasts per day; and Excavation method statement. 	<ul style="list-style-type: none"> Visual inspection SHE Leader and / or the EP; and Approved excavation method statement.
			G2	Use a competent person with sufficient experience to conduct blasting.	Contractor		
G3			Detonate only one detonation series per day.	Contractor			
G4			Appoint competent personnel to ensure that no marine mammals or swimmers are present in the area at least 2 hours prior to blasting and for the duration of blasting activities.	Contractor			
G5			Delay blasting until marine mammals have moved at least 2 km from the intake gully.	Contractor			
G6			Utilise a crane to remove large rocks dislodged by blasting	Contractor			
G7			Draft method statement for the excavation of loose rock in the sea water gully.	Contractor			
G8			Submit the method statement for excavation to an independent Marine Ecologist for approval.	Head of SHE / EP			
G9			Commence excavations only following the approval of the method statement.	Contractor			
G10			Use water tight plastic/canvas bags supported and shaped within metal frames for in-water casting of cement (if necessary).	Contractor			

MATRIX NAME: Environmental Management Measures: Construction of Infrastructure for the East OFS Project		DURATION OF ACTIVITY: Construction Period		REVISION NO. 1	
Aspect	No.	Mitigation Measures	Responsible Parties	Monitoring and Performance Evaluation	
				Performance Indicators	Monitoring Methods
	G11	Inform all staff about consequences of littering in the marine environment <u>and instruct staff not to litter the marine environment.</u>	Contractor		
	G12	Filter backwash effluent on start-up of pumps to remove plastic particles that may be contained within the system from construction.	Contractor		
	G13	<u>Limit the extent of construction activities as far as possible.</u>	<u>Contractor</u>	• <u>Extent of construction activities limited to footprint</u>	• <u>Visual inspection</u>
H	Protection of archaeological and paleontological sites	H1	Stop work immediately if any material of paleontological / archaeological importance is found during site work. Follow standard procedures for the discovery of such material.	Contractor / Head of SHE / EP	• Discovery of any possible paleontological / archaeological material. • Reports of discovery; and • Visual inspection by SHE Leader and / or the EP.
I	Dust Management	I1	Avoid clearing of vegetation until such time as works are required.	Contractor	• Visible erosion of topsoil or stockpiles; and • Number of incidences of disturbance outside Works footprint. • Air Quality Monitoring results • Audit
	I2	Stabilize (rehabilitate) exposed surfaces as soon as is practically possible	Contractor		
	I3	Avoid excavation, handling and transport of materials which may generate dust under high wind conditions or when a significant visible dust plume is present.	Contractor		
	I4	Implement erosion control measures on stockpiles.	Contractor		
	I5	Use appropriate dust suppression measures (i.e. spray unconsolidated areas with sea water / use shade netting) when dust generation is unavoidable.	Contractor		
	I6	As far as possible prohibit the use of potable water for dust suppression.	Head of SHE / EP		
	I7	<u>Enforce speed limits on unpaved or untreated roads.</u>	<u>Head of SHE / EP</u>		
	I8	<u>Continue to monitor dust fallout on the Mine boundary and respond to exceedances of fall-out limits specified in the National Dust Control Regulations, 2013 or applicable legislation.</u>	<u>Head of SHE / EP</u>		
	I9	<u>Apply additional air quality mitigation in response to exceedances of particulate matter or dust fallout guideline thresholds at the Mine boundary.</u>	<u>Head of SHE / EP</u>		
J	Noise Management	J1	Comply with the applicable municipal by-laws / industry / SANS codes and standards regarding noise generation.	Contractor	• Number of complaints received. • Observations by SHE Leader and / or the EP; and • Complaints register.
	J2	Notify Brand se Baai recreational users of the proposed blasting schedule by way of notice boards near the site.	Contractor / Namakwa Sands	•	•

MATRIX NAME: Environmental Management Measures: Construction of Infrastructure for the East OFS Project			DURATION OF ACTIVITY: Construction Period		REVISION NO. 1
Aspect	No.	Mitigation Measures	Responsible Parties	Monitoring and Performance Evaluation	
				Performance Indicators	Monitoring Methods
	J3	Limit blasting to occur Mondays to Fridays between the hours of 08h00 and 18h00 pm if there are recreational users.	Contractor	•	•
	J4	Verbally notify recreational users (if any are present) of blasting outside of these times is essential for technical reasons.	Contractor / Namakwa Sands		
	J5	Do not conduct any activities related to <i>the upgrade of the seawater intake</i> during school holidays if there are recreational users present in the area.	Contractor		
K Fire Prevention	K1	Prohibit fires at the site.	Contractor	• Number of fire incidents.	• Attendance registers for training sessions.
	K2	Ensure that sufficient fire-fighting equipment is available on site.	Contractor		
	K3	Ensure that all personnel on site are aware of the location of firefighting equipment on the site and how the equipment is operated.	Contractor		
	K4	Suitably maintain firefighting equipment.	Contractor		
L Ablution Facilities	L1	Provide portable ablution facilities (i.e. chemical or formal toilets) for all site staff at a ratio of preferably 1 toilet per 15 workers (absolute minimum ratio of 1:25).	Contractor	• Number of incidents of staff not using facilities; and • Number of spills.	• Visual inspections and approval by SHE Leader and / or the EP; and • Records of waste disposal.
	L2	Locate temporary ablution facilities outside of sensitive areas .	Contractor		
	L3	Secure all temporary / portable toilets to the ground to the satisfaction of the SHE Leader and / or the EP to prevent them toppling due to wind or any other cause.	Contractor		
	L4	Maintain toilets in a hygienic state (i.e. toilet dispensers to be provided, toilets to be cleaned and serviced regularly, and toilets to be emptied before long weekends and builders' holidays).	Contractor		
	L5	Remove accumulations of chemicals and treated sewage from the site and dispose of at an approved waste disposal site or sewage plant.	Contractor		
	L6	Ensure that no spillages occur when the toilets are cleaned or emptied.	Contractor		
	L7	Prohibit urination and defecation on site, other than at designated facilities.	Contractor		
M Rehabilitation and Site Closure	M1	Ensure that slopes that are disturbed / cleared for construction are immediately stabilized using appropriate erosion stabilisation technique to prevent erosion, e.g. geofabric, berms or other suitable methods.	Contractor	• Completion of identified actions.	• Final approval of site closure by SHE Leader and / or the EP
	M2	Replace topsoil that was initially removed, and rehabilitate all areas disturbed through construction activities incrementally using standard Mine rehabilitation methods.	Contractor		
	M3	Remove all construction equipment, vehicles, equipment, waste and surplus materials from the site.	Contractor		

MATRIX NAME: Environmental Management Measures: Construction of Infrastructure for the East OFS Project		DURATION OF ACTIVITY: Construction Period		REVISION NO. 1		
Aspect	No.	Mitigation Measures	Responsible Parties	Monitoring and Performance Evaluation		
				Performance Indicators	Monitoring Methods	
	M4	Clean up and remove any spills and contaminated soil.	Contractor			
	M5	Ensure that no discarded materials are buried on the construction site or on any other land not designated for this purpose.	Contractor			
	M6	Ensure the Head of SHE / EP is satisfied with the site and that all actions identified have been completed.	Contractor			
	M7	Ensure that rehabilitated areas are kept clear of alien invasive vegetation.				
N	General	N1	Include the EMPr in all contract documentation for all phases of its implementation	Namakwa Sands	• Contract documentation	• Audit
		N2	A copy of the EMPr and Environmental Authorisation must be kept on the site where construction activities are taking place	Namakwa Sands		
		N3	<u>Implement the design recommended for the East OFS RSF in the final design report for the facility (Appendix C2 to the Final EIR)</u>	<u>NOM</u>	• <u>As built design aligns with Design Report</u>	• <u>Audit</u>
O	Socio-economic	S1	<u>Procure goods and services from local suppliers where these are available in the WCDM</u>	<u>NOM</u>	• <u>Procurement records</u>	• <u>Audit</u>

5.3 Environmental Management Measures for Operations

This section of the EMPr applies specifically to the operation of new infrastructure required for the East OFS Project as listed in Section 2.3. The management specifications listed in Table 5-3 form part of Namakwa Sands' ongoing environmental commitments. Aspects of the existing EMS that do not apply to the East OFS Project are not reported on. New measures for operations recommended as part of this EIA process are indicated in underline and bold and should form part of Tronox's EMS for the East OFS project throughout operations.

Compliance with all existing operating procedures at the Mine will also be mandatory.

Table 5-3: Environmental management specifications for Operations

MATRIX NAME: Environmental Management Measure: Operation of the East OFS Project		DURATION OF ACTIVITY: Life of Mine		REVISION NO. 1	
Aspect	Objective	No.	Management Principle or Measure		
A	Soil	Minimise the impact and extent of contaminated soil	A1	Identify and treat contaminated soil, which could present a hazard, appropriately i.e. ameliorate or dispose of at a registered site.	
			A2	Prevent the contamination of soil by spillages of potentially hazardous substances such as sea water and hydrocarbons.	
			A3	Report spillage of potentially hazardous substances such as sea water and hydrocarbons as environmental incidents (burst pipes, leaks, etc.).	
			A4	Apply the Integrated water and waste management plan to the East OFS Project infrastructure.	
			A5	Maintain pipelines, pump stations and storage dams to prevent leakage of seawater	
			A6	Inspect pipeline routes <u>daily</u> to ensure that no leaks develop until such time as leak detection equipment has been installed.	
			A7	Cease use of the pipelines <u>immediately</u> if leaks are detected.	
			A8	Repair pipeline leaks before recommissioning the pipeline.	
			A9	Ensure that dam water levels are kept within legal freeboard limits.	
			A10	Keep clean and dirty water systems separate.	
			A11	Regularly inspect and maintain infrastructure installed for storm water management	
			A12	Restrict refuelling and maintenance for all vehicles used on site to designated areas.	
B	Land Capability	Prevent the unnecessary loss of grazing land capability	B1	Ensure that grazing land is not unnecessarily used for Mine infrastructure and mining activities.	
C	Vegetation	Manage the natural vegetation and rehabilitated vegetation so as to avoid the loss of species diversity and habitats by mining activities	C1	Clearly demarcate processing areas to prevent unnecessary impacts on rehabilitated or natural veld.	
			C2	Restrict access to areas that fall outside of the footprint of the current mine plan (including processing areas) and previously disturbed areas at the sea water intake to prevent indiscriminate trampling of undisturbed and rehabilitated vegetation.	

MATRIX NAME: Environmental Management Measure: Operation of the East OFS Project		DURATION OF ACTIVITY: Life of Mine		REVISION NO. 1
Aspect	Objective	No.	Management Principle or Measure	
		C3	Restrict the footprint of maintenance activities to areas that have been rehabilitated following construction.	
		C4	Inspect the new sea water pipeline route daily to ensure that no leaks develop until such time as leak detection equipment has been installed.	
		C5	Cease use of the pipeline immediately if leaks are detected.	
		C6	Repair pipeline leaks before recommissioning the pipeline.	
		C7	Should leaks occur, rehabilitate the affected area.	
		C8	<u>Monitor sand accretion into the Hardpan and buffer every six months.</u>	
		C9	<u>Install wind breaks within the buffer area if significant sand accretion is observed.</u>	
		C10	<u>Monitor for surface seepages within a 1 km radius of the RSF on a six-monthly basis in potential discharge areas (e.g. topographically low-lying areas and riverbanks).</u>	
		C11	<u>Inspect the 50m long stretch of the southern Sout River riverbank (where the groundwater model indicated that groundwater seepage may occur) annually.</u>	
		C12	<u>Apply additional mitigation measures if groundwater discharges are observed in the riverbanks, such as actively pumping from a strategically placed wellfield(s) to minimise mounding and limit the migration of groundwater in unintended directions (such as towards private boreholes, the shoreline and/or rivers).</u>	
		C13	<u>Inspect the Groot Goeraap Riverbed abutting rehabilitated areas (particularly low points) monthly during active backfilling within 300m of the Groot Goeraap River and for one year thereafter to identify significant moisture plumes likely to intercept the riverbed or banks.</u>	
		C14	<u>Implement practical mitigation measures to prevent seepage into the Groot Goeraap River should seepage be identified during monitoring (e.g. the installation of cut-off drainage pipes along the closest edge to the river).</u>	
		C15	<u>Install stormwater diversion berm(s) downgradient of STF2 to prevent runoff and erosion downgradient of this facility.</u>	
		C16	<u>Inspect the site for erosion annually and after storm events exceeding the 1 in 10 year event.</u>	
		C17	<u>Dissipate stormwater where it discharges from defined channels.</u>	
		C18	<u>Close erosion gullies where these are observed and rehabilitate (revegetate) these areas.</u>	
	<u>Promote a return to ecological functioning of the site</u>	C19	<u>Rehabilitate (revegetate) mined out areas concurrently with mining</u>	
	<u>Prevent access to sensitive areas</u>	C20	<u>Maintain a buffer of 130 m or the 1:100 year floodline plus 30 m</u>	
		C21	<u>Demarcate the Hardpan and Groot Goeraap River buffers and prevent unauthorised access to these areas.</u>	

MATRIX NAME: Environmental Management Measure: Operation of the East OFS Project		DURATION OF ACTIVITY: Life of Mine		REVISION NO. 1
Aspect	Objective	No.	Management Principle or Measure	
D	Fauna	Avoid actions which may cause the unnecessary destruction or disturbance of fauna species	D1	Ensure that environmental education of all Mine staff takes place at all levels to limit unnecessary damage to habitats and/or disturbance of fauna.
			D2	Restrict access to all identified restricted areas and un-mined areas
			D3	Remove unspayed domestic cats from the Mine if found.
			D4	Prohibit hunting of wildlife on the Mine.
E	Freshwater Ecology	Minimise the pollution of freshwater and surface water resources	E1	Prohibit servicing of mining equipment in the field.
			E2	Use drip trays in breakdown situations to intercept any oil needed to be drained from vehicles.
			E3	Remove hydrocarbon contaminated soils and remediate at the landfarm site should any oil or fuel spillage have occurred.
			E4	Maintain seawater infrastructure such as pipelines, pump stations and storage dams to prevent the accidental leakage of seawater.
			E5	Shape depressions in rehabilitated areas to form sustainable pans or to drain in a controlled manner.
F	Marine Ecology	Reduce the impact on marine organisms.	F1	Test the intake flow rate following construction and implement additional design interventions if the flow rate exceeds 0.25 m/s.
			F2	Ensure kelp build up does not occur in sea water outflow stream.
			F3	Dispose of kelp regularly and appropriately.
			F4	Clean intake pipes and screens by mechanical means only.
G	Groundwater	Minimise the pollution of groundwater resources	G1	Prevent and minimise spillages of chemicals, process (sea) water, fuel and lubricants.
			G2	Prohibit servicing of mining equipment in the field.
			G3	Use drip trays in breakdown situations to intercept any oil needed to be drained from vehicles.
			G4	Remove faulty machinery out of operation and repair it before it is used again.
			G5	Prevent the discharge of polluted water from the EMV satellite workshop to the environment.
			G6	Remove hydrocarbon contaminated soils and remediate at the landfarm site should an oil or fuel spillage have occurred.
			G7	Ensure a quantity of appropriate remedial agent, capable of containing and/or remediating a hydrocarbon spill is available at the new diesel storage tank in the East Mine at all times in case of an emergency spill
			G8	Maintain seawater infrastructure such as pipelines, pump stations and storage dams to prevent the accidental leakage of seawater.
			G9	Treat sewage at the sewage treatment plant and adhere to all permit conditions.
			G10	Continue to monitor groundwater through the groundwater monitoring network on a quarterly basis continuing for a period of 5 years post closure.

MATRIX NAME: Environmental Management Measure: Operation of the East OFS Project		DURATION OF ACTIVITY: Life of Mine		REVISION NO. 1
Aspect	Objective	No.	Management Principle or Measure	
		G11	<u>Drill an additional three boreholes in the following approximate locations: 1)-31.221185°S,18.000656°E; 2)-31.224872°S;17.895495°E and 3)-31.234620°S;17.892371°E.</u> <u>Monitor these boreholes on a quarterly basis to monitor/detect groundwater concentrations towards the Groot Goeraap and Sout River.</u>	
		G12	<u>Monitor surface seepage quality within the site boundary at discharge zones, e.g. low-lying areas and riverbanks, on a six-monthly basis continuing for a period of five years post-closure</u>	
		G13	<u>Monitor potential discharge zones within the site boundary, e.g. low-lying areas and riverbanks on a six-monthly basis continuing for a period of five years post-closure (if contaminated surface seepage is evident in these areas).</u>	
		G14	<u>Conduct surface water sampling in the Sout River every six months to monitor the influence of the RSF on river salinity.</u>	
		G15	<u>Drill an additional monitoring borehole into preferential pathways to monitor plume migration if these are found to intercept the STFs or RSF through geotechnical analysis.</u>	
		G16	<u>Implement additional mitigation measures and/or corrective action if monitoring data shows a significant variation in groundwater depth (>6m) or quality compared to the modelled outputs or if surface seepage is evident, such as actively pumping from a strategically placed wellfield(s) to minimise mounding and limit the migration of groundwater in unintended directions (such as towards private boreholes, the shoreline and/or rivers).</u>	
		G17	<u>Provide an alternative source of water should users' groundwater quality or yield be shown to be negatively affected by the Mine.</u>	
H	Water Use	Minimise and optimise the use of fresh water	H1	Limit water use by minimisation, pollution prevention, re-use and waste water treatment and reuse.
		Minimise the use of sea water and prevent leaks and spills	H2	Control the use of seawater and record consumption levels to detect leaks in sea water infrastructure timeously.
			H3	Report all sea water spillages as environmental incidents.
I	Air Quality	Minimise dust generation	I1	Implement dust suppression measures to prevent dust emissions from exposed areas such as access roads.
			I2	Apply water or environmentally-friendly chemicals (such as Dustex) to un-surfaced roads to prevent the liberation of dust from vehicular movements.
			I3	Enforce speed limits on unpaved or untreated roads.
			I4	<u>Implement dust suppression measures to prevent dust emissions from exposed areas such as the southern and western wall faces/side slopes of the RSF, STFs and Overburden Stockpile, access roads and the new ROM stockpile.</u>
			I5	<u>Profile, re-vegetate and stabilise RSF, tailings backfill areas (including STFs) and Overburden Stockpile walls with windbreaks as soon as practically possible, i.e. during operations</u>
			I6	<u>Continue to monitor dust fallout on the Mine boundary and respond to exceedances of fall-out limits specified in the National Dust Control Regulations, 2013, or applicable legislation.</u>

MATRIX NAME: Environmental Management Measure: Operation of the East OFS Project		DURATION OF ACTIVITY: Life of Mine		REVISION NO. 1
Aspect	Objective	No.	Management Principle or Measure	
		I7	<u>Apply additional air quality mitigation in response to exceedances of particulate matter or dust fallout guideline thresholds at the Mine boundary.</u>	
J	Noise	Keep noise levels caused by mining activities to a minimum	J1	Monitor and record ambient noise levels periodically. Compare results with applicable standards and/or guidelines (e.g. SANS, Industry etc.).
			J2	Ensure that plant equipment is included on regular maintenance schedules.
			J3	Carry out additional noise measurements in response to noise complaints received.
K	Visual	Minimise the negative impact on aesthetic value of the area due to mining and mineral separation activities	K1	Ensure an efficient and effective implementation of waste management and removal system to prevent visual pollution from litter.
			K2	Develop a closure management plan that specifies the final design, position and rehabilitation measures to be applied to structures and facilities.
			K3	Consider the use of excavated rock from the sea water intake gully to enhance the visual absorption capacity of existing infrastructure.
			K4	Consider painting existing and new buildings at the pumpstation to blend better with the local backdrop or maintain the colouring of the pump station and accompanying infrastructure at Brand se Baai to be in visual harmony with the environment.
			K5	<u>Place associated infrastructure so as to be screened by the RSF and STFs as far as possible.</u>
			K6	<u>Install no or indirect low intensity lighting on remote (mobile) plant (e.g. stackers and conveyors), if possible.</u>
			K7	<u>Backfill tailings and overburden to a minimum of 1m in the mined out pit.</u>
			K8	<u>Profile, re-vegetate and stabilise RSF, tailings backfill areas (including STFs) and Overburden Stockpile walls with windbreaks as soon as practically possible (i.e. during operations).</u>
			K9	<u>Slope unmined pinnacles in the mining pit.</u>
L	Waste Management	Manage waste in processing areas	L1	Apply standard operating procedures for the management of waste in processing areas.
			L2	Ensure that non-hazardous and hazardous substances are appropriately identified, collected, stored and disposed of.
M	Socio-economic	Promote the development of the local economy	M1	Favour employment of people (and contractors) from the local region.
			M2	Employ contractors and staff through recognized tender processes and employment practices.
			M3	Continue with the existing corporate social responsibility initiatives aimed at improving the quality of life of staff and investing in the broader region.
			M4	Sub-contract local business as far as possible.
N	<u>Fine Residue Management</u>	<u>Promote consolidation of fines and decrease the period required for rehabilitation</u>	N1	<u>Incorporate the RSF into the seawater management plan and seawater balance for the Mine.</u>
			N2	<u>Investigate measures to improve fines density.</u>

MATRIX NAME: Environmental Management Measure: Operation of the East OFS Project		DURATION OF ACTIVITY: Life of Mine		REVISION NO. 1
Aspect	Objective	No.	Management Principle or Measure	
	<u>Ensure the structural integrity of the RSF</u>	<u>N3</u>	<u>Implement measures to improve fines density if feasible and cost-effective measures are identified.</u>	
		<u>N4</u>	<u>Carefully control, monitor and manage fines deposition to ensure that the containment walls do not scour or erode</u>	
		<u>N5</u>	<u>Spread fines away from RSF walls to promote beaching of coarser material against the walls, and to ensure that supernatant water does not undermine the slopes</u>	
		<u>N6</u>	<u>Recover process water from the RSF whenever the supernatant pool is above the minimum level where pumping is possible / keep the supernatant pool as small as possible.</u>	
		<u>N7</u>	<u>Record the volume of return water returned from the RSF</u>	
		<u>N8</u>	<u>Apply a freeboard limit of at least 1 m at the RSF</u>	
		<u>N9</u>	<u>Ensure that the RSF holds at least minimum process water in the supernatant pool during normal operating conditions.</u>	
		<u>N10</u>	<u>Monitor and ensure an independent registered professional engineer biannually reviews RSF design parameters and overall stability (erosion, slumps etc.), and introduce stabilising measures as required.</u>	
		<u>N11</u>	<u>Inspect and survey the elevation of RSF walls and maintain dam crests at their design height.</u>	

6. Decommissioning

When the holder of a Prospecting or Mining Right, Mining Permit or Reconnaissance Permission intends closing down operations, EA is required in terms of NEMA, informed by an EIA process. Furthermore, an Environmental Risk Report (including an EIA) and up to date Closure Plan must accompany the application for closure. The requirements of such a risk report are contained in Regulation 60 of the MPRDA Regulations. Tronox will need to comply with these requirements.

The Closure Plan for Tronox has been compiled in accordance with the commitments contained in the approved EMPs and the requirements of the MPRDA. The Closure Plan outlines Namakwa Sands commitments for decommissioning and closure of the Mine and addresses all operational sites. This plan is reviewed annually, and independent verification of the closure cost estimate is done on an annual basis. The last independent verification of the closure cost was completed in 2019. The closure cost estimate for the East OFS Project is appended to the EIA Report to be submitted to the DMRE for approval (SRK Report Number 548215/5).

General closure activities that are undertaken as part of closure, and will continue to apply to the East Mine are as follows:

- Consult with various stakeholders as required by NEMA in the period prior to decommissioning in order to determine the best end land use and what infrastructure could be reutilised;
- Demolish facilities and infrastructure. Sell recoverable material and bury other rubble and material *in situ*;
- Assess sites for contamination and, as far as practicable, treat wastes *in situ* or remove for appropriate disposal;
- Establish vegetation through rehabilitation and monitor until self-sustaining on all areas (see Section 6.1.1) so that the agreed final post closure land use (small-stock grazing) is achieved;
- Fill and shape all mining voids (to max 1:5 edge slopes) as appropriate, reshape stockpiles to an approximately 1:5 slope and institute erosion control measures by profiling the shape of constructed slopes to mimic natural landforms where possible (see Section 6.2.1); and
- Monitor all areas to confirm whether rehabilitation has been effective such that a closure certificate can be issued. Aspects to be monitored could include physical stability and re-vegetation success. The duration of monitoring required prior to the issuing of a closure certificate is unclear at this point in time.

6.1 Rehabilitation of Backfilled Areas

The objective of rehabilitation at the Mine is to landscape and revegetate mined out areas with indigenous vegetation in conjunction with active mining while ensuring the safety of workings, minimising erosion and restoring land to a condition capable of sustaining the pre-mining land use, namely dryland small-stock grazing.

The following methods will continue to apply at the East Mine for the East OFS project:

- Vegetation and topsoil are removed prior to mining;
- Mining proceeds;
- Tailings are returned to mined out areas during operations;
- Mined out areas are landscaped / re-profiled;

- The mostly flat – perhaps slightly convex – STF top surfaces will be profiled to be free-draining and stable without pooling of water;
- STF walls are profiled to a slope not exceeding 1:5 (see Figure 6-1) taking surface water flow / drainage into consideration;
- Windbreaks are installed;
- Profiled areas are revegetated during the growing seasons thereby minimising required area of rehabilitation on closure;
- Rehabilitated areas are monitored to establish rehabilitation success; and
- Ultimately mined out areas are returned to small-stock grazing.

6.1.1 Topsoil and Vegetation Removal, Reprofilng and Replacement

The following general procedures are followed for topsoil and vegetation removal prior to mining:

- At least the top 50 mm of topsoil is removed from mining areas prior to any major disturbance (e.g. haul road construction or mining);
- Following tailings and RAS tailings overburden backfilling, the backfilled pit is profiled to mimic the natural landscape form as far as possible;
- Topsoil and vegetation are either stored for the short term (less than three months), or returned immediately to mined out areas where tailings have been backfilled and profiled; and
- Topsoil is then spread in areas where tailings have been profiled.

6.1.2 Erection of Windbreaks

Windbreaks perpendicular to the prevailing wind direction are erected at 5 m intervals in order to control wind erosion and prevent loss of topsoil and the seedbank.

6.1.3 Re-vegetation

The current techniques used for revegetation are well documented. These include a combination of recruitment from seed, supplementation through the broadcasting of hand harvested indigenous seed and transplants harvested directly in the veld following rain events. Furthermore, topsoil is managed to ensure that maximum germination of indigenous species can occur.

6.1.4 Monitoring

Historically, vegetation has been sampled at a number of rehabilitation sites and natural (reference), but different techniques have been applied. As a consequence, previous studies provided only a subset of the biodiversity and ecosystem attributes required (principally plant species presence and cover).

In 2016 comprehensive monitoring protocols were developed for both rehabilitation and reference sites, drawing on established mine closure principles and integrating an understanding of key drivers of biodiversity and ecosystem functioning for the Sandveld and Sand Fynbos bioregions of Namaqualand.

The primary purposes of the monitoring protocols are to assess the success of the rehabilitation programme undertaken at Namakwa Sands to date, in terms of the recovery of biodiversity (plant species richness), ecosystem function and grazing value, and to demonstrate progress in achieving closure over time (i.e. through ongoing monitoring). The results of monitoring are also intended to

inform adaptive management of rehabilitation practices on the Mine; and secondly, to monitor ecosystem recovery as an indicator of progress toward closure targets.

Thirty five rehabilitation sites and 15 reference sites were monitored using the new monitoring method for the first time in 2016. On-going monitoring at these sites took place again in 2020, including a more detailed assessment into soil chemistry in rehabilitated areas.

6.2 Rehabilitation and Closure of Residue Stockpiles

The closure objective for residue stockpiles is to return these facilities to their pre-mining land use both physically and ecologically (i.e. low density stock agriculture) as soon as practically possible after the completion of residue (either fine or sand tailings) deposition. In the case of RSFs, this will only be possible in the long-term.

6.2.1 Fine Residue Storage Facilities

The existing closure criteria for fine residue disposal facilities at the Mine, which will be applied to the RSF, are as follows:

- Cap RSF dam crests with tailings (in this case, RAS tailings overburden from the Overburden Stockpile) to have a safe and stable surface;
- Profile side slope to a slope not exceeding 1:5 to produce an overall profile that mimics the natural topography, eliminating any geometric patterns and/or profiles (see Figure 6-1);
- Take surface water flow / drainage into consideration during final profiling and sloping of fine residue dams wall in order to prevent erosion;
- Cover the profiled RSFs (walls and crests) with a growth medium (average depth of 50mm) and protect with windbreaks (see Figure 6-1); and
- Establish a sustainable indigenous vegetation cover on all fine residue dams (walls and crests) that will support the overall closure criteria for the Mine (see Figure 6-1).

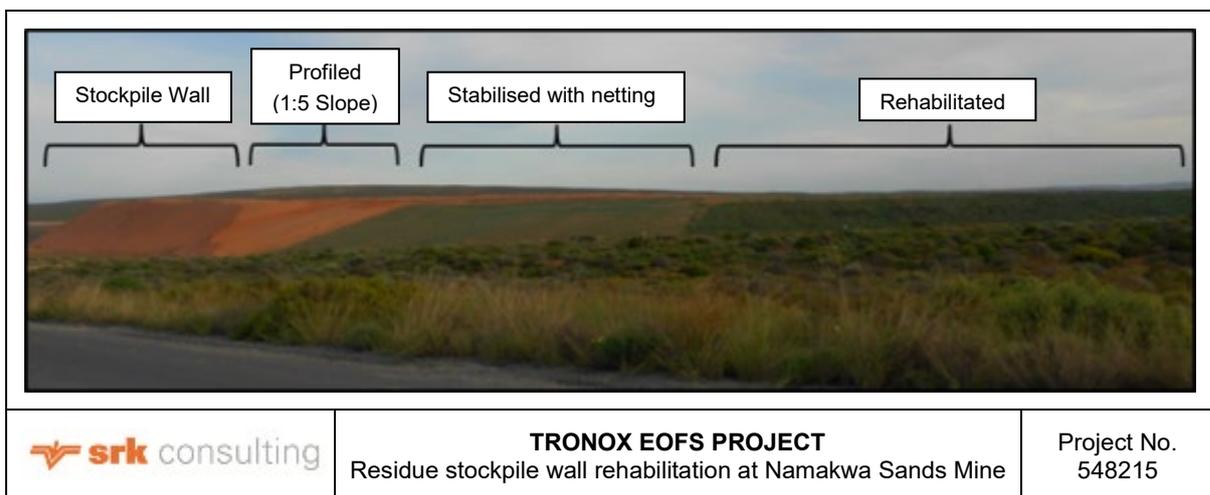


Figure 6-1: Residue stockpile (RSF) wall rehabilitation at Namakwa Sands Mine

The key issue for RSF closure is how to gain access onto the unconsolidated fines **surface** (the top 5 m to 10 m of the fine residue body) to place the capping layer. Although financial provision has been made for the closure of RSFs and Tronox has made progress in capping RSFs in the West Mine, Tronox is yet to achieve full functional closure of any of their RSFs.

Prepared by

SRK Consulting - Certified Electronic Signature



548215/44187/Report

9389-6778-1539-LAWM-24/12/2020

This signature has been printed digitally. The Author has given permission for its use for this document. The details are stored in the SRK Signature Database

A handwritten signature in black ink, appearing to read 'Matthew Law', written over the SRK Consulting logo and the digital signature text.

Reviewed by

SRK Consulting - Certified Electronic Signature



548215/44174/Report

6496-7709-4387-DALC-11/12/2020

This signature has been printed digitally. The Author has given permission for its use for this document. The details are stored in the SRK Signature Database

A handwritten signature in black ink, appearing to read 'Chris Dalgliesh', written over the SRK Consulting logo and the digital signature text.

Matthew Law

Principal Consultant

Chris Dalgliesh

SRK Partner